

National Women's Newborn Services Annual Clinical Report 2006

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Chapter **1**

INTRODUCTION

1 INTRODUCTION

1.1 Report structure

The chapters in this report contain figures and commentary with limