



Malatest
International

Review of neonatal care in New Zealand

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Acronyms

Acronym	
ALOS	Average length of stay
AN	Ante-natal
CNS	Clinical nurse specialist
DHB	District Health Board
GA	Gestational age
HCAI	Health care–associated infections
LOS	Length of stay
LMC	Lead maternity carer
MoH	Ministry of Health
NICU	Neonatal intensive care unit
OT	Oranga Tamariki
PN	Post-natal
SCBU	Special Care Baby Units

Executive summary

This review of neonatal intensive care has been commissioned by the Ministry of Health (MoH) with support from District Health Board Chief Executives with the New Zealand Newborn Clinical Network taking the lead. It follows earlier reviews completed in 2004 and 2008.

This report contributes to the review by synthesising information from different sources to provide a foundation for recommendations from the New Zealand Newborn Clinical Network. The review was completed in a short time frame and on a limited budget.

The review considered NICU as part of the maternity and child health system

NICU care ranges from intensive care provided in Level 3 (L3) units to Level 1 (L1) care provided for babies with minimal complications. Care for some moderate to minimal complications is also provided in postnatal wards.

Neonatal units operate on a regionally distributed network model. The different levels of care are not available at all DHBs. Babies needing a level of care not provided by their DHB are transferred, ideally to the nearest DHB providing the level of care they require. Each unit is funded and managed independently by the DHB where it is located.

A systems approach to a review of neonatal intensive care was important as NICU interface with all other aspects of maternity and newborn care. Inflows to NICU may be influenced by changes in population health, changes to obstetric practices and technological advances lowering the gestational age for viability of premature babies.

Outflows or exits are influenced by the capacity of lower level units or postnatal wards to take babies. Complex health and social needs of families of babies admitted to NICU including poverty (lack of warm, safe housing) and interfaces with other agencies such as Oranga Tamariki all influence length of stay.

Capacity and occupancy of neonatal intensive care units

International literature and NICU staff all reported increases in occupancy over time and changes in the reasons for admission for babies. The birth rates in New Zealand were relatively constant between 2012 and 2017 but with annual fluctuations. Demand for NICU/SCBU cots parallels these annual fluctuations. Some locations

have small numbers of resourced cots so small fluctuations in demand can have a disproportionate effect on occupancy levels.

As for other forms of intensive care, neonatal intensive care is resourced at a level below 100% to allow for peaks in demand. While there is no agreed safe level of occupancy of neonatal units, 85-90% occupancy is considered by New Zealand stakeholders as a realistic level considering fluctuations in demand and the costs of providing neonatal intensive care.

All levels of NICU consistently operated above resourced capacity over the 2012-2017 time period. In 2017, occupancy exceeded 85% of resourced capacity for 98% of days per annum in L3 units, for 72% of days in L2A units and 51% of days in L2 units. The proportion of time the occupancy of L2 units has exceeded 85% has been steadily increasing since 2012. This increase is important to note as increased L2 occupancy may delay discharges of babies from L3 units and back transfers of babies to their home DHB.

Neonatal unit staff managed the demand for occupancy that exceeded the resourced number of cots in different ways. Some DHBs had flexi-cots. Where physical space allowed, additional cots above the resourced number were fitted into NICU. Where physical space was not available babies could be transferred to other localities. On occasion deliveries may be delayed until cot space was available.

Drivers of demand for neonatal care

The coding structure prioritises birthweight, so the main reasons recorded for NICU admissions were low birthweight and low gestational age. In interviews, stakeholders described slight increases in the proportion of very early gestation and very late gestational age babies admitted to L3 units, but these very small increases were not observable in the MOH-DHB data. However, there was a slight increase in admissions for babies with birthweights between 3 and 3.5 kgs in L3 and L2A units.

Although the proportion of very low gestational age and low birthweight babies is small, the biggest impact is the substantially longer length of stay of these babies.

Sector stakeholders described increases in demand arising from changes in population health leading to more babies affected by gestational diabetes and babies with feeding problems. However, multiple diagnostic codes, inconsistent coding of diagnoses and annual variation as a result of small numbers in each coding category made it difficult to identify time trends in the MoH-DHB data.

Population health factors including high maternal BMI, smoking, drug use, and living in a low decile (economically disadvantaged) locality increase the risk of NICU admissions. Babies born to mothers from higher levels of deprivation were over-represented in NICU/SCBU.

Although the birth rates in New Zealand were relatively constant between 2012 and 2017, there were increases in births in localities with higher levels of risk factors for NICU admissions (poverty, high rates of smoking and addictions).

Babies cared for elsewhere

There was general acceptance that babies should be cared for where they live and DHB's should provide adequate cot space in their neonatal units for their local populations. When the level of care an infant requires is not available at the DHB (e.g. care for babies born at less than 32 weeks gestation, babies who have undergone surgery) where the mother lives then the baby must be transferred to another location.

Approximately one-quarter of babies requiring L3 care were cared for in neonatal units away from where they lived.

Although the cost of the transfer and accommodation is funded from the public purse there are personal economic and social costs for families and whānau. The transfer of babies to another location disadvantages people who live in rural locations and may disproportionately affect families with lower incomes.

Efficient transfers are essential for the safety of the baby. Most interviewed stakeholders considered New Zealand had well defined processes for transferring babies.

Returning babies to their DHB of origin was frequently cited by stakeholders as a priority with delays in back transfers contributing to longer length of stay in L3 units. Capacity and over occupancy in L2A and L2 units for back transfers were reported as always or often a problem by 67% of L3 unit survey respondents.

High levels of occupancy increase the pressure on staff

There are no alternatives to NICU care for babies that require that level of support. Therefore, if there are no free cots the system must adapt to support these babies. NICU do this by adding additional cots that are not resourced primarily with overtime by nurses or increasing the baby to nurse ratio.

The addition of extra cots places sustained pressure on staff, as staff are resourced according to the number of resourced cots. Committed NICU staff respond to the levels of need to provide a high quality of care. However, the specialist NICU nursing workforce is aging and looking to the future it may be difficult to staff to current staffing levels and expertise.

Maternity and new born care is provided by health professionals across different workforce roles. Sector staff were mostly satisfied with their roles and most

considered they provided a high quality of neonatal care. However, the workforce is under pressure with workforce shortages reported across all health professional groups. Workforce shortages combined with under-resourcing resulted in scheduling challenges for managers, especially in scheduling staff for night shifts.

A high proportion of the workforce considered they were overworked. Perceptions of overwork were associated in the literature with missed nursing care and adverse events. Overwork and workforce shortages flowed through to challenges in finding time for workforce development.

The capacity and capability of the workforce has the potential to influence admissions to NICU, transfers to L3 NICU and length of stay in NICU. Shortage of outreach staff and roles such as social workers can increase length of stay in NICU.

Other systemic issues also influence NICU

In interviews and surveys, staff described other systemic issues where there was the potential for improvements:

- Information shortages limit monitoring – there is no national data set that allows effective monitoring of neonatal intensive care and tracks cot numbers and resourcing.
- National and local leadership – has the potential to drive sector development if adequately resourced
- National cot status – a national website was often described as inaccurate because it was not kept up to date. Managers spent considerable time phoning around to find cot space. Stakeholders also described overcrowding as influencing decisions to transfer or accept transferred babies.
- Information sharing – IT systems that restrict information sharing result in inefficiencies and duplication of tests.
- Lack of interface with other agencies, especially Oranga Tamariki can extend the length of stay in neonatal intensive care for babies who do not have safe warm home to go to. Shortages of social workers compound these challenges.

Opportunities

The key findings from this review are consistent with reviews commissioned by specific DHBs¹.

The most important priority for the sector is the need for increased resourcing to bring occupancy levels down to 85% most of the time. Increased resourcing includes

¹ Provided in confidence so not cited

cot space and numbers, staff time (medical, nursing and allied health) and specialised equipment. The need for additional resourcing is urgent to address the potential for adverse outcomes and to provide relief to staff.

Lack of equity is a challenge for the system. L3 units are geographically located to service the largest populations. However, birth rates and prevalence of risk factors were higher in some of New Zealand's most economically disadvantaged areas. The MoH-DHB data demonstrated higher overall occupancy of NICU by Māori babies but lower relative occupancy in L3 units compared with babies from other ethnic groups.

Alongside additional resourcing there is the potential to improve the effectiveness and efficiency of the neonatal intensive care system by increased national coordination of cot space, better integration of neonatal care with the First 1,000 days strategies and improved communication and information flow through maternity to newborn care. New models of care such as transitional care have the potential to reduce pressure on NICU but to also improve social outcomes for families.

National level strategies are required for workforce development to address shortages across the different health professional and social service groups that interface with neonatal intensive care. Workforce shortages cannot be quickly addressed but developing consistent approaches to professional development is an interim step to maintain the current high quality of care.

Improved national data collection about neonatal intensive care is required to monitor the effectiveness of changes.

1. Overview and approach to a review of neonatal intensive care

A review of neonatal intensive care has been commissioned by the Ministry of Health (MoH) with support from District Health Board Chief Executives with the New Zealand Newborn Clinical Network taking the lead.

Earlier reviews of NICU were completed in 2004² and in 2008³ in response to identification of an insufficient number of neonatal unit cots. The 2004 review identified increases in the number of babies being admitted to neonatal units, despite a decreasing birth rate. The increase was greatest at the lower gestational ages. The review resulted in some increases to the number of neonatal intensive care cots. The 2008 review recommended the development of a Newborn Clinical Network to address issues of quality and staffing. The Newborn Clinical Network was established in 2013.

Pressure on the capacity of neonatal units has continued. Sector stakeholders' descriptions of shortages of capacity due to either cot numbers and/or staffing shortages and advocacy from the sector resulted in the commissioning of this 2018/19 review.

1.1. Neonatal intensive care in New Zealand

Neonatal units are categorised on the level of complexity of care they can provide. A National Service Specification for neonatal intensive care and home care⁴ describes the current expectations of care at the different levels of neonatal units.

NICU care ranges from intensive care provided in Level 3 (L3) units to Level 1 (L1) care provided for babies with minimal complications. Care for some moderate to minimal complications is also provided in postnatal wards.

Neonatal units operate on a regionally distributed network model. The different levels of care are not available at all DHBs and babies needing a level of care not provided by their DHB are transferred, ideally to the nearest DHB providing the level of care they require. Each unit is funded and managed independently by the DHB where it is located.

² Ministry of Health (2004). Neonatal bed status in New Zealand. Ref No 20035064

³ Provided by MoH. Gilli Sinclair can be contacted at gzsincclair@cmdhb.org.nz

⁴ Services for Children and Young People - Specialist Neonatal and Inpatient Homecare Services tier two service specification December 2010 Nationwide Service Framework

Table 1. Levels of NICU care provided by New Zealand DHBs

Levels of care	Location
L3: Intensive care units	Auckland (National Women’s Hospital), Middlemore, Waikato, Wellington, Christchurch, Dunedin (except surgery). Starship Children’s Hospital also provides care for a small number of babies with cardiac conditions of complex surgical conditions requiring specialist care.
L2 A / L2 Plus	For infants with moderate to severe complications and GA 28 weeks and above: New Plymouth, Hawke’s Bay, Palmerston North.
L2	Babies with moderate complications and GA 32 weeks or above: Whangarei, North Shore, Waitemata, Tauranga, Rotorua/Taupo, Gisborne, Hutt, Nelson, Invercargill.
L1	Babies with minimal complications and GA over 35 weeks: Greymouth, Blenheim, Masterton, Wanganui, Timaru

1.2. The objectives of the review

To describe how well current NICUs in NZ are functioning in today’s health environment; to include but not limited to:

- (i) capacity tensions
- (ii) capability concerns

To profile the current pressures in NICUs for each of Levels 2, 2A and 3

If apparent, to describe emerging drivers to changing patterns of occupancy and care and if so, how these changes relate to each of the 3 NICU levels of care

Based on a literature review describe the ‘optimal model of care’ for neonatal service delivery and test this with the review committee.

Make recommendations for

- (i) any short-term changes to any perceived need
- (ii) long-term recommendations for service provision.

This report contributes to the review by synthesising information from different sources to provide a foundation for recommendations from the New Zealand Newborn Clinical Network.

1.3. The approach to the review

NICU are part of the wider maternity and newborn system of care. Occupancy of NICU is influenced by the capacity of NICU in the DHBs, transfers from outside the DHB and the capacity of the postnatal wards. The review therefore considers NICU in the context of the wider system that influences demand and length of stay in NICU.

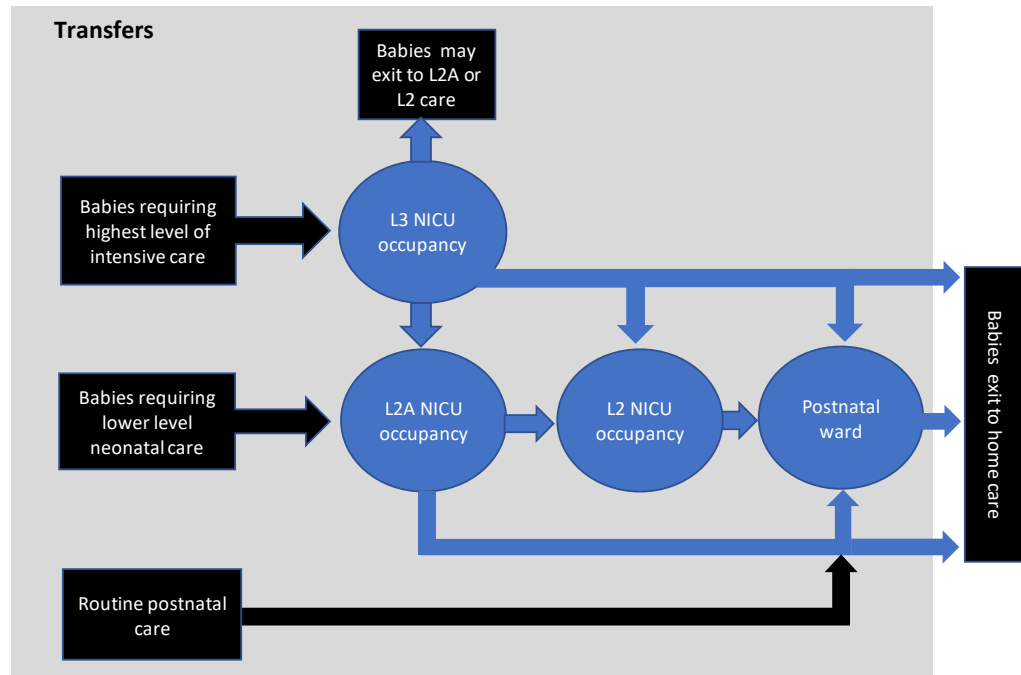


Figure 1. Overview of newborn care

1.4. Information sources for the review

1.4.1. Literature scan

A limited literature search and review was completed. The Ministry of Health librarians were invaluable in searching for literature and in accessing relevant papers.

Review documents were prioritised to ensure inclusion of recent reports (last five years), review reports, and reports and papers about NICU in New Zealand, Australia, Canada and UK. The focus was on current status and changing trends.

The search terms were based on the review questions and included peer reviewed published literature as well as grey literature and websites.

It is important to note that while the quality of the literature was assessed at a high level. The literature review was not a systematic review or metaanalysis.

1.4.2. MoH and DHB Data

A data review sub-committee of the Newborn Clinical Network advised on the data to be requested. There were no identifiers in the MoH datasets that clearly identified which babies used the neonatal intensive or special care. We therefore requested data from the individual DHBs that identified babies who had been admitted to NICU. DHBs provided their data directly to MoH. DHB data were linked with MoH data from the National Minimum Data set and maternity datasets using encrypted NHI numbers.

The format and availability of the data required the following decisions to be made about the analysis of the data:

- Levels refer to the facility not necessarily the level of care received. For example, level 3 units include level 2 cots but it was not possible to identify what level was received for what period of time.
- Not all DHBs included time of admission/discharge from care so we have used date only in calculating length of stay.
- DHBs sent their data from 2012-2017 to the Ministry of Health. Not all DHBs provided data and not all the data provided by DHBs was able to be retrieved by the Ministry. Data were not able to be included from Hauora Tairāwhiti, Bay of Plenty, Southern, Whanganui, Timaru, West Coast and Ivercargill DHBs.

1.4.3. Interviews

In-depth interviews were completed with 13 members of the NZ Newborn Clinical Network Neonatal Intensive Care Review Committee. Members represented different levels of neonatal care and held different professional roles.

Table 2. Interviewed stakeholders

Stakeholder group	Number interviewed
Clinical nurse managers/ nurse managers	3
Manager	1
Midwifery directors	3
Ministry of Health	1
Neonatologist	2
Obstetrician	1
Paediatrician	2

1.4.4. Stakeholder survey

An online survey was developed with the NZ Newborn Clinical Network Neonatal Intensive Care Review Committee. An email including a link to the survey was sent to NICU managers. Managers were asked to complete the survey themselves and to distribute the survey to the health professionals directly and indirectly involved in maternity and newborn care.

The survey was completed by 387 people. Survey respondents included a range of different health professional roles (Table 3). The largest group of respondents were nurses (43% of all respondents). Professional groups have been combined where the numbers in a group were too small to allow meaningful analysis.

Table 3. Roles of survey respondents

Stakeholder group	L3	L2A	L2	PN	AN	Other	Total
Managers	16	4	11	1	1	1	32
Midwives	6	5	2	10	16	3	31
Neonatologist	16		1				16
All nurses	103	23	48	3		2	166
CNS	25	1	5	1			27
Obstetrician	8	5	3	5	14		24
Paediatricians	11	17	44	4	3	1	72
Other e.g. lactation consultants, social workers	8	1	10	3	2	1	19
Total	193	56	124	27	36	8	387

The geographical location and place of work of survey respondents is described below.

Table 4. Profile of people completing the online survey (Note: 57 people worked in more than one location)

DHB	L3	L2A	L2	PN	AN	Other	Total
L3 - ADHB	30		1	6	9	1	38
L3 - CCDHB	36		0	1	2		38
L3 - CMDHB	20		8			1	24
L3 - Waikato DHB	16		2			1	19
L3 - CDHB	69		11	2	2		69
L3 - Southern DHB	19		4	2	1		23
Total – all L3	190		26	11	14	3	211

DHB	L3	L2A	L2	PN	AN	Other	Total
L2a - HBDHB		20	2	6	8		29
L2a - MDHB		13					13
L2a - TDHB		23		2	1	1	24
Total – all L2A		56	2	8	9	1	66
L2 – BOPDHB			19		3	2	23
L2 – Hutt Valley DHB			13				13
L2 – Lakes DHB	1		11	4	4		16
L2 – NDHB			16	1	1		16
L2 – Hauora Tairāwhiti			5	1	1		6
L2 – Waitemata DHB	1		10		2	2	14
L2 – CDHB			7				7
L2 – NMDHB	1		15	2	2		15
Total – all L2	3		96	8	13	4	110
Total	193	56	124	27	36	8	387

1.5. Strengths and limitations of the review

The review includes information from multiple sources allowing triangulation of findings. However, the scope of the work was limited by the small review budget of \$30,000 and the timeframes for completion of the work.

The review took a national perspective and does not provide detailed feedback for individual DHBs. Several DHBs have commissioned their own service reviews at various times since the 2008 review. This review aims to complement the service reviews. The review did not seek to assess the quality of care provided by the neonatal care units.

The data review time period of 2012-2017 may have missed some trends that occurred between 2008 and 2012. Another major limitation to the data review was the absence of a standard approach to identify individuals who had received care in NICU or SCBU. While all hospital admissions and discharges were recorded the National Minimum Data set there was no clear indicator for use of the NICU or SCBU. We have used data provided by the DHBs to identify NICU or SCBU babies, but we were not able to access data for all DHBs.

2. Capacity and occupancy of neonatal intensive care units

Key messages

International literature and NICU staff all reported increases in occupancy over time and changes in the reasons for admission for babies. The birth rates in New Zealand were relatively constant between 2012 and 2017 but with annual fluctuations. Demand for NICU/SCBU cots parallels these annual fluctuations. Some locations have small numbers of resourced cots so small fluctuations in demand can have a disproportionate effect on occupancy levels.

As for other forms of intensive care, neonatal intensive care is resourced at a level below 100% to allow for peaks in demand. While there is no agreed safe level of occupancy of neonatal units, 85-90% occupancy was considered by New Zealand stakeholders as a realistic level considering fluctuations in demand and the costs of providing neonatal intensive care.

All levels of NICU consistently operated above resourced capacity over the 2012-2017 time period. In 2017, occupancy exceeded 85% of resourced capacity for 98% of days per annum in L3 units, for 72% of days in L2A units and 51% of days in L2 units. The proportion of time the occupancy of L2 units exceeded 85% has been steadily increasing since 2012. This increase is important to note as increased L2 occupancy may delay discharges of babies from L3 units and back transfers of babies to their home DHB. Increased L2 unit occupancy may also reflect a longer length of stay and increased complexity of babies affecting readiness for home.

Neonatal unit staff managed the demand for occupancy that exceeded the resourced number of cots in different ways. Some DHBs had flexi-cots. Where physical space allowed, additional cots above the resourced number were fitted into NICU. Where physical space was not available babies could be transferred to other localities. On occasion deliveries may be delayed until cot space was available.

2.1. Live births in New Zealand

New Zealand's total fertility rate has been relatively stable for the last four decades, ranging from 1.81 births per woman (in 2017) to 2.19 (in 2008). Despite the stable birth rate, the total New Zealand population continues to grow and is increasing at a

rate of 1.4–2.0% per year, driven by near-record levels of migration in 2017⁵. In June 2018, New Zealand had an estimated population of 4,885,300⁶, up from the 4,027,947 recorded in the 2006 census.

Despite the population growth the total fertility rate dropped to a low of 1.87 births per woman, compared with an annual average of about 2.02 from 1980–2015.

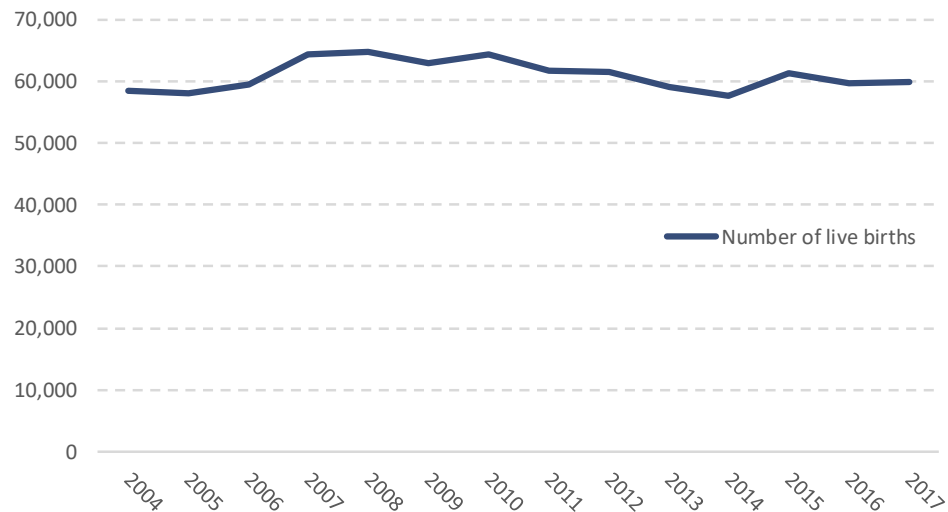


Figure 2. Numbers of live births in New Zealand (Source: Statistics New Zealand Census)

Fluctuations in birth rates are one of the challenges for neonatal intensive care occupancy. The percentage change in birth rates can impact demand for NICU/SCBU, especially those with relatively low numbers of beds. Percentage changes in NICU/SCBU occupancy reflect these fluctuations (Figure 3).

There are also different birth rates in different DHBs. The highest fertility rates⁷ are in Northland (2.55), Hawke’s Bay (2.46), Tairāwhiti (2.4) and the Bay of Plenty (2.34) – compared with a birth rate of 1.67 in Otago⁸.

⁵ <https://www.stats.govt.nz/news/birth-rate-down-to-record-low>

⁶ Subnational Population Estimates: At 30 June 2018 (provisional)". Statistics New Zealand. 23 October 2018.

⁷ An indication of how many births women will have during their lifetime

⁸ Statistics New Zealand 2013 Census of Populations and Dwellings. http://archive.stats.govt.nz/browse_for_stats/population/births/births-tables.aspx

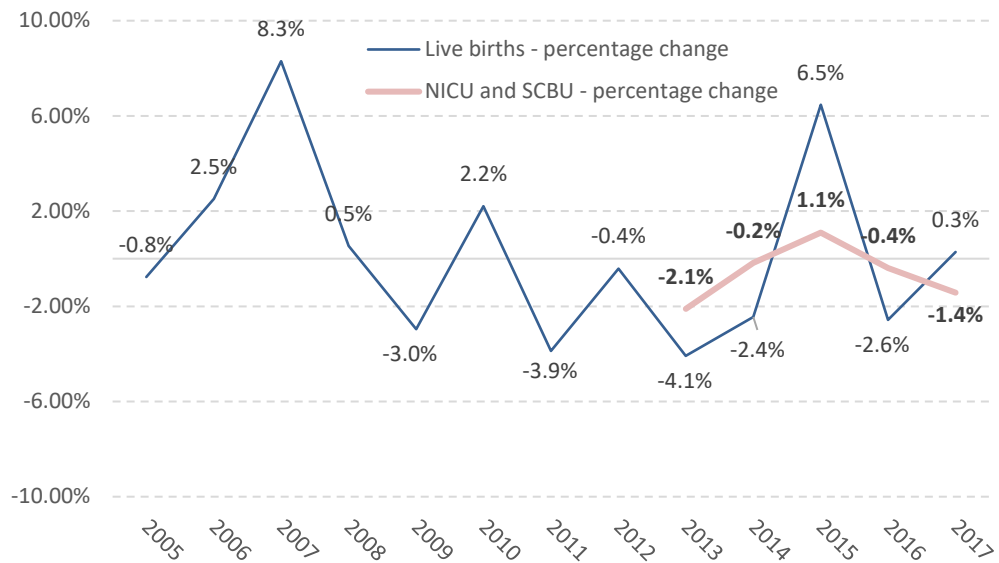


Figure 3. Percentage change in live birth rates from 2005 (Source: Statistics New Zealand Census) with percentage change in NICU/SCBU numbers (Source: MOH and DHB data)

Neonatal care, in common with other forms of unplanned care, varies enormously in workload hour by hour⁹. Babies who require intensive care often require it immediately. Therefore, as for other forms of intensive care, neonatal intensive care is resourced at a level below 100% to allow for peaks in demand.

There is no agreed safe level of occupancy of neonatal units in New Zealand. Stakeholders recognised the challenges of unpredictable demand leading to peaks in demand and suggested an occupancy of 85-90% as a compromise between efficiency and safety. However, information from interviews and the survey, supported by DHB occupancy data demonstrated that occupancy rates of 85% were rarely achieved.

One of the recommendations of the 2004 report is that we should run occupancy levels of around 70-80%. Actually, no one does that. (Interview)

We haven't been at that for years. (Interview)

2.2. NICU occupancy rates consistently exceeded resourced capacity

The number of resourced cots in 2004 and 2018 was sourced from each DHB (Table 5). A total of 319 cots was resourced in 2004 and had increased by 23 cots (7%) to 342 in 2018.

⁹ BAPM Guidance on Cot Capacity and the use of Nurse Staffing standards

Table 5. Numbers of resourced cots in total (SCBU and NICU combined) by DHB in 2004 and 2018 (Source: DHB unit survey response)

DHB	Total resourced cots – 2018	Total resourced cots - 2004
Level 3		
L3 – ADHB	40	46
L3 – C&CDHB	36	36
L3 - CMDHB	32	24
L3 - Waikato DHB	41	31
L3 - CDHB	41	37
L3 - Southern DHB (Dunedin)	16	16
Level 2A		
L2a - HBDHB	12	12
L2a - MDHB	14	17
L2a - TDHB	8	6
Level 2		
L2 – BOPDHB	11	16
L2 – Hutt Valley DHB	12	12
L2 – Wairarapa	4	1
L2 – Lakes DHB	8	10
L2 – NDHB	10	10
L2 – Hauora Tairāwhiti	6	6
L2 – Waitemata DHB	24	12 (about to open addition 12, Auckland to reduce)
L2 – Whanganui DHB	3	4
L2 – NMDHB	12	14
L2 – Timaru	2	2
L2 – West Coast DHB	2	2
L2 – Invercargill	8	5
Total across all levels	342	319

The number of resourced cots in 2018 was compared with the occupancy rate data sourced from the combined MoH and DHB data sets. The charts for each level of neonatal care demonstrate the gap between resourced capacity (labelled occupancy limit), occupancy and the average per annum occupancy between 2012 and 2017.

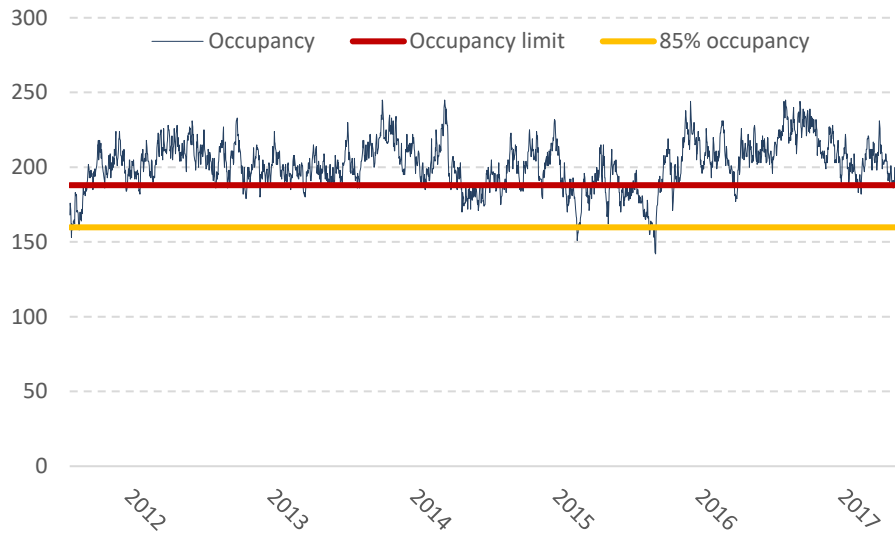


Figure 4. Occupancy by day of L3 NICU. Includes ADHB, CCDHB, CMDHB, Waikato DHB, CDHB (no data from Southern DHB) (Source: Combined MoH and DHB data)

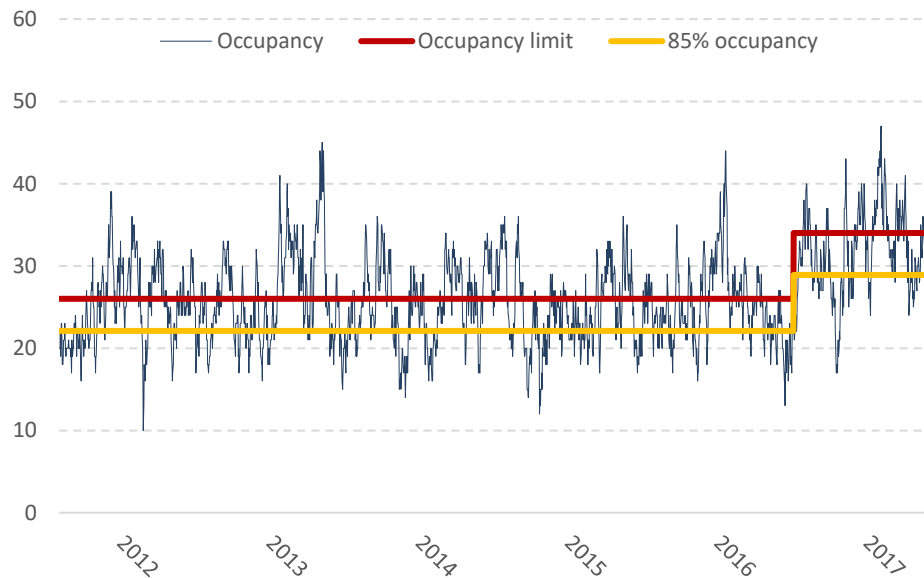


Figure 5. Occupancy by day of L2A NICU. Includes HBDHB, MDHB and TDHB. NOTE: TDHB provided data for 2017 only so their capacity is only added to the chart for 2017. The step up in the occupancy limit and 85% occupancy lines in 2016 reflect the addition of TDHB resourced cots and occupancy data (Source: Combined MoH and DHB data)

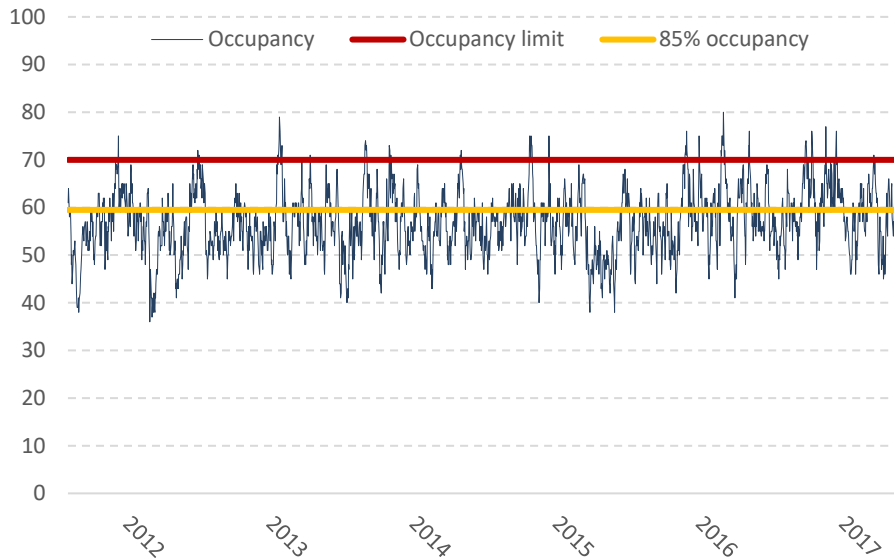


Figure 6. Occupancy by day of L2 NICU. Includes HVDHB, Wairarapa DHB, Lakes DHB, NDHB, Waitemata DHB, NMDHB (Source: Combined MoH and DHB data)

2.3. The proportion of days occupancy has exceeded 85% of resourced capacity

In 2017, occupancy exceeded 85% of resourced capacity for 98% of days per annum in L3 units, for 72% of days in L2A units and 51% of days in L2 units. The proportion of time the occupancy of L2 units has exceeded 85% has been steadily increasing since 2012. This increase is important to note as:

- The L2 units provide a ‘safety net’ for L3 units
- Increased L2 occupancy may delay discharges of babies from L3 units and back transfers of babies to their home DHB.

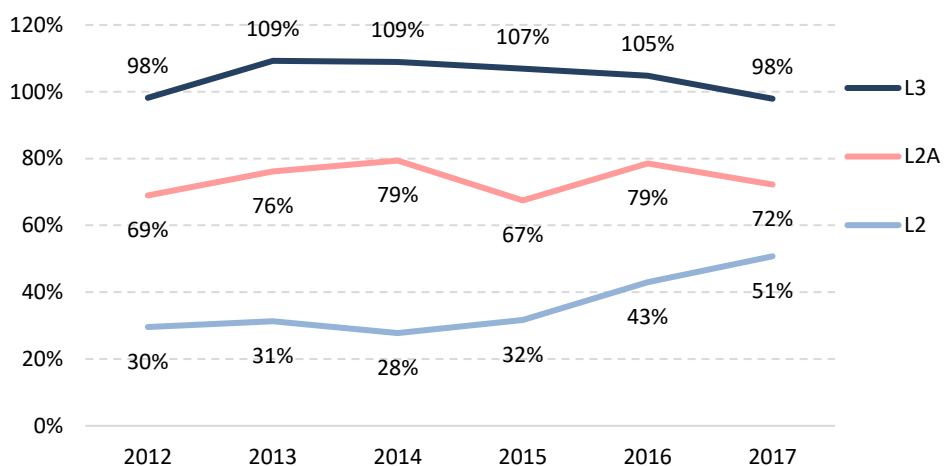


Figure 7. Percentage of days NICU operated above 85% occupancy by level over time (Source: Combined MoH and DHB data)

Many staff said their NICU could function at high occupancy levels in response to short-term demand but that this rate was not sustainable over a longer-term.

When SCBU is full and pushed, the stress and workload can overflow into rest of unit. Midwives and RNs not specifically neonatally trained are burdened with care they are not fully trained to provide. (Survey – core midwife)

The problem is, there aren't enough beds and resources come with the beds, so when I say there aren't enough beds, I mean there aren't enough nurses.... You just have to have a mechanism and a way of staffing it in a way that, for ninety percent of the time you are not under undue stress. (Interview)

2.4. Regional differences in capacity and occupancy

Regional differences in cot numbers and occupancy levels are summarised in Table 6. Information about resourced cot space was sourced from DHBs by the New Zealand Newborn Clinical Network.

Some locations have small numbers of resourced cots so small fluctuations in demand can have a disproportionate effect on occupancy levels.

Table 6. Numbers of resourced NICU cots and days when occupancy exceeded 85% (Source: Combined MoH and DHB data for occupancy, survey of unit managers for capacity)

DHB	Resourced # ICU cots	Resourced # SCBU cots	% of days occupancy exceeded 85% 2012-2017
Level 3			
L3 – ADHB	18	22	100%
L3 – C&CDHB	18	18	93%
L3 - CMDHB	12	20	89%
L3 - Waikato DHB	17	24	76%
L3 - CDHB	11	30	82%
L3 - Southern DHB (Dunedin)	5	11	Data not available
Level 2A			
L2a - HBDHB	2	10	53%
L2a - MDHB	5	9	67%
L2a - TDHB	2	6	47% (2017 only)
Level 2			
L2 – BOPDHB	3	8 (5 Tauranga, 3 Whakatane)	Data not available
L2 – Hutt Valley DHB	4	8	56%
L2 – Wairarapa		4	3%
L2 – Lakes DHB		8	47%
L2 – NDHB		10	55%
L2 – Hauora Tairāwhiti		6	Data not available
L2 – Waitemata DHB	10 (5 Northshore, 5 Waitakere)	14 (7 Northshore, 7 Waitakere)	63%
L2 – Whanganui DHB		3	Data not available
L2 – NMDHB	2	10 (8 Nelson, 2 Blenheim)	3%
L2 – Timaru		2	Data not available
L2 – West Coast DHB		2	Data not available
L2 – Invercargill	2	6	Data not available

2.5. Shortage of cot space was a challenge for staff

Corresponding with the high occupancy levels, cot space was always or often a problem for 64% of people across all levels of NICU who responded to the survey (Figure 8). Shortage of cot space was always or often a problem for 77% of people working in DHBs with Level 3 units.

Peaks and troughs but more peaks. ... Everyone is over capacity now and happening more often. (Interview)

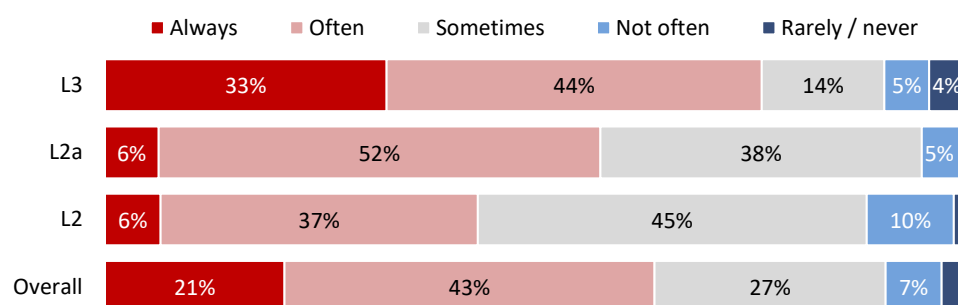


Figure 8. How often cot space in SCBU/NICU was problematic (Source: Survey n=387)

More survey respondents from Canterbury (67%) and Counties Manukau (43%) DHBs identified cot space as always a problem than people from other DHBs.

Table 7. How often cot space is a problem in different Level 3 units (Source: Survey n=210)

	Always	Often	Sometimes	Not often	Rarely/never
L3 - ADHB	13%	74%	11%	3%	0%
L3 – C&CDHB	16%	53%	26%	3%	3%
L3 - CMDHB	43%	30%	17%	4%	4%
L3 - Waikato DHB	11%	74%	11%	0%	5%
L3 - CDHB	67%	33%	0%	0%	0%
L3 - Southern DHB	0%	0%	43%	35%	22%
L3 - All	33%	44%	14%	5%	4%

2.6. Managing sustained pressure on NICU space over time

Working over capacity leads to physical space challenges which can lead to lack of space and challenges for staff (Section 5) and influence the numbers of babies cared for elsewhere (transfers) (Section 6).

On-going significant number of antenatal women needing to be transferred elsewhere due to our lack of space and adequate staffing, both financial and psychological unmeasured impacts. (Survey – manager)

One admission can tip us over. (Interview)

Neonatal unit staff managed the demand for occupancy that exceeded the resourced number of cots in different ways (Figure 9). Some DHBs had flexi-cots. Where physical space allowed, additional cots above the resourced number were fitted into NICU.

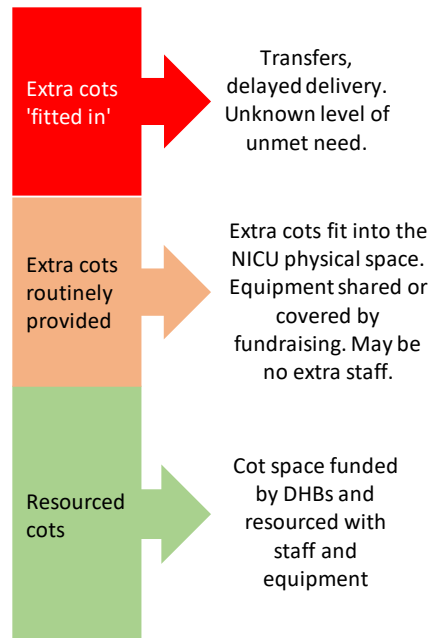


Figure 9. Strategies to meet demand for NICU occupancy when demand exceeds resourced cots

2.7. Specialist equipment was less of a problem

Most tertiary units were upgraded following the 2004 review. In contrast to cot space, access to specialist equipment was less of a problem. However, approximately a quarter of survey respondents reported shortage of specialist equipment was always or often a problem in their DHB (Figure 10). Comments suggested that equipment shortages were linked with overcrowding.

We have gone up as high as [number] in which case we do not have resuscitation equipment for each space. (Survey – manager)

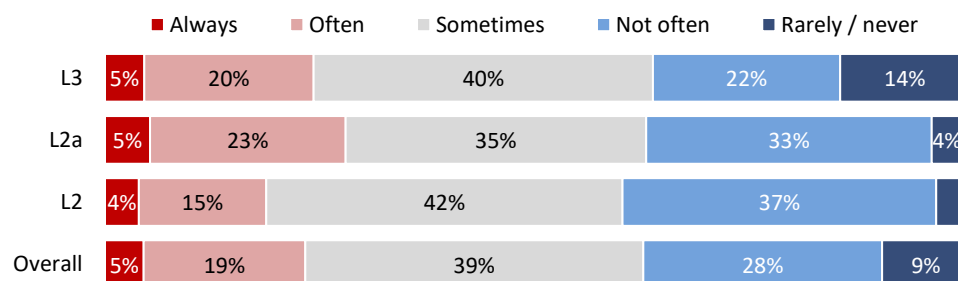


Figure 10. The extent shortage of specialist equipment was problematic for SCBU/NICU (Source: Survey n=387)

3. Drivers of demand for neonatal care

Key messages:

The coding structure prioritises birthweight, so the main reasons recorded for NICU admissions were low birthweight and low gestational age. In interviews, stakeholders described slight increases in the proportion of very early gestation and very late gestational age babies admitted to L3 units, but these very small increases were not observable in the MOH-DHB data. However, there was a slight increase in admissions for babies with birthweights between 3 and 3.5 kgs in L3 and L2A units.

Although the proportion of very low gestational age and low birthweight babies is small, the biggest impact is the substantially longer length of stay of these babies

Sector stakeholders described increases in demand arising from changes in population health leading to babies affected by gestational diabetes and babies with feeding problems. However, multiple diagnostic codes, inconsistent coding of diagnoses and annual variation as a result of small numbers in each coding category make it difficult to identify time trends.

Population health factors including high maternal BMI, smoking, drug use, and living in a low decile (economically disadvantaged) locality increase the risk of NICU admissions. Babies born to mothers from higher levels of deprivation were over-represented in NICU/SCBU.

Although the birth rates in New Zealand were relatively constant between 2012 and 2017, there were increases in births in localities with higher levels of risk factors for NICU admissions (poverty, high rates of smoking and addictions).

International literature reports increased NICU occupancy for all birthweight categories¹⁰. Internationally, total NICU admissions have increased due to a mixture of increased survival at younger gestational age and an increase in medical admissions¹¹. In the New Zealand MoH-DHB data we had available, except for L2

¹⁰ A six-year study of American NICUs showed an increase in NICU admission rates for all birthweight categories: Harrison, W., & Goodman, D. (2015). Epidemiologic trends in neonatal intensive care, 2007-2012. *JAMA pediatrics*, 169(9), 855-862.

¹¹ O’Gorman, J., Milne, S., Arthur, F., & Carachi, R. (2015). The Dan Young Neonatal Surgical Unit audit: an audit of admissions and mortality rates pre-and post-amalgamation. *Scottish medical journal*, 60(3), 132-135.

units, overall increases in admissions were not evident between 2012 and 2017. When occupancy is at very high levels it is not possible to detect increases in demand over time.

3.1. Main reasons for admission to NICU

Admissions to NICU can be broadly considered as unavoidable or potentially modifiable admissions. Unavoidable admissions are admissions for babies who require the level of care provided for in each unit. For example, low gestational age babies require L3 intensive care and there are no alternative options for the care of these babies.

Potentially modifiable admissions include:

- Babies admitted to a level of care that does not match their clinical needs
- Babies who could be cared for in another setting such as a transitional care unit on a post-natal ward. In the literature, the ability to correctly triage infants with short-term medical difficulties has been reported as impacting admission levels¹².
- Babies who could be discharged to home care if suitable support was available for them e.g. extended neonatal outreach nursing, safe warm homes, foster homes, social worker support and/or support from lactation consultants.

Pressure on neonatal units by obstetric issues (ambulance at bottom of cliff). (Interview)

- Admissions relating to:
 - Obstetric and foetal medicine practices including early induction to lower the rate of still births and thresholds for extremely low gestational age babies
 - Potentially modifiable population health factors beyond the control of neonatal services.
 - Smoking in high risk populations
 - Maternal overweight and obesity
 - Deprivation and socioeconomic disadvantage.

The main reasons for admissions at different gestational ages are based on information provided by the Newborn Clinical Network.

¹² Richardson, D. K., Zupancic, J. A., Escobar, G. J., Ogino, M., Pursley, D. M., & Mugford, M. (2001). A critical review of cost reduction in neonatal intensive care II. Strategies for reduction. *Journal of Perinatology*, 21(2), 121.

Table 8. The main reasons for admission to NICU

Gestational age	Main reasons for admissions
< 32 weeks	Peri-viability to 23 weeks. Previous preterm birth, PIH, Fetal medicine service in 3 centres and high-risk pregnancy management, LMC registration timing and access, Continuity of care protective
32-36 weeks	SGA pathway in pregnancy, Diabetes, PIH associated with BMI Baby management of SGA or at risk of hypoglycaemia. Multiple pregnancy
37-38 weeks	Diabetes induced if > 91 st %, Maternal drugs, - methamphetamine, antidepressants Induction duration. Skin to skin effectively, temperature in the first 2 hours, NOC/NEWS Elective caesarean < 39 weeks – role of steroids
39 weeks plus	HIE, foetal distress, deferred cord clamping and polycythaemia and jaundice, caesarean section, respiratory distress, sepsis. Poor feeding and excess weight loss.

In interviews, stakeholders described trends in reasons for neonatal intensive care admissions and changes affecting the length of stay of babies. The coding structure prioritises birthweight, so the main reasons recorded for NICU admissions recorded in the MoH-DHB data were low birthweight and low gestational age. Of other codes, respiratory reasons accounted for approximately one-quarter of admissions. Other diagnoses of interest such as diabetes related reasons for admissions were not on the coding sheets completed by medical staff.

3.2. Gestational age

Changes in practice and increases in technology have increased survival rates for very premature babies (less than 30 weeks) which in turn increases NICU demand¹³. Improved survival rates of babies with low gestational age contributes to increased numbers of babies who require L3 intensive care. In interviews, stakeholders described slight increases in the proportion of very early gestation and late gestational age babies admitted to L3 units. Numbers of very early gestation babies were small and trends were not observable in the MOH-DHB data.

The proportion of babies between 37 and 41 weeks gestation who were admitted to all levels of NICU increased from 2012 to 2013 and remained relatively constant at a higher level.

¹³ Seuseu, J. (2016). A career devoted to neonates. *Kai Tiaki: Nursing New Zealand*, 22(4), 30.

Table 9. Time trends in the gestational age of babies admitted to NICU/SCBU (Source: Gestational age from MOH maternity dataset)

	2012	2013	2014	2015	2016	2017
20-23	<1%	<1%	<1%	<1%	<1%	<1%
24-27	3%	3%	3%	3%	3%	2%
28-31	7%	6%	6%	6%	6%	6%
32-36	34%	32%	31%	31%	32%	31%
37-41	55%	57%	58%	59%	57%	59%
42	1%	1%	1%	1%	1%	1%

Although the number of very low gestational age babies is small, they require L3 care for a long time and there are flow on effects throughout the health system.

A 23 weeker results in 14 weeks of bed blocking that wouldn't have been there last year. (Interview)

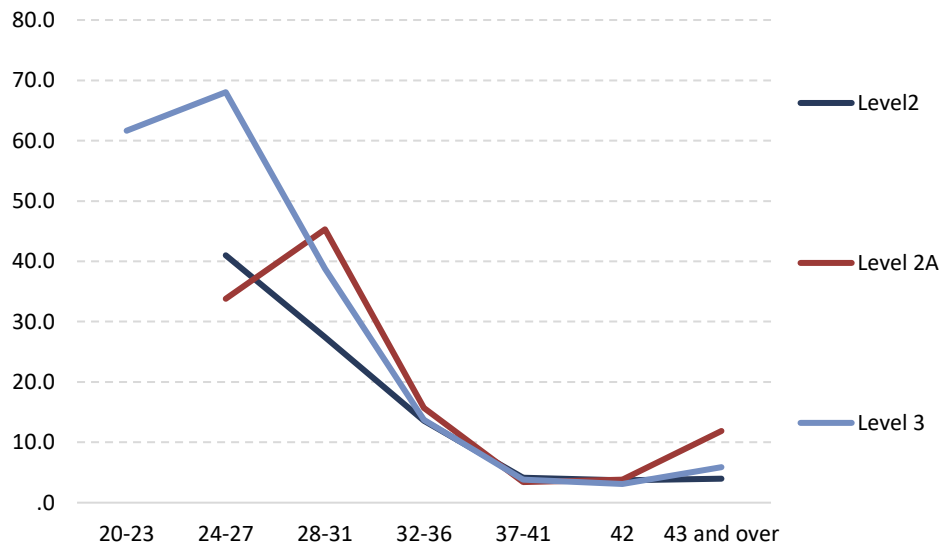


Figure 11. Mean length of stay in days by gestational age. Babies are allocated to the highest level of unit and length of stay includes all continuous days regardless of transfers (NOTE: includes babies who died) (Source: MoH-DHB data)

3.3. Birthweight

There were no clear trends in NICU admissions by birthweight except for a slight increase for babies with a birthweight between 3 and 3.5 kgs. This may reflect stakeholders' descriptions of increased demand for intensive care for larger babies. Stakeholders attributed these increases to gestational diabetes and feeding challenges after induction and caesarean section deliveries.

Increased numbers in last few years of late preterm babies who need a little bit more observation and intervention – not normal baby care.

Table 10. Proportion of babies at each birthweight by year and highest level of the units they received care (Source: Birthweight from MOH data, babies identified by DHB data)

	2012	2013	2014	2015	2016	2017
<= 1000	3%	3%	3%	3%	3%	3%
1,001 – 1,500	5%	4%	5%	5%	5%	5%
1,501 – 2,000	10%	10%	9%	9%	10%	9%
2,001 – 2,500	18%	18%	17%	17%	17%	17%
2,501 – 3,000	17%	17%	18%	17%	18%	17%
3,001 – 3,500	20%	20%	20%	21%	20%	22%
3,501 – 4,000	17%	17%	18%	18%	18%	17%
4,001 – 4,500	7%	7%	8%	8%	8%	7%
4,501+	3%	2%	3%	2%	3%	3%

Macrosomic birth weight (>4,500g) is more prevalent and low birth weight (<2,500g) less prevalent in Pacific Island infants compared to Caucasian infants. In one study, 65% of macrosomic Pacific Island infants in Samoa were transferred to NICU¹⁴.

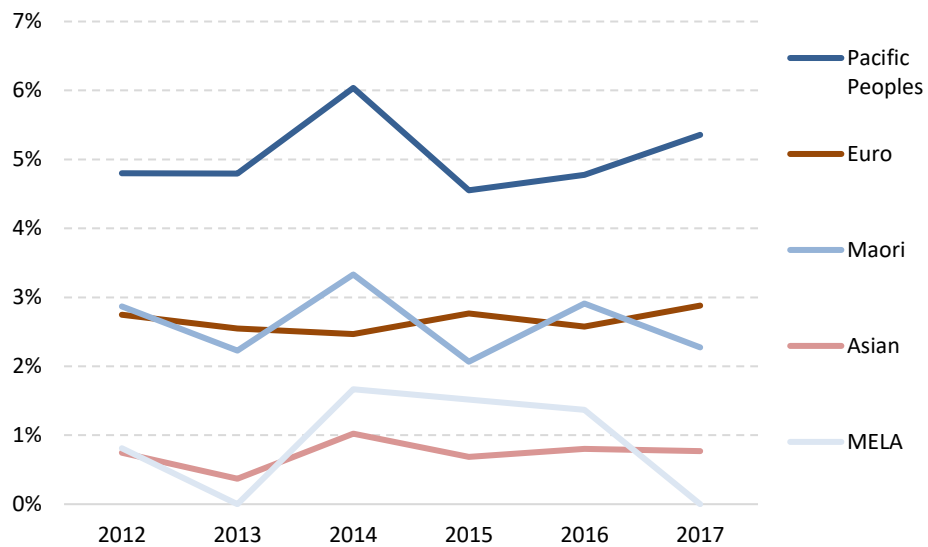


Figure 12. Proportion of babies across all units who were flagged as high birthweight in the Ministry of Health data by ethnicity (MOH prioritised ethnicity) and year (n = 37,000).

¹⁴ Tsitias, M., Schmid, B. C., Oehler, M. K., & Tempfer, C. B. (2015). Macrosomic and low birth weight neonates in Pacific Islanders from Samoa: a case-control study. *Archives of gynecology and obstetrics*, 292(6), 1261-1266.

Although the proportion of very low birthweight babies is small, the biggest impact is the substantially longer length of stay of these babies (Figure 13). The length of stay for babies 1.5-2.5 kgs may be increasing since 2015. There were higher proportions of small for gestational age at term babies in Northland, Tairāwhiti, Counties Manukau and Waikato.

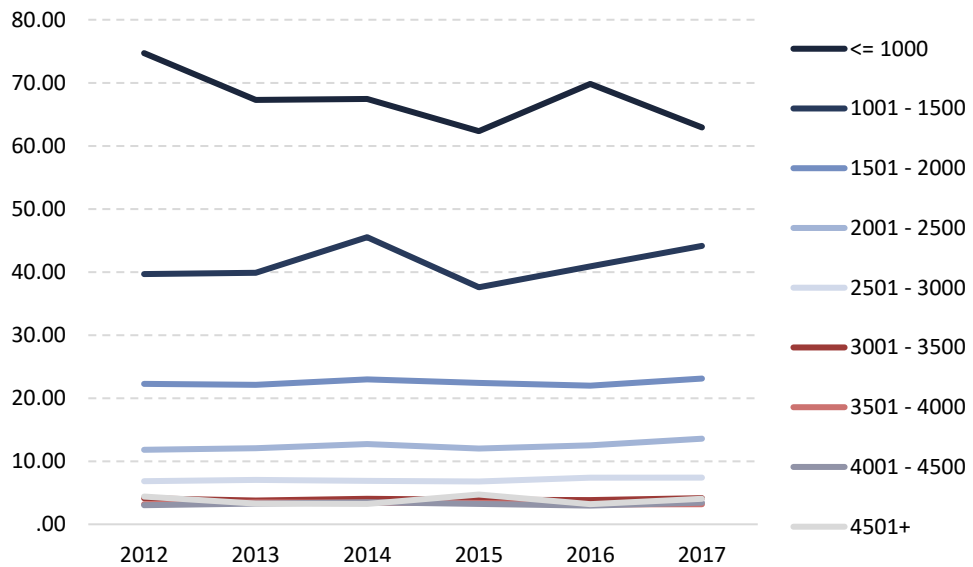


Figure 13. Length of stay over time for all babies by birthweight (Source: DHB data for length of stay and baby identification).

3.4. Changes in demand for different recorded diagnoses

Multiple diagnostic codes, inconsistent coding of diagnoses and annual variation as a result of small numbers in each coding category make it difficult to identify time trends. Some variation in reasons for admissions may be detectable if each diagnostic code is examined by level of care.

3.5. Population health

3.5.1. Smoking

Smoking is one of the main reasons for low birthweight babies. Although overall smoking rates have declined, rates at LMC registration remain higher for Māori women than women from other ethnic groups.

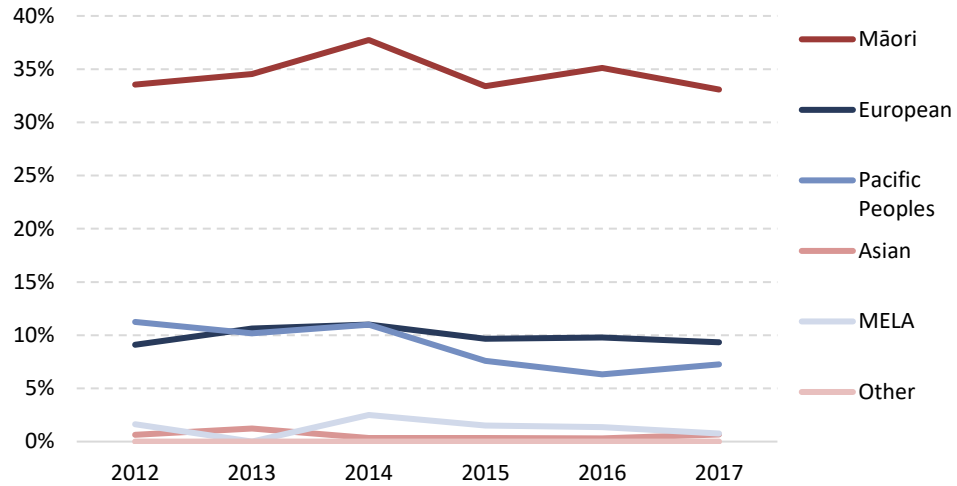


Figure 14. Proportion of NICU/SCBU mothers who smoked at the time of their first LMC appointment by ethnicity (Source: MOH data, n = 37,017)

Looking across all units, the proportion of mothers of included babies who smoked at the time of their first LMC visit remained relatively constant between 14.6% and 16.5% from 2012 to 2017. Ministry of Health 2015 DHB data about maternal smoking at the time of registration shows the highest rates of smoking for women in Northland, Lakes, Tairāwhiti and Whanganui DHBs¹⁵.

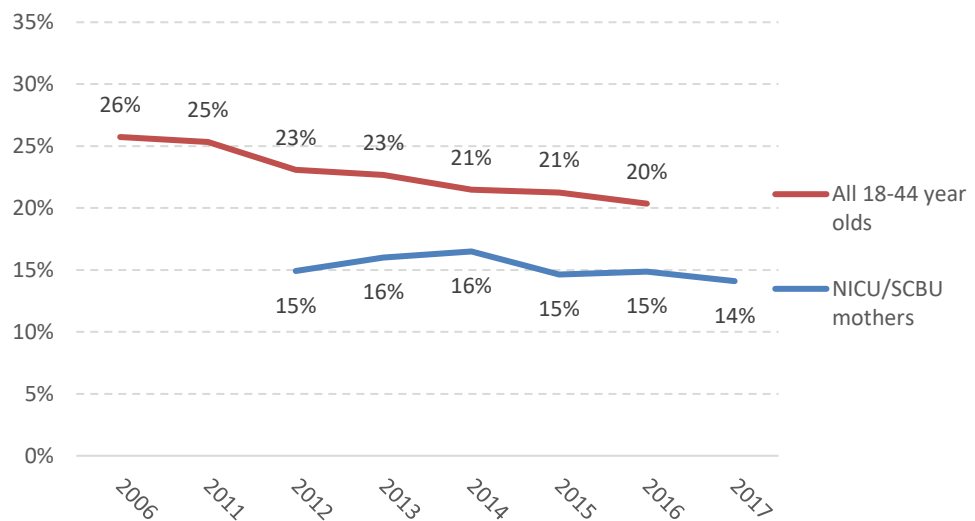


Figure 15. Percentage of females 18-44 years who smoke (Source: NZ Health Survey) and proportion of NICU/SCBU mothers who smoked at the time of their first LMC appointment (Source: MOH data, n = 37,017).

¹⁵ Duncanson M, Oben G, Adams J, Wicken A, Morris S, Richardson G. and McGee MA Draft. The early years: Draft report for New Zealand Aotearoa 2017. Dunedin: New Zealand Child and Youth Epidemiology Service, University of Otago.

3.5.2. Older maternal age

The proportion of mothers of NICU/SCBU babies in the 25-29 and 30-34 year old age groups increased between 2012 and 2017 (Figure 16). There were corresponding decreases in the other age groups. This change was evident in all three levels of units.

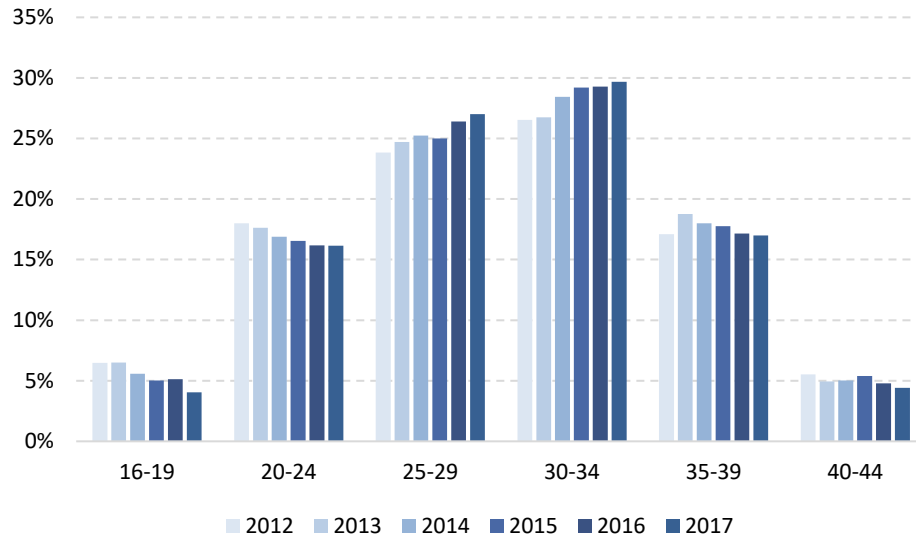


Figure 16. Proportion of SCBU/NICU mothers in each age group by year (Source: MOH data, n = 37,017)

Mean gravida was consistent across levels of care. Mothers of children in level 2A care tended to have lower parity (44% at 0) than level 2 (48%) and level 3 (49%).

3.5.3. Maternal BMI

Obesity is also correlated with increased incidence of caesarean delivery, preterm birth and NICU admission. The risk increases as obesity becomes more severe¹⁶.

Women are more co-morbid with obesity issues, older ages so they have other health problems...We see more unwell women who may need babies delivered earlier.

Ministry of Health 2015 DHB data about maternal weight at the time of registration shows:

- The highest proportions of women with BMI of 30 or over lived in Northland, Counties Manukau, Lakes, Tairāwhiti, Whanganui, Wairarapa and South Canterbury DHBs.

¹⁶ Bodnar, L. M., Pugh, S. J., Lash, T. L., Hutcheon, J. A., Himes, K. P., Parisi, S. M., & Abrams, B. (2016). Low gestational weight gain and risk of adverse perinatal outcomes in obese and severely obese women. *Epidemiology (Cambridge, Mass.)*, 27(6), 894.

- The highest proportions of women with very low BMI (less than 18.5) lived in Waitemata, Auckland and Nelson Marlborough DHBs¹⁷.

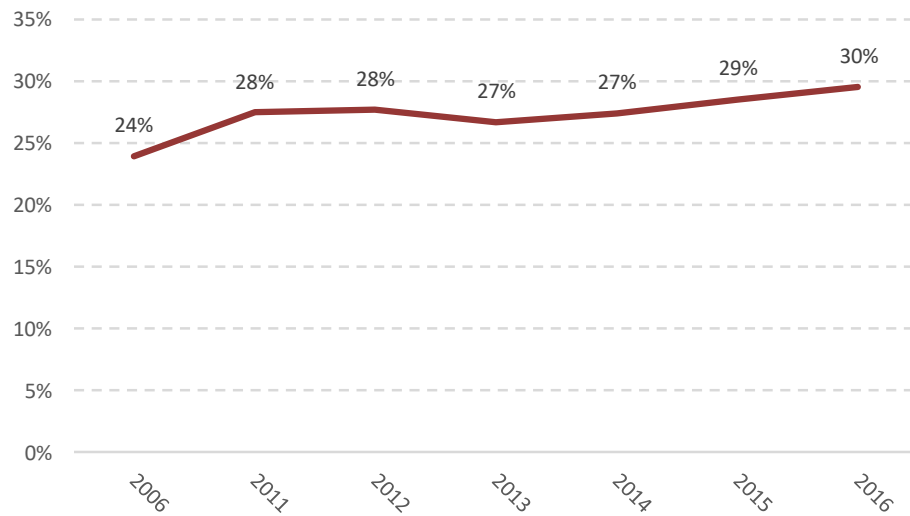


Figure 17. Proportion of females aged 18-24 categorised as obese based on BMI (Source: New Zealand Health Survey, MOH)

3.5.4. Substance use/abuse and withdrawal

Substance use or abuse during pregnancy are correlated with an increased likelihood of preterm birth and NICU admission. Substance use can include prescribed medications, legal drugs such as alcohol and tobacco and illegal drug use. Mothers admitted to hospital for mental and behavioural disorders linked with alcohol before or during pregnancy were significantly more likely to have infants with low birthweight, preterm birth, and admission to NICU. Mothers admitted for disorders linked with cannabinoids or opioids were three times more likely to give birth to preterm babies and mothers admitted for disorders with opioids were six times more likely to have babies admitted to NICU¹⁸.

¹⁷ Duncanson M, Oben G, Adams J, Wicken A, Morris S, Richardson G. and McGee MA Draft. The early years: Draft report for New Zealand Aotearoa 2017. Dunedin: New Zealand Child and Youth Epidemiology Service, University of Otago.

¹⁸ Bonello, M. R., Xu, F., Li, Z., Burns, L., Austin, M. P., & Sullivan, E. A. (2014). Mental and behavioural disorders due to substance abuse and perinatal outcomes: a study based on linked population data in New South Wales, Australia. *International journal of environmental research and public health*, 11(5), 4991-5005.

3.6. Poverty and disadvantage

New Zealand’s perinatal and mortality Review Committee report that increasing socio-economic deprivation is associated with increasing odds of stillbirth and neonatal death (after adjusting for maternal age, ethnicity, multiple pregnancy, baby sex and year of birth)¹⁹.

Babies born to mothers from higher levels of deprivation were over-represented in NICU/SCBU (Figure 18). Deprivation quintiles four and five accounted for 52% of babies in level 2, 61% of babies in level 2A and 48% of babies in level 3 units.

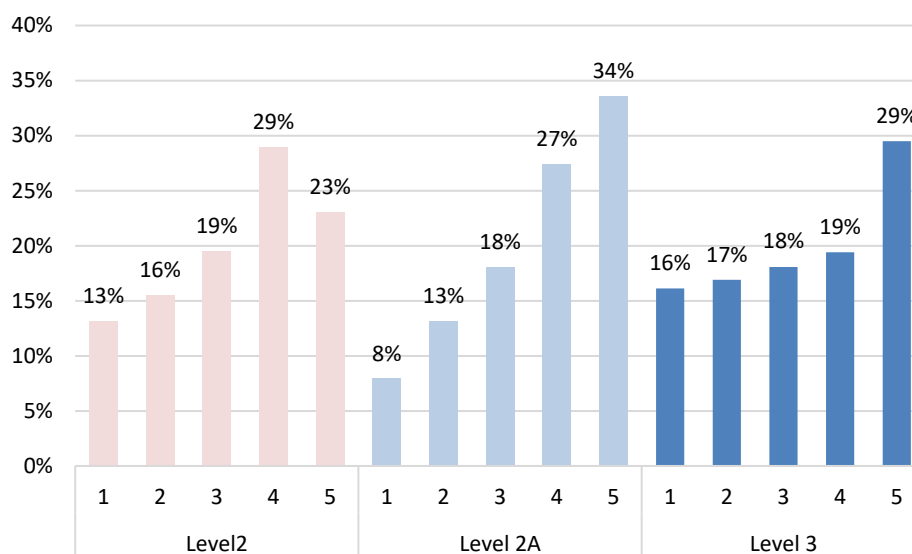


Figure 18. Proportion of SCBU/NICU mothers from each deprivation quintile by highest level of care (Source: MOH data) (n = 35,856)

Māori are over-represented in SCBU/NICU babies, accounting for 28%. However, a higher proportion of Māori babies were in Level 2 and 2A care than level 3 (Figure 19). Between 2012 and 2014, the total fertility rate was 2.5 for Māori women, compared with 1.9 for non-Māori women. Northland has the highest proportion of Māori. The highest numbers of Māori live in Auckland, Waikato and the Bay of Plenty.

¹⁹ Perinatal and Maternal Mortality Review Committee. 2017. Eleventh annual report. Wellington. Health Quality and Safety Committee.

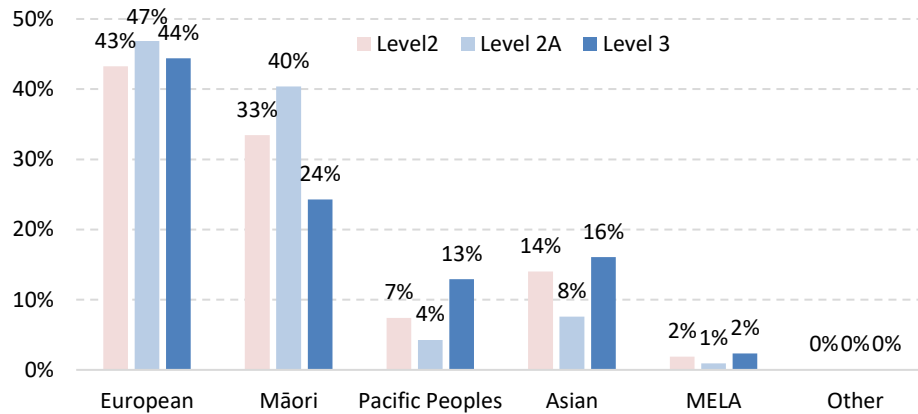


Figure 19. Proportions of SCBU/NICU mothers of each ethnicity (prioritised ethnicity from MOH data) (n = 36,350)

Babies from areas of higher deprivation had longer stays on average than those from areas with lower deprivation (Figure 20).

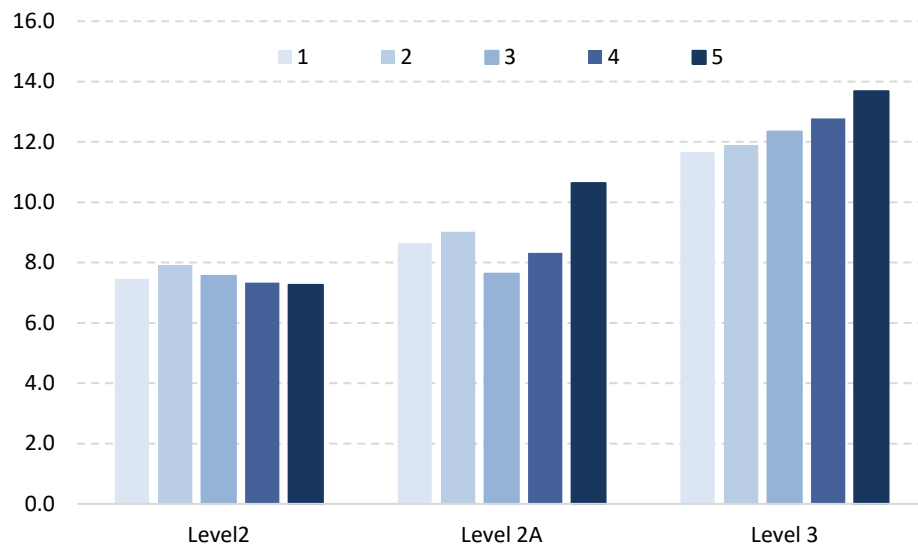


Figure 20. Average length of stay for all NICU/SCBU babies by unit level and deprivation quintiles (Source: MOH data).

L3 units are geographically located to service the largest populations. However, birth rates and prevalence of risk factors were higher in some of New Zealand’s most economically disadvantaged areas. The MoH-DHB data demonstrated higher overall occupancy of NICU by Māori babies but lower relative occupancy in L3 units compared with babies from other ethnic groups.

3.7. Complex social issues

Changes in population health contribute to changes in admission rates to neonatal care. Stakeholders' described complex families with multiple challenges including mental health and addiction issues and family violence.

An increasing proportion of parents of babies in SCBU have significant life stressors, that impact upon their ability to care for their infant. (Survey – specialist paediatrician)

We are the ambulance at the bottom of the hill. There needs to be structures in place to educate the community about their health. Talking with my maternity colleagues their patients (mums) are very sick themselves... (Survey – registered nurse)

This is a highly rewarding area to work but very demanding with a high prevalence of mental health and social issues with the families we work with. Due to poor staffing we have little time to give these families to make a difference long-term. (Survey – registered nurse)

A shortage of social workers was described as limiting exits from NICU to home care. Stakeholders also described delays in Oranga Tamariki setting up appropriate foster care or child protection arrangements as contributing to longer lengths of stay.

Social workers used to work on neonatal wards with the family unit and support them. Now they just do high risk Oranga Tamariki babies. (Interview)

A major factor in deciding whether babies go home is a safe place. We need to identify at risk mothers early, put plans in place at 12 weeks gestation, and get supports in place. (Interview)

Patients are significantly more complex and yet we are expected to cope with the same patient to nurse ratio. Society's expectations of parental rights has changed. Often this means the mother and/or father is catered to over the baby i.e. parental substance use, social issues, mental health. A baby often has a longer stay in NICU due to these parental issues rather than their actual physical health needs. (Survey - other)

3.8. Technology

Late preterm singletons conceived with fertility treatment have increased risk for NICU admission and respiratory support compared to spontaneously conceived infants²⁰. Assisted conception increased from 6.5% to 11.7% of births between 1995

²⁰ Wang, E. T., Sundheimer, L. W., Spades, C., Quant, C., Simmons, C. F., & Pisarska, M. D. (2017). Fertility Treatment Is Associated with Stay in the Neonatal Intensive Care Unit and Respiratory Support in Late Preterm Infants. *The Journal of Pediatrics*, 187, 309-312.

and 2009. The rate of NICU admissions of assisted conception very premature infants also increased over this period.²¹

New neonatal practices have been introduced that are more effective but more intensive in terms of staff time e.g. cooling, increased non-invasive ventilation.

CPAP is better but requires more intensive nursing than respirators. (Interview)

A bundle of care, it's called, about how we look after [long] lines, and so we've gone from things like a single person, unsterile change of a bag in a long line, to a two-person sterile change. It's double plus the time, ... there's a lot more nursing care that's gone into keeping babies well, and if we reduce the ventilation days for instance... just because we've reduced the volume of days the babies are on a mechanical ventilator doesn't make the care of that baby easier. It makes it actually harder. (Interview)

3.9. Changes in obstetric practice

Changes in obstetric practice have the potential to reduce and increase the need for neonatal care. For women with singleton breech pregnancies at term, intended vaginal delivery was more likely to result in NICU admission than planned caesarean delivery²².

European research shows changes to maternity and neonatal unit policies including an increased willingness to perform caesarean section at earlier gestational ages in the case of foetal distress. These changes were accompanied by an increase in survival rates for infants born before 27 weeks²³.

Stakeholders reported that parental knowledge and anxiety has increased pressure for early delivery.

People are more accepting of disabilities than in utero death...we deliver them earlier and we accept the downside of that. (Interview)

²¹ Lee, Q., Chow, S., & Lui, K. (2013). A population study of demographic changes and outcomes of very premature multiple births infants admitted to NICU in Australia and New Zealand. *Journal of Paediatrics and Child Health*, 29, 125.

²² Bin, Y. S., Roberts, C. L., Ford, J. B., & Nicholl, M. C. (2016). Outcomes of breech birth by mode of delivery: a population linkage study. *Australian and New Zealand Journal of Obstetrics and Gynaecology*, 56(5), 453-459.

²³ Bonet, M., Cuttini, M., Piedvache, A., Boyle, E. M., Jarreau, P. H., Kollee, L., ... & Barros, H. (2017). Changes in management policies for extremely preterm births and neonatal outcomes from 2003 to 2012: two population-based studies in ten European regions. *BJOG: An International Journal of Obstetrics & Gynaecology*, 124(10), 1595-1604.

National rates of caesarean section overall moved between 23% and 26% from 2006 to 2015 (Figure 21). NICU and SCBU babies had a higher rate, with elective caesarean rates steady at 15-16% and emergency caesarean rates at 29-31% from 2012-2017. Elective caesarean delivery is associated with increased rates of admission to special care nurseries (SCN) for respiratory complications²⁴.

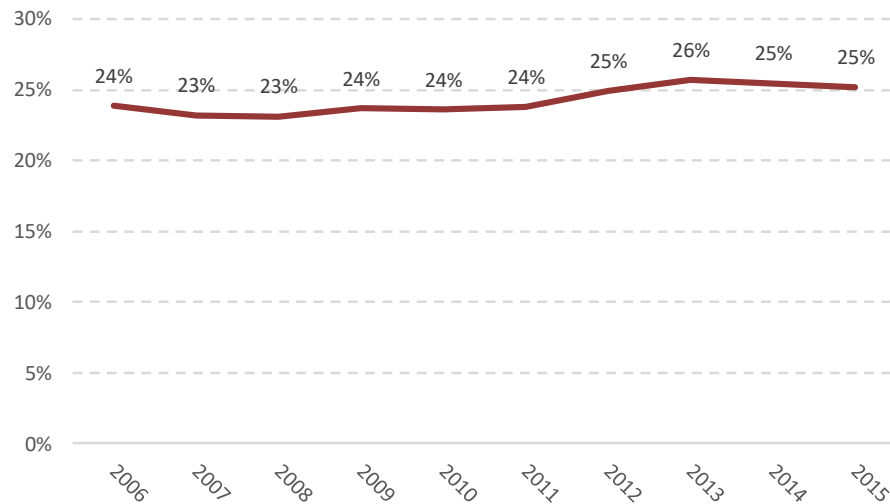


Figure 21. Percentage of live births that are caesarean section (Source: MOH statistics)

²⁴ Alkiaat, A., Hutchinson, M., Jacques, A., Sharp, M. J., & Dickinson, J. E. (2013). Evaluation of the frequency and obstetric risk factors associated with term neonatal admissions to special care units. *Australian and New Zealand Journal of Obstetrics and Gynaecology*, 53(3), 277-282.

4. Babies cared for elsewhere

Key messages:

There was general acceptance that babies should be cared for where they live and DHB's should provide adequate cot space in their neonatal units for their local populations. When the level of care an infant requires is not available at the DHB (e.g. care for babies born at less than 32 weeks gestation, babies who have undergone surgery) where the mother lives then the baby must be transferred to another location.

Approximately one-quarter of babies requiring L3 care were cared for in neonatal units away from where they lived.

Although the cost of the transfer and accommodation is funded from the public purse there are personal economic and social costs for families and whānau. The transfer of babies to another location disadvantages people who live in rural locations and may disproportionately affect families with lower incomes.

Efficient transfers are essential for the safety of the baby. Most interviewed stakeholders considered New Zealand had well defined processes for transferring babies.

Returning babies to their DHB of origin was frequently cited by stakeholders as a priority with delays in back transfers contributing to longer length of stay in L3 units. Capacity and over occupancy in L2A and L2 units for back transfers were reported as always or often a problem by 67% of L3 unit survey respondents.

There was general acceptance that babies should be cared for where they lived and neonatal units prioritised cot space for local populations. When the level of care an infant required was not available at the DHB where the mother lived then the baby must be transferred to another location. The reasons for this included:

- Babies who need a level of care their home DHB does not provide. For example, babies who require L3 care who do not live in one of geographical locations where the L3 units are located must be transferred
- Babies who need L3, L2A or L2 care and there are no cots available at the DHB where they live may also be transferred to another location. This should happen rarely.
- In the greater Auckland area, the LMC may be registered to deliver at a hospital that is not where the mother lives. For example, women who live in

Counties Manukau and are seeking private LMC care are likely to deliver in ADHB as there is no private LMC care available in CMDHB.

Approximately one-quarter of babies requiring L3 care were cared for in neonatal units away from where they lived.

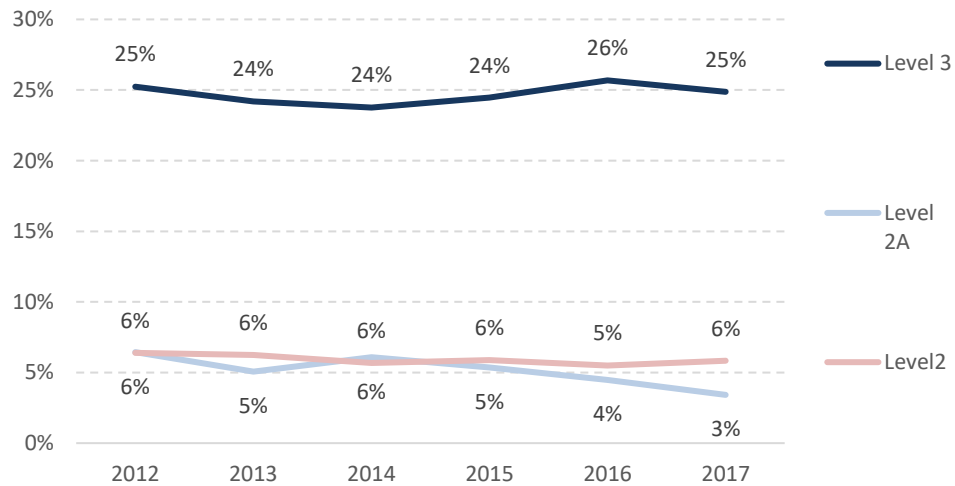


Figure 22. Proportion treated outside their home DHB by highest level of care received (Source: MOH data and DHB data, n = 36,365)

Many of those we interviewed discussed the challenges for families of being transferred out of the area. Although the cost of the transfer and accommodation is funded from the public purse there are personal economic and social costs that include:

- Travel for partners and whānau
- Time from work that may not be paid for by employers
- Lack of whānau support
- Separation from other children
- The potential for separation from the baby when transport for the mother is not immediately available that may affect parenting.

The transfer of babies to another location disadvantages people who live in rural locations and may disproportionately affect families with lower incomes. Families, often vulnerable families had to bear the costs associated with the transfers such as loss of income from work and in some cases the costs of accommodation.

Disastrously poor region with complete inequity of care compared with DHB 10km up the road. No onsite consultation by tertiary services including but not limited to surgery, neurology, genetics, etc. Inadequate facilities. (Survey – manager)

National Travel Assistance work is underway to consider a more equitable focus.

4.1. The transfer process

Efficient transfers are essential for the safety of the baby. Most interviewed stakeholders considered New Zealand had well defined processes for transferring babies.

Timely access to reliable transport services. At recent NEC reviews three cases of transport delays or confusion which may have contributed to adverse outcomes. Different protocols in different NICUs and different advice from different people within the same NICU. Lack of planning of patient flow across units and the need to transfer to distant units. (Survey-Specialist paediatrician)

Although there are defined national criteria for which babies should be transferred some interviewed stakeholders described national variation and that factors such as high staff workloads may influence some decisions to transfer babies.

Are decisions based on good processes and decisions...there are big implications for the family] when transferred to another area] and the cost of getting them back. (Interviews)

In utero transfers were preferable for very pre-term babies. However, 39% of L3 NICU staff considered there was always or often insufficient capacity in maternity units for antenatal transfers.

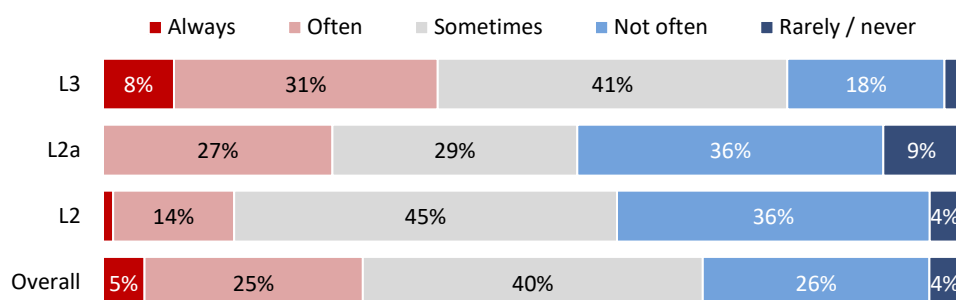


Figure 23. How often the capacity in maternity for antenatal transfers needing inpatient care is a problem (Source: Online survey)

Similarly, 38% of L3 staff considered the capacity in the birthing unit for acute transfers was always or often a problem. This was regarded as a problem by higher proportions of staff at ADHB, CMDHB and Waikato DHB L3 units.

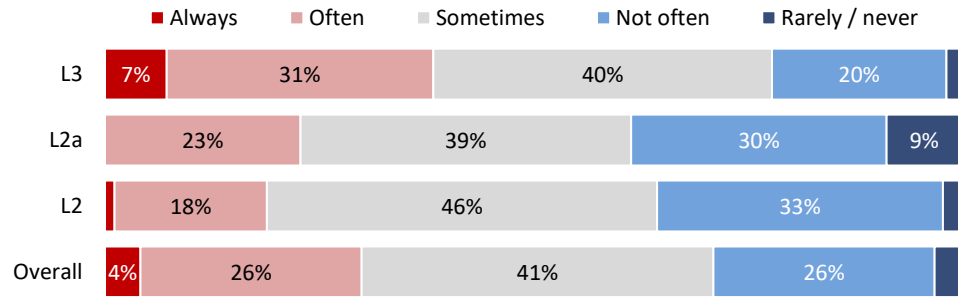


Figure 24. How often the capacity in the birthing unit for acute transfers is a problem (Source: Online survey)

4.1.1. Transfers where the home DHB does not provide the required level of care

The process of transferring babies to L3 NICU was mostly considered to be somewhat or very effective.

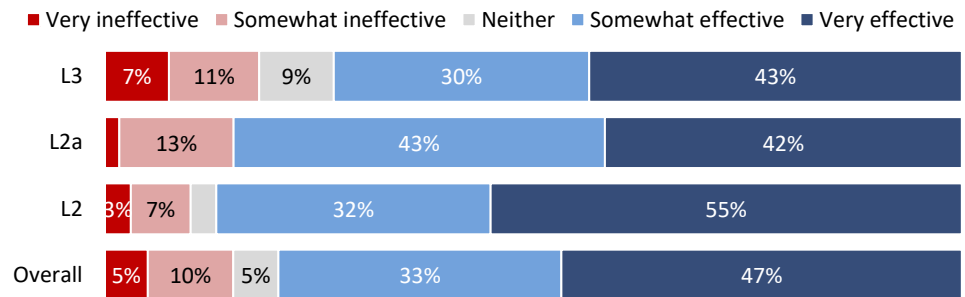


Figure 25. How effective is the process of transferring babies to L3 NICU

A New Zealand review found that factors preventing immediate emergency transfer such as delays due to weather, non-availability of NICU beds, lack of availability of helicopter, remote location, delayed request or slow transfer potentially contributed to development of neonatal encephalopathy²⁵.

4.2. Back transfers

Returning babies to their DHB of origin was frequently cited by stakeholders as a priority with delays in back transfers contributing to longer length of stay in L3 units. One in twenty (6%) of the babies who received level 3 care had transfers from level 2 or level 2A care recorded (where the baby’s first admission was to a level 2 or 2A unit and was subsequently admitted to a level 3 unit). A higher proportion (11%) had

²⁵ Battin, MR., Sadler, L., Masson, V., & ven den Boom, J. (2018). Perinatal transfer and contributing factors for neonatal encephalopathy (NE). *Journal of Paediatrics and Child Health* 54 59.

back transfers recorded where they received level 3 care and were subsequently admitted to level 2 or 2A care. Babies with back transfers had average lengths of stay around 26 days compared to 11 days for those without and will be babies with lower gestational age at birth.

When antenatal women are transferred out due to us being overfull it is very hard to get families back as we are consistently over full. This is very distressing for families. (Survey – registered nurse)

Exits from L3 units were affected by the capacity of L2a and L2 units to take babies from L3 units (back transfers). Capacity related to lack of staff and lack of cot space.

Very good service from our local tertiary NICU. They are often frustrated at our inability to take babies back when we are full or have not enough nursing staff to manage the numbers. (Survey – registered nurse)

One survey respondent also noted a reluctance of L3 units to transfer babies back to L2 care.

Certain consultants can keep a baby in the tertiary unit longer than necessary considering they are being nursed in our level 2 area. Some consultants do not show faith in the level 2 unit to care effectively for the long-term infant. This can then make it very problematic for the parents once they are transferred. (survey – manager)

Capacity shortages in L2A and L2 units for back transfers were reported as always or often a problem by 67% of L3 unit survey respondents.

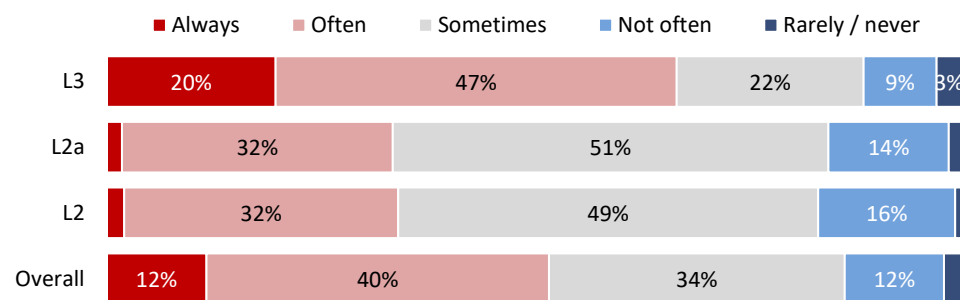


Figure 26. The extent L2A and L2 capacity to take babies from L3 NICU (back transfers) is a problem

Back transfers can be held up due to bed capacity in the smaller centres and this leads to bed block in the Level 3 NICU. (Survey – registered nurse)

I feel our babies at the L3 could go back to L2 units sooner but the L2 units frequently lack capacity. (Manager)

Problems arise when the "home" DHB cannot accept their babies back which results in a bed block in our unit. (Specialist paediatrician)

The capacity to discharge babies from L3 units to L2A and L2 was reported as always or often a problem by a higher proportion of survey respondents from C&CDHB, ADHB and Waikato DHB.

Table 11. Differences between L3 units in the extent L2A and L2 capacity to take babies from L3 NICU (back transfers) is a problem (Source: Survey n=188)

	% Always	% Often	% Sometimes	% Not often	% Rarely/never
L3 - ADHB	30%	52%	9%	9%	0%
L3 – C&CDHB	19%	72%	3%	6%	0%
L3 - CMDHB	21%	42%	26%	11%	0%
L3 - Waikato DHB	0%	82%	18%	0%	0%
L3 - CDHB	23%	35%	37%	5%	0%
L3 - Southern DHB	9%	9%	30%	26%	26%
L3	20%	47%	22%	9%	3%

As well as increasing the baby's length of stay in the L3 unit, finding a cot and coordinating the back transfer was time consuming for staff.

Time consuming process to find a bed if need to transfer a baby to another L3 NICU. Can take a long time to find a bed for a back transfer. (Survey – manager)

Effective transfers between L3 and L2 units have been associated with costs savings and no additional risks to the baby. The addition of extra beds in level two NICUs mean that fewer level three patients occupy level three beds²⁶.

Zein et al. found that elective transfer of stable neonates on NCPAP from level three to level two NICUs within an established clinical network was safe and led to substantial cost savings and increased bed capacity at level three NICUs²⁷.

²⁶ Fournier, D. L., & Zaric, G. S. (2013). Simulating neonatal intensive care capacity in British Columbia. *Socio-Economic Planning Sciences*, 47(2), 131-141.

²⁷ Zein, H., Yusuf, K., Paul, R., Kowal, D., & Thomas, S. (2018). Elective transfers of preterm neonates to regional centres on non-invasive respiratory support is cost effective and increases tertiary care bed capacity. *Acta Paediatrica*, 107(1), 52-56.

5. Workforce

Key messages:

There are no alternatives to NICU care for babies that require that level of support. Therefore, if there are no free cots the system must adapt to support these babies. NICU do this by adding additional cots that are not resourced primarily with overtime by nurses or increasing the baby to nurse ratio.

The addition of extra cots places pressure on staff as staff are resourced according to the number of resourced cots. Committed NICU staff respond to the levels of need to provide a high quality of care. However, the specialist NICU workforce is aging and looking to the future it may be difficult to staff to current staffing levels and expertise.

Maternity and new born care is provided by health professionals across different workforce roles. Sector staff were mostly satisfied with their roles and most considered they provided a high quality of neonatal care. However, the workforce is under pressure with workforce shortages reported across all health professional groups. Workforce shortages combined with under-resourcing resulted in scheduling challenges for managers, especially in scheduling staff for night shifts.

A high proportion of the workforce considered they were overworked. Perceptions of overwork were associated in the literature with missed nursing care and adverse events. Overwork and workforce shortages flowed through to challenges in finding time for workforce development.

The capacity and capability of the workforce has the potential to influence admissions to NICU, transfers to L3 NICU and length of stay in NICU. Shortage of outreach staff and roles such as social workers can increase length of stay in NICU.

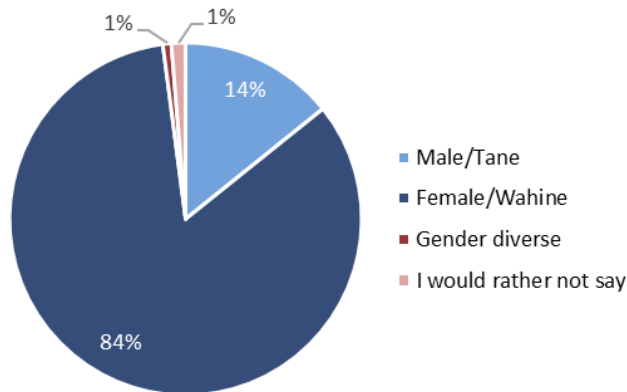
The online survey explored the main workforce roles and survey respondents' views of the availability of the workforce.

5.1. The demographic profile of the workforce

The online survey responses provide a picture of the demographic profile of the workforce. The demographic profile varied between the different groups in the workforce. The medically qualified workforce tended to work full-time and the nursing workforce to be younger, except for the clinical nurse specialists. The younger nursing workforce has implications for workforce development with one stakeholder noting that they almost all needed training.

Of those who responded to the survey:

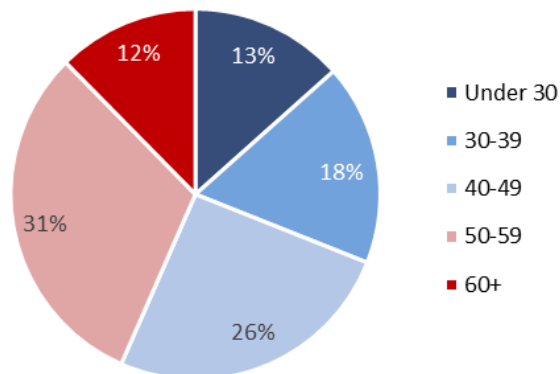
- Most (84%) were female



- The workforce was an ageing one with 43% aged over 50 years. Older age is not necessarily a challenge as neonatal care requires experienced staff. However, there must be sufficient inflow of new staff to enable succession planning.

Many of the nursing staff are long term neonatal nurses >20years. I am concerned about succession planning [as I have] limited ability to employ nursing staff with the capacity to train them adequately as they are rostered 1 of 2 staff / time is limited. (Survey – manager)

Considerable proportion of Neonatal SMOs in NZ are 55+ years of age. Succession planning is a major worry. (Survey – neonatologist)



- Almost all (73%) were NZ European or identified with another European ethnic group. Māori are under-represented at 4% of the workforce and Pacific represent 1%. The under-representation of Māori and Pacific staff means the neonatal care workforce does not reflect the population it supports.

- While 63% of the workforce were full-time, 33% worked part-time.

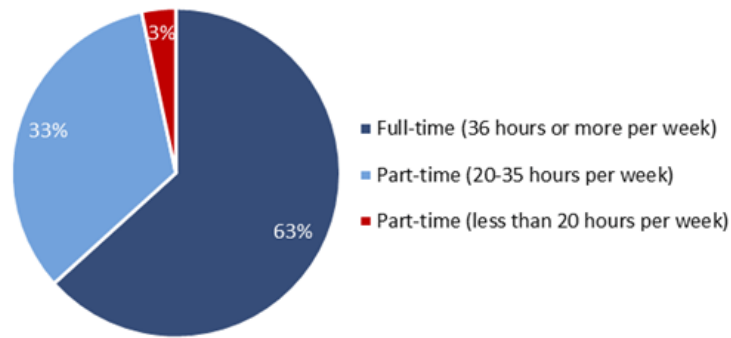


Table 12. Different workforce roles (Source: Survey n-387)

Unit level	Gender		Age		Ethnicity				Full or part-time	
	Male	Female	50-59	60+	NZ European	Māori	Pacific	Other	Full-time	Part-time
Manager (n=32)		97%	56%	25%	84%			19%	84%	16%
Neonatologist (n=16)	31%	63%	25%	25%	73%	7%		20%	100%	0%
Midwife (n=31)		100%	45%	19%	77%	6%		19%	48%	52%
All nurses (n=166)	1%	97%	23%	8%	72%	4%	1%	29%	51%	49%
CNS (n=27)	7%	89%	48%	19%	78%	7%		33%	81%	19%
Obstetrician (n=24)	25%	71%	33%	8%	83%	4%		17%	88%	13%
Paediatricians (n=72)	54%	44%	28%	11%	65%	1%		38%	68%	32%
Other (n=19)	5%	89%	26%	11%	74%	11%		21%	58%	42%

5.2. Workforce satisfaction

Overall, most people who responded to the survey were satisfied with their roles. In interviews, NICU staff were described as committed to their roles.

When staffing and acuity is at good levels it is a great place to work but care becomes compromised when these are not appropriate. (Survey – registered nurse)

We all work so hard to create good memories for our families that we serve in the work that we do. It would be amazing to be more appreciated. (Survey – registered nurse)

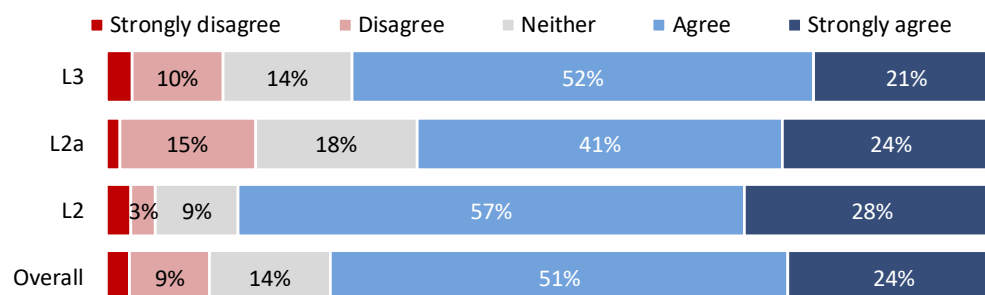


Figure 27. The proportion of survey respondents who disagreed or agreed they found their day to day work satisfying (Source: Survey n=387)

5.3. Quality of care

There are important long-term impacts of early life experience, and neonatal professionals feel passionately about optimising the quality of neonatal care to deliver the best outcomes for babies and their families²⁸. Most staff responding to the interviews considered they provided quality care. However, clinical nurse specialists (27%) were more likely to disagree they provided quality care.

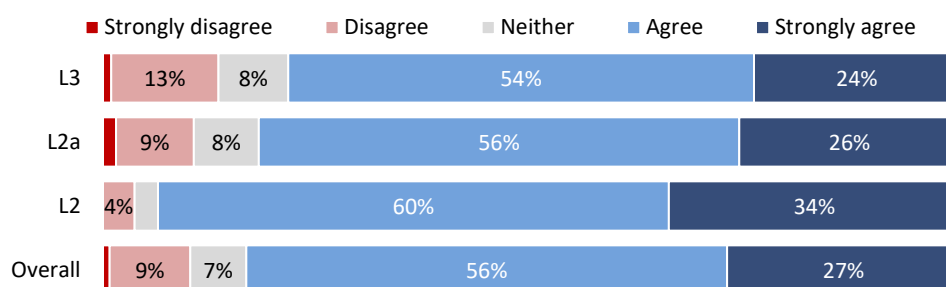


Figure 28. The proportion of survey respondents who disagreed or agreed they provided quality care (Source: Survey n=387)

In their comments in response to the survey many staff qualified their comments and noted the challenges of providing a high quality of care when occupancy rates were too high.

We are all very dedicated to our craft and believe we offer exceptional service but are under enormous stress constantly with substandard equipment or no equipment and expectations of delivery suite and postnatal services. (Survey – registered nurse)

It is disheartening not to be able to provide the best care every time due to workload and staff shortages. (Survey – other)

²⁸ British Association of Perinatal Medicine. Neonatal Service Quality Indicators June 2017.

On the days when it is very busy and we are stretched to full capacity, it is harder to do more than adequate work. This is unfair on the patients and their families. It also means I go home feeling stink about the work I did. (Survey – other)

5.4. Workloads

In interviews, NICU managers described the challenges of scheduling nurses to the different shifts required and considering leave and experience. One of the main challenges in staffing was the irregular workloads and unpredictability of the demand on the units.

I feel the ACNM's need more support/guidance. I often feel isolated as the staff on the floor don't understand what it is like having to support all the staff, keep an overview of the whole unit, organise transfers, deaths, admissions, theatre etc. (Survey – manager)

Another scheduling challenge was being resourced to provide adequate cover for evening shifts. Unlike some other speciality areas within a hospital, babies requiring NICU/SCBU care were likely to need admissions during night shifts as well as day shifts.

Mostly we work as an effective team. Its stressful when there is an imbalance of skill mix on a shift. (Survey – registered nurse)

A substantial proportion of staff felt they were overworked: 50% overall and 57% in L3 units disagreed or strongly disagreed the volume of work they were responsible for was about right.

I feel my health is excellent due to what I do outside of work. However, I work more hours than I should and definitely feel I am becoming compromised. (survey – other)

Work load is a massive factor. Sometimes there are not enough nurses for the care demand and this is very stressful as we just have to deal with it. (Survey – registered nurse)

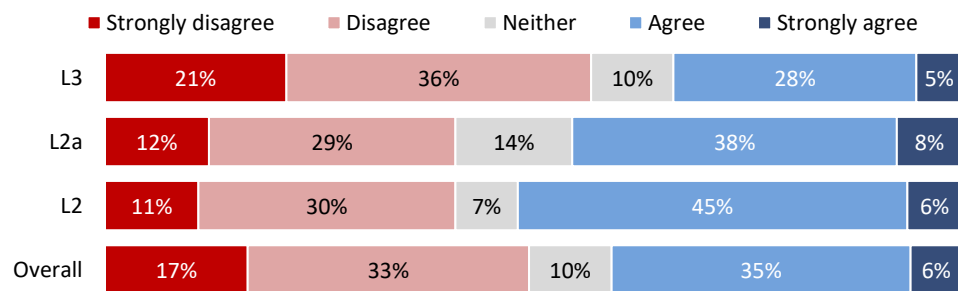


Figure 29. The proportion of survey respondents who disagreed or agreed the volume of work they were responsible for was about right (Source: Survey n=387)

Some staff were concerned about the safety implications of high workloads. In the literature, it is the workload of NICU nurses rather than occupancy levels that is

significantly associated with missed nursing care. Subjective workload ratings were particularly important. Subjective workload represents an important aspect of nurse workload that remains largely unmeasured despite high potential for intervention²⁹. Beltempo et al. found high unit occupancy rates were not associated with increased odds of infection³⁰. However, nursing overtime was associated with higher odds of healthcare-associated infection in the following three days.

I know people are paid to come to work and I understand that, but the unrelenting pressure on staff of no downtime at all... (interview)

There are often occasions where all nurses will have EXTREMELY unsafe workloads and admissions continue to come in. We inform the ACNM that we feel unsafe but nothing is done/can be done as there is no more staff. ... I have told my manager that our stress levels when there are high patient volumes, especially if they are sick, often feels like we are all treading water and we are seconds away from drowning. (Survey-registered nurse)

In contrast, high nursing provision ratios in Canada were associated with lower risk or mortality, major morbidity, and medical incidents³¹.

A new workforce planning and workload management system, Trend Care, is being introduced by DHBs³². The expectation is that Trend Care will improve patient flow, bed use and discharge processes by providing a better understanding of nursing staff workloads and supporting patient care.

5.5. Workforce shortages

Workforce shortages contributed to increased workloads. In response to the survey, respondents noted workforce shortages across all health professional groups.

As nurse manager of a over occupied under resourced service the challenges of nursing retention and recruitment going forward a real concern having confidence we have skilled flexible workforce is not our current reality without extra resources. (Survey – manager)

²⁹ Heather L. Tubbs-Cooley, PhD, RN; Constance A. Mara, PhD; Adam C. Carle, MA, PhD; Barbara A. Mark, PhD, RN; Rita H. Pickler, PhD, RN (2018). Association of Nurse Workload with Missed Nursing Care in the Neonatal Intensive Care Unit. *AMA Pediatr.* doi:10.1001/jamapediatrics.2018.3619

³⁰ Beltempo, M., Blais, R., Lacroix, G., Cabot, M., & Piedboeuf, B. (2017). Association of Nursing Overtime, Nurse Staffing, and Unit Occupancy with Health Care–Associated Infections in the NICU. *American journal of perinatology*, 34(10), 0996-1002.

³¹ Barr, P. (2018). The five-factor model of personality, work stress and professional quality of life in neonatal intensive care unit nurses. *Journal of advanced nursing*, 74(6), 1349-1358.

³² Trend Care is described as providing dynamic data for clinicians, department managers, hospital executives and high-level healthcare planners. Care planning components within the system ensure best practice. <http://www.trendcare.com.au/>

Neonatal units cannot work in isolation from maternity services. Our backlog impacts safe obstetric care in a significant way and antenatal transfers are a very real prospect. Delayed inductions and elective caesareans are also a common occurrence in our DHB. Resourcing with staff numbers and equipment is not terribly hard but resourcing with skill to match acuity and complexity is inordinately difficult. If we are to be rescuing younger and younger babies (22-23 weeks) this will have a major impact on our ability to cope. I think we need to fix our current problems before we tackle this ethically debateable challenge. (Survey – neonatologist)

They also noted the importance of the specialty skills within different professional groups.

Midwives need extra training to do neonates Direct entry midwives do not have skill and exposure to the unwell....If you want to keep babies with mum then need midwives with an extra package of training. (Interview)

Paediatric nurses can support sick babies but may not know the mother part of it. (Interview)

Lactation should be bread and butter of the nurse but nurse workloads too big to do this. (Interview)

I have nurses that are lactation specialists but workloads don't allow them to champion breastfeeding with colleagues... We might have ED, ICU nurses who don't know anything about breastfeeding. (Interview)

Shortages of outreach roles also contributed to admissions to NICU rather than care on the postnatal ward and/or to longer length of stay in NICU.

Neonatal outreach nurse is a real bonus – can have babies go home without them.

Significant shortage of midwives. Low numbers of postnatal beds for mothers – being discharged very quickly, meaning neonates who could have been discharged to postnatal ward can't be. (Survey – other)

Midwives are trained in areas of expertise and could do monitoring, glucose, IV Ab in the postnatal wards... the workforce is not there. (Interview)

Table 13. The proportion of survey respondents who considered a shortage of workforce in various professional groups was always or often a problem (Source: Survey)

Role	L3	L2A	L2
Specialist paediatric/ neonatal staff	47%	36%	19%
Neonatal trained nurses	62%	36%	39%
Midwives on the postnatal ward	77%	58%	53%
Lactation consultants	54%	35%	27%
Outreach neonatal trained nurses	33%	33%	25%
Social workers	40%	28%	31%

5.6. Workforce development

In response to the survey, between 25% and 43% of staff disagreed they had adequate opportunities for education and training relevant to their work (Figure 30). More staff from L2A units were likely to disagree.

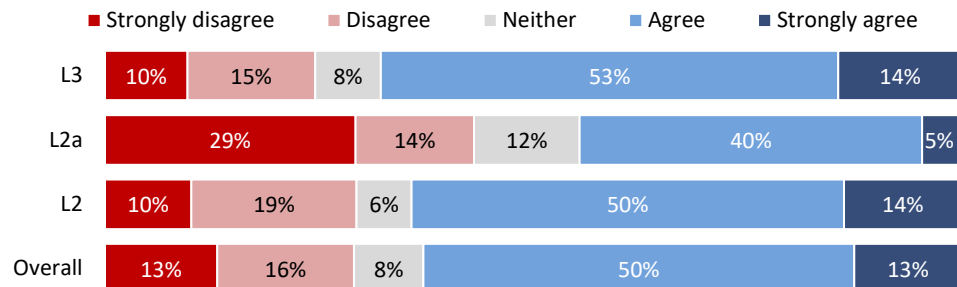


Figure 30. The proportion of survey respondents who disagreed or agreed they had adequate opportunities for education, training for your work (Source: Survey n=387)

In the survey and interviews, staff described challenges to workforce development to respond to workforce shortages:

- Lack of a standard approach to workforce development across DHBs. The resources available to deliver education vary between DHBs and there is no national standardised education programme for NICU nurses³³. Some DHBs have no nurse educator for NICU nurses.

There is no nurse educator in our unit so we are relying on learning skills from peer/senior nurses sometimes not much more experienced than you are. There have been two clinical coaches employed but the majority of their time is spent with upskilling nurses as fast as they can. (Survey – registered nurse)

- Challenges in developing and maintaining specialist skills for staff who work in a DHB that does not have a L3 unit. L3 placements are necessary for medical and nursing staff to develop specialist skills. L2 units are run by general paediatricians. L2 NICU is a rotation in the first year of fellowship training. However, general paediatricians also need to have L3 placements to develop skills.

I believe ongoing education should be improved. There are excellent postgraduate neonatal nursing papers available however once you have done them, there is nothing to maintain your knowledge. (Survey – registered nurse)

Skill mix of paediatricians because spend less time in SCBU, so not as exposed to little more urgent babies. (Survey – paediatrician)

³³ Information supplied by the Neonatal Review Committee

- Challenges in keeping skills levels for specialised but low volume activities e.g. neonatal resuscitation skills for paediatricians and midwives.

We have no plans for retention of trained Neonatal staff - it would be good to have a programme with a level 3 unit that provided opportunities to keep level 3 practice current and up to date. (Survey- Registered nurse)

- Freeing up staff for study leave or to attend training. There is insufficient capacity in some locations to free up nursing staff for training making it hard for smaller localities to develop a skilled workforce (Figure 31). Staff in L2A units (34%), clinical nurse specialists (30%) and nurses (30%) were more likely to disagree they could get study leave when requested.

Study days cancelled due to lack of staff on the floor. Not many down time days as work loads are heavy due to lack of space and staff. (Survey – registered nurse)

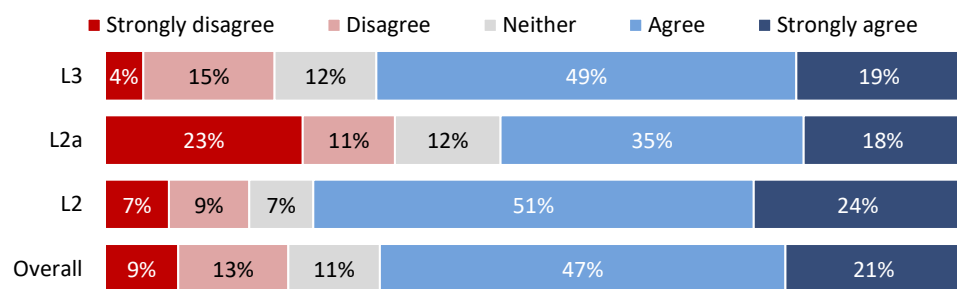


Figure 31. The proportion of survey respondents who disagreed or agreed they can get study leave when requested (Source: Survey n=387)

- Limited funding for nurses and midwives to attend conferences.
[There are] good opportunities for professional development however would like to see full funding for conference like our medical counterparts - i.e. accommodation, travel and registration. (Survey – registered nurse)

There were some examples of good training and workforce development partnerships described in interviews:

- Training partnerships in some geographically close L2 and L3 units e.g. Wellington and Hutt Valley. Geographical proximity makes it feasible to move staff between locations and share training sessions.
- Dual trained people in L2 units so there is someone with neonates training.
She did dual training in paediatrics and neonates, and they gave her the neonatal lead job, and she's put so many things in place where their nursing staff feel very well supported and trained to look after these babies. She's put in a whole lot of processes where people can come across and spend some time here, do all of those things, so that's actually made a big difference.

Neonatal nurse practitioners have the potential to fill a skills gap but stakeholders considered they may not be busy enough in L2 units.

5.6.1. Overview of the impact of staff shortages on NICU occupancy

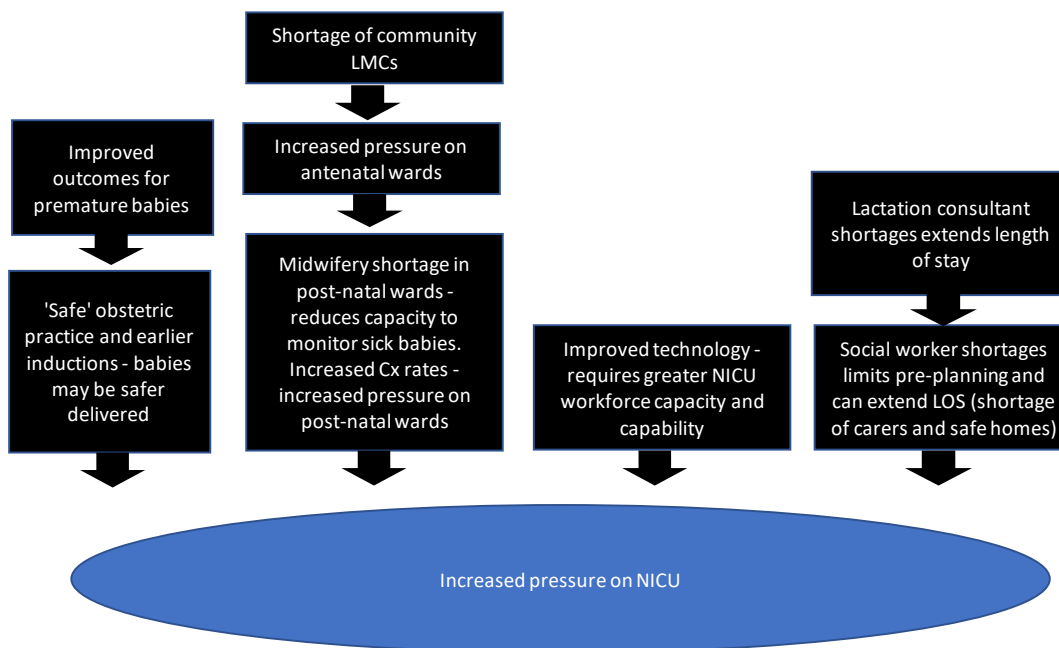


Figure 32. The impact of different workforce roles and responsibilities on NICU capacity

5.7. Workforce health and safety

Staff stress was associated with high turnover rates. However, managers and senior staff also described the importance of staff retention because of the challenges in building a workforce with the specialist skills needed in NICU.

New nurses will be trained and then they leave, either for Australia or less stressful careers. (Survey – registered nurse)

The workforce is an incredible team of knowledgeable and skilled people and it should be a priority to keep our nurses and doctors supported and well. (Survey – specialist paediatrician)

Overall, 25% of staff strongly disagreed or disagreed they were able to take annual leave when they requested it. The proportions were higher for clinical nurse specialists (50%) and nurses (36%).

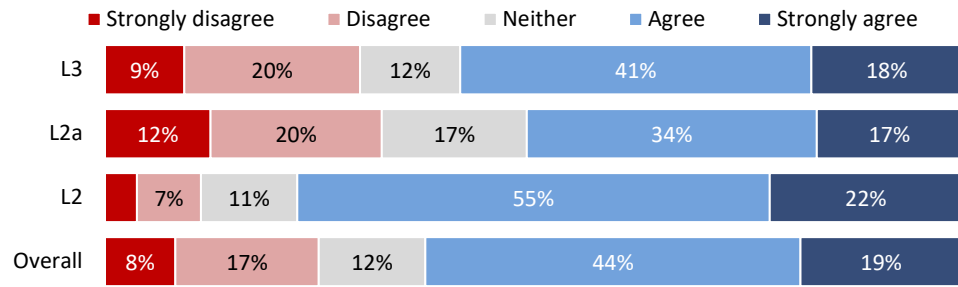


Figure 33. The proportion of survey respondents who disagreed or agreed they were able to take annual leave when requested (Source: Survey n=387)

I have never had leave declined by my clinical leader but I have a huge amount of unused leave because you know if someone else is already off, those remaining are going to be rostered on too frequently for safety. (Survey – Other)

Survey respondents were asked to self-assess their wellbeing on a 1-5 scale for each of the four domains of Te Whare Tapa Whā, where 5 is the most positive score. There was little difference between self-assessed wellbeing for staff from L3, L2A and L2 units. Overall, staff self-assessed their mental health slightly lower than other dimensions of wellbeing.

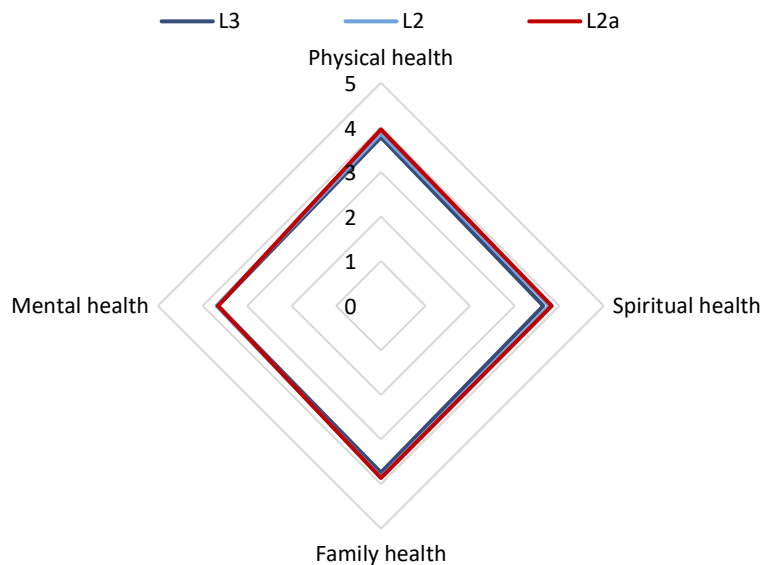


Figure 34. Average scores for survey respondents in the four domains of wellbeing in Te Whare Tapa Whā

Three-quarters of survey respondents self-assessed their wellbeing in all four domains as 3-5 on a five-point scale and approximately one-quarter rated at least one dimension of wellbeing as poor or very poor.

There is a high rate of mental health issues noted among staff. (Survey – registered nurse)

I am not happy of how I am treated at work because I feel I am undervalued in my work place. (Survey – registered nurse)

Staff becoming run down after months of high acuity in the Unit. (Survey – registered nurse)

I answered neither to physical/spiritual health because whilst I'm generally healthy/ happy in life, my work load is increasingly heavier, thus less satisfying. It's not great to be so overloaded at work that I cannot provide the due care I should be able to. (Survey – other)

6. System issues

Key messages:

In interviews and surveys, staff described other systemic issues where there was the potential for improvements:

- Information shortages limit monitoring – there is no national data set that allows effective monitoring of neonatal intensive care and tracks cot numbers and resourcing.
- National and local leadership – has the potential to drive sector development if adequately resourced
- National cot status – a national website was often described as inaccurate because it was not kept up to date. Managers spent considerable time phoning around to find cot space. Stakeholders also described overcrowding as influencing decisions to transfer or accept transferred babies.
- Information sharing – IT systems that restrict information sharing result in inefficiencies and duplication of tests.
- Lack of interface with other agencies, especially Oranga Tamariki can extend the length of stay in neonatal intensive care for babies who do not have safe warm home to go to. Shortages of social workers compound these challenges.

6.1. Lack of information

A recent King's Fund report contained the following quote:

"We can only be sure to improve what we can actually measure."³⁴

In completing this review, we had to request data from each DHB and that data had to be linked to Ministry of Health data. Understanding reasons for admissions and any time trends in the drivers of demand for neonatal intensive care was limited by missing data and inconsistent coding of reasons for admissions. Acuity data was not robust meaning that identifying increases in the acuity of admissions to different levels of intensive care was not possible.

³⁴ Cited by Health Quality and Safety Commission. <https://www.hqsc.govt.nz/our-programmes/health-quality-evaluation/projects/health-quality-and-safety-indicators/>

In addition, there were no data to assess any levels of unmet need, especially for babies cared for on postnatal wards.

Data are not there to look at the complexity of a family not just baby. e.g. the impact of paternal mental health, medications. (Interview)

Outreach and acuity definitions are long overdue. (Survey – other)

The current acuity tool in the postnatal wards did not capture babies requiring additional care such as for jaundice, feeding problems. Following the 2004 review a 2008 paper by Gilli Sinclair³⁵ recommended consideration be given to a national acuity process that acknowledged social factors as well as medical/clinical factors. Work underway including a National Coding Working Group and development of a National Neonatal Acuity Tool development has the potential to improve data collection if enough resources are committed to effective implementation of the recommendations of the working groups.

6.2. National coordination

The need for improved nation coordination was raised by stakeholders regarding:

- Sector leadership
- Coordination of availability of cot space
- Quality standards
- Workforce standards
- Standards for transferring babies.

6.2.1. Sector leadership

Some interviewed stakeholders and some in response to the survey described a lack of leadership, and a lack of understanding of the perspectives and challenges facing different units.

There needs to be better understanding of the capacity of different units, and greater respect for the limitations that different units work in. (Survey – specialist paediatrician)

Lack of a clinical leader role in L2 units was described by stakeholders as making communication difficult because there was no one person to contact.

6.2.2. Coordination of the availability of cot space

Following the 2004 review, a website was developed to provide a daily assessment of neonatal bed status. However, interviewed stakeholders were critical of the

³⁵ Provided by MoH. Gilli Sinclair can be contacted at gzsincclair@cmdhb.org.nz

website and the extent it provided accurate information. Sixty-four survey respondents made specific comments about difficulties in finding beds when units were busy and over capacity.

We waste a lot of time trying to find placements for impending arrivals that are very prem. (Survey – obstetrician)

The national cots webpage is rarely accurate and should be discontinued. (Survey – registered nurse)

Some considered clearly establishing rules about cot availability would improve coordination.

“What are the rules that the NHS set about when you can say whether you’re closed or half-closed or open?” and I think we’re missing those ... We’ve got this network, but it’s not behaving as a network, because no one’s clear about the rules. They’re not nationally consistent. (Interview)

6.2.3. Quality standards

Previous research has shown a wide variety of practice in NICUs across areas such as administration of inhaled nitrous oxide³⁶, use of saline as an adjunct to endotracheal suctioning³⁷, PCVC insertion and monitoring^{38 39}, use of human milk fortifier⁴⁰, management of neonatal hyperglycaemia⁴¹, chlorhexidine use as a skin antiseptic solution⁴² and use of pulse oximetry studies before discharge⁴³. Variance across practices and policies can lead to increased risks. For example, lack of policies to

³⁶ Sasi, A., & Sehgal, A. (2014). Use of inhaled nitric oxide in preterm infants: a regional survey of practices. *Heart & Lung: The Journal of Acute and Critical Care*, 43(4), 347-350.

³⁷ Van Heerden, MK. & Hough, JL. (2016). Saline and suction in NICUs: A qualitative investigation of practices and policies. *Journal of Paediatrics and Child Health* 52 84-85.

³⁸ Verma, N., Balegar, V. K., Deshpande, G., Brandenburg, U., Shingde, V., & Downe, L. (2013). PCVC Insertion And Monitoring: Survey Of Practice Across ANZNN: p381. *Journal of Paediatrics and Child Health*, 49, 103-194.

³⁹ Taylor, J. E., McDonald, S. J., & Tan, K. (2015). Prevention of central venous catheter-related infection in the neonatal unit: a literature review. *The Journal of Maternal-Fetal & Neonatal Medicine*, 28(10), 1224-1230.

⁴⁰ Webster, C. J., Holberton, J., Opie, G. F., & Klingenberg, C. (2013). what Are The Other Half Doing? A Comparison Of Feed Fortification Practice Between Nursing And Medical Staff: p348. *Journal of Paediatrics and Child Health*, 49, 95.

⁴¹ Gandhi, P., Wheeler, BJ., Edmonds, L., Medicott, N., Broadbent, R., & Al-Sallami, HS. (2018). How is neonatal hyperglycaemia treated in NICUs across Australia and New Zealand? *Journal of Paediatrics and Child Health* 54, 75.

⁴² Shah, D., & Tracy, M. B. (2013). Skin Antisepsis Survey In Australia-New Zealand Neonatal Nurseries: p454. *Journal of Paediatrics and Child Health*, 49, 124.

⁴³ Wellington, G., Campbell, A. J., & Elder, D. E. (2016). Oximetry for preterm infants at neonatal discharge: What is current practice in New Zealand and Australia?. *Journal of paediatrics and child health*, 52(3), 333-337.

indicate correct prevention strategies for infections caused by CVC insertion and management may contribute to mortality and morbidity⁴⁴.

Sector stakeholders described different policies for what care is provided on the post-natal wards.

... the bottom line is we want to work closely together as we are all experiencing similar challenges and demands and lack of resources but still some of the ways we work are inconsistent such as defining our categories of care, nursing workloads, etc and reviewing and as a speciality being involved in the review of the service specs will assist with this to be able to articulate where our constraints/pressure points are (Survey – other)

They considered quality standards would contribute to improved data collection.

National guidelines/protocols to align neonatal care throughout NZ so we are all on the same page with care delivery. (Survey – registered nurse)

We are not even as NICU saying the same thing re. categories of care and workload...we need to define L3, high intensity baby, transitional care and where they are cared for. ... need to review and redefine categories of care throughout country and what that means for nursing ratios. (Interview)

The British Association of Perinatal Medicine has defined Neonatal Service Quality Indicators⁴⁵ that relate to the structure and delivery of services and as such are different from Clinical Quality Indicators which relate to the quality of care of individual patients.

6.2.4. Workforce standards

Stakeholders also noted the importance of workforce standards. Several cited the MERAS guidelines as applicable but not consistently applied.

6.2.5. Standards for transferring babies

While some stakeholders considered transfer processes to be clear and working well, others recommended a logic/decision tree was needed to guide decisions about transfers to ensure national general principles.

6.3. Local leadership and communication

The flow of information through the maternity care system was important for effective functioning. Information from foetal medicine experts and obstetricians

⁴⁴ Taylor, J. E., McDonald, S. J., & Tan, K. (2015). Prevention of central venous catheter-related infection in the neonatal unit: a literature review. *The Journal of Maternal-Fetal & Neonatal Medicine*, 28(10), 1224-1230.

⁴⁵ British Association of Perinatal Medicine. Neonatal Service Quality Indicators June 2017.

could alert neonatal intensive care units about high risk deliveries enabling advanced planning.

Presence on vulnerable women’s groups helps identify women who might be delivering. We try to get a pre-birthing plan at 35 weeks but social work shortages are a problem.

Going to maternity handovers and preparing. Knowing when they have elective caesareans coming up.

Information from the delivery suite would enable better preparation by NICU.

You should know when you are about to get into trouble. You should know when babies are pending/in labour. (Interviews)

Very rarely will nurses be informed of an incoming admission (high risk), we usually find out when the CNS is attending the delivery. (Survey - Registered nurse)

Multidisciplinary team meetings were an effective way of communication in some but not all DHBs.

I think the neonatal nurse specialists are outstanding and hardworking and caring, and the NICU is a good example of good interdisciplinary collegiality. (Survey – obstetrician)

Communication and interaction with our tertiary unit is great. (Survey – registered nurse)

Several stakeholders discussed the need to break down silos between different parts of the maternity care system to ensure better communication. In response to the survey, approximately one-quarter of stakeholders considered poor communication about high risk births was a challenge.

Within the units, maternity to SCBU the information flow could be improved. There are so many different teams (CMCs, AN clinic, acute birthing suite) and all feed into SCBU....The teams are not aware of each other and what is going on. (Interview)

In a perfect world – there would be no silos between obstetrics and neonatal. We would alert each other around volumes, shared conversations around admission decisions for babies. There is capacity needed to do this better. (Interview)

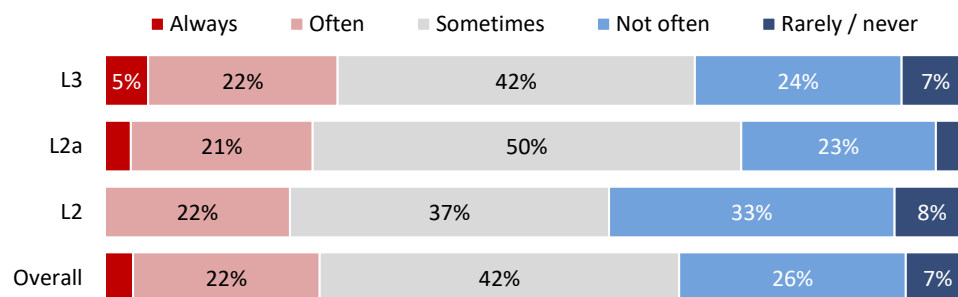


Figure 35. The extent poor communication about high risk births is a challenge (Source: Survey n=387)

Lack of information and shared notes was also a challenge for patient care, especially for transferred babies.

Electronic data system is needed to share AN bloods etc both between and within DHB. I can't see LMC or GP notes. I need to rely on the bluecard or see previous hospital letters. This can lead to wrong information or duplication of tests. (Interview)

Poor archaic means of referrals requiring repetitive information and services that don't speak to each other. Often multiple people involved where they are fulfilling the same role. Often key social information is missed. (Survey – core midwife)

6.4. Interface with other agencies

As described in Section 5, interfaces with Oranga Tamariki were frequently mentioned as influencing the ability to discharge babies from NICU where there were care and protection concerns.

Delayed planning from Oranga Tamariki leading to chaos in the unit with distress for families and risks to staff. (Survey – specialist paediatrician)

7. Opportunities

Key messages:

Alongside additional resourcing there is the potential to improve the effectiveness and efficiency of the neonatal intensive care system by increased national coordination of cot space, better integration of neonatal care with the First 1,000 days strategies and improved communication and information flow through maternity to newborn care. New models of care such as transitional care have the potential to reduce pressure on NICU but to also improve social outcomes for families.

National level strategies are also required for workforce development to address shortages across the different health professional and social service groups that interface with neonatal intensive care. Workforce shortages cannot be quickly addressed but developing consistent approaches to professional development is an interim step to maintain the current high quality of care.

Improved national data collection about neonatal intensive care is required to monitor the effectiveness of changes.

7.1. Increasing resourcing is a priority

The key findings from this review are consistent with reviews commissioned by specific DHBs⁴⁶.

The most important priority for the sector is the need for increased resourcing to bring occupancy levels down to 85% most of the time. Increased resourcing includes cot space and numbers, staff time and specialised equipment. The need for additional resourcing is urgent to address the potential for adverse outcomes and to provide relief to staff.

In the stakeholder survey, staff were asked about the priorities to improve neonatal care services. Improvements to staffing numbers of different professional groups and increased resourcing were the most frequently mentioned suggestions. In interviews the need to define, agree and monitor acceptable levels of occupancy was highlighted by stakeholders.

⁴⁶ Provided in confidence so not cited

Table 14. Staff priorities for changes to improve neonatal care services

Survey respondent suggestions	Number	Percentage
Staff		
Increase staff numbers to create safe work load	205	53%
More lactation consultants/ increase in lactation support	47	12%
More outreach nurses/homecare	20	5%
More social workers	16	4%
Other staffing suggestions	22	6%
Resourcing		
More resourced beds	216	56%
Better equipment & facilities, more space	78	20%
More L2 beds/units	38	10%
More units	31	8%
Review the funding model, collect data on resource need	21	5%
Other resourcing	8	2%
Different models of care		
Increase capacity for L1 transitional care/mother-baby rooming in	88	23%
Family integrated care	56	14%
More emphasis on developmental care	47	12%
Staff support and development		
Improved training, upskilling, education	99	26%
Better leadership/coordination	37	10%
Salary/bonding incentives to improve staff retention	12	3%
Staff interfaces		
Better communication /collaboration /handover of care /MDT approach	73	19%
Improve the workplace culture	29	7%
System		
Nationwide clarity and consistency in approach to neonatal care	25	6%
Shared access to written protocols and guidelines	19	5%
National oversight of services with equal funding	15	4%
Increased planning for discharge	11	3%

Transfers		
Reliable nationwide centralised system for coordinating transfers to available beds	11	3%
Reduce need for transfers/ Prioritise people delivering in their own DHB	20	5%
Support for parents/families		
Accommodation for parents and families, siblings	18	5%
More psychological support for families	16	4%
More financial assistance for parents	1	0%
Public health and education		
Increase antenatal educational for parents, eg. Psychosocial, nutrition, drug use	15	4%

7.2. Lack of equity

Lack of equity is a challenge for the system. The highest fertility rates⁴⁷ are in some of New Zealand's most economically disadvantaged areas of Northland (2.55), Hawke's Bay (2.46), Tairāwhiti (2.4) and the Bay of Plenty (2.34) – compared with a birth rate of 1.67 in Otago⁴⁸.

L3 units are geographically located to service the largest populations. However, the geographical locations of the highest levels of care do not align with areas with the highest proportion of the population needing NICU care.

Māori are over-represented in SCBU/NICU babies, accounting for 28%. However, a higher proportion of Māori babies were in Level 2 and 2A units than level 3. There was higher overall occupancy of NICU by Māori babies but lower relative occupancy of L3 units compared with babies from other ethnic groups.

7.3. Improved national coordination

Alongside additional resourcing there is the potential to improve the effectiveness and efficiency of the neonatal intensive care system by increased national coordination of cot space, better integration of neonatal care with the First 1,000 days strategies and improved communication and information flow through maternity to newborn care.

⁴⁷ An indication of how many births women will have during their lifetime

⁴⁸ Statistics New Zealand 2013 Census of Populations and Dwellings.
http://archive.stats.govt.nz/browse_for_stats/population/births/births-tables.aspx

Regular review of neonatal occupancy trends and a regional approach to cot allocation in the L2A and Level 2 units aligned to the L3 units is needed.

7.4. Different models of care

The NZ Triple Aim Framework adopted by the Health Quality and Safety Commission and other health agencies⁴⁹ provides a framework for models of care:

- improved quality, safety and experience of care
- improved health and equity for all populations
- best value from public health system resources.

7.4.1. Patient centred care

Internationally there is an increasing emphasis on patient centred models of care for NICU. An example is the Welsh and Scottish person-centred care model.



Figure 36. All of Wales dimensions of person-centred care⁵⁰

7.4.2. Integrated NICU and maternity services

Research suggests that Family Integrated Care (FICare) where parents take a more active role in neonates' care increases average daily weight gain, reduces parental stress⁵¹, reduces rates of nosocomial infections and retinopathy of prematurity,

⁴⁹ <https://www.hqsc.govt.nz/our-programmes/health-quality-evaluation/projects/health-quality-and-safety-indicators/>

⁵⁰ All Wales Neonatal Standards – 3rd Edition Approved: Neonatal Network Steering Group 19th September 2017

⁵¹ O'Brien, K., Robson, K., Bracht, M., Cruz, M., Lui, K., Alvaro, R., ... & Soraisham, A. (2018). Effectiveness of Family Integrated Care in neonatal intensive care units on infant and parent

increases breastfeeding rates⁵², and may be able to reduce health care costs through reduced resource use including length of stay⁵³.

I would really like to see an integrated NNU and Maternity service. ... Separation of mothers and babies is a concern here in our DHB and by integrating services, this could be eliminated along with a midwife being present at C/S, both elective and emergency (only NNU attend at this stage). (Survey – core midwife)

The British Association of Perinatal Medicine is developing strategies to increased family engagement in neonatal care and have identified three action areas: communication, care, partnership⁵⁴.

7.4.3. Transitional care

Many stakeholders described the need to develop transitional care capacity and this work is underway in some DHBs. Transitional care can lead to fewer admissions per month and avoid medicalisation for near term babies who would otherwise come into NICU.

Transitional care either co-located on the postnatal ward or in a separate unit has the potential to reduce pressure on NICU but to also improve social outcomes for families. For transitional care to be provided on the postnatal ward additional staffing is required. The ideal ratio is 12-beds staffed by two nurses and one midwife.

The national service specification review has outlined the care that could be provided in transitional care either on the postnatal or in a specially designed unit. The key factors is the presence of the mother 24/7 throughout the babies inpatient stay.

We need to look outside the box of our traditional model. (interview)

Lack of transition nurseries – not in a neonatal or postnatal unit. If you had this area for L1 or L2 babies where mums can stay supported by clinical staff. Free up beds and mothers can support them as well. (Interview)

Love to see more units where mums and babies are together. Some separation is required but families need to feel they can be with their babies easily. (Interview)

outcomes: a multicentre, multinational, cluster-randomised controlled trial. *The Lancet Child & Adolescent Health*, 2(4), 245-254.

⁵² O'Connor, T. (2016). Involving parents in the care of neonates. *Kai Tiaki Nursing New Zealand* 22(4), 12-13.

⁵³ O'Brien, K., Bracht, M., Robson, K., Xiang, Y. Y., Mirea, L., Cruz, M., ... & Narvey, M. (2015). Evaluation of the Family Integrated Care model of neonatal intensive care: a cluster randomized controlled trial in Canada and Australia. *BMC pediatrics*, 15(1), 210.

⁵⁴ British Association of Perinatal Medicine Strategic Plan Draft 2 (Sept 2014)

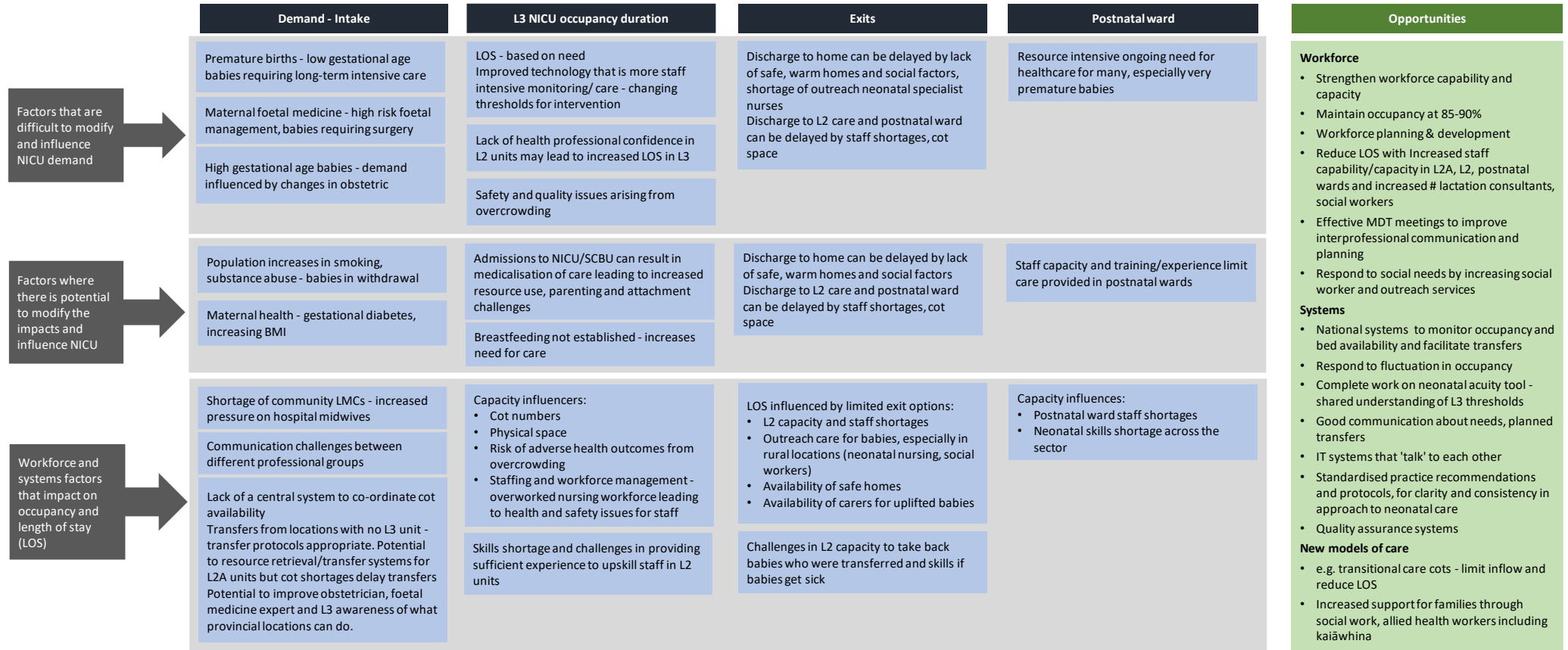
7.5. Workforce development

National level strategies are also required for workforce development to address shortages across the different health professional and social service groups that interface with neonatal intensive care. Workforce shortages cannot be quickly addressed but developing consistent approaches to professional development is an interim step to maintain the current high quality of care.

7.6. Improved national data collection

Improved national data collection about neonatal intensive care is required to monitor the effectiveness of changes.

7.7. System overview



Appendix One: Regional fertility rates

Total Fertility Rate⁽¹⁾				
<i>Regional council areas</i>				
1996, 2001, 2006, and 2013				
Regional council area	December year ⁽²⁾			
	1996	2001	2006	2013
Northland Region	2.49	2.40	2.67	2.55
Auckland Region	2.00	1.99	2.01	1.99
Waikato Region	2.12	2.10	2.22	2.17
Bay of Plenty Region	2.36	2.31	2.44	2.34
Gisborne Region	2.61	2.61	2.68	2.40
Hawke's Bay Region	2.32	2.30	2.41	2.46
Taranaki Region	2.05	2.09	2.30	2.28
Manawatu-Wanganui Region	2.02	2.00	2.16	2.09
Wellington Region	1.79	1.79	1.81	1.78
Tasman Region	1.85	1.97	2.16	2.06
Nelson Region	1.68	1.85	2.02	1.98
Marlborough Region	2.03	1.88	2.01	2.13
West Coast Region	2.03	1.96	2.06	2.19
Canterbury Region	1.70	1.70	1.88	1.90
Otago Region	1.56	1.56	1.59	1.67
Southland Region	1.97	2.07	2.18	2.05
New Zealand ⁽³⁾	1.97	1.96	2.04	2.02
(1) The average number of live births that a woman would have during her life if she experienced the age-specific fertility rates of a given period (usually a year). It excludes the effect of mortality.				
(2) To minimise annual fluctuations, calculations are based on the annual average number of live births over three years. For example, the total fertility rate for 1996 is based on the annual average number of births registered during the three-year period 1995–1997.				
(3) Includes births where usual residence of mother was outside regional council boundaries or not stated.				
Note:				
(a) Births and fertility rates are based on births registered in New Zealand to mothers resident in New Zealand by date of registration.				
(b) Due to small populations in some regions, changes over time should be interpreted with caution.				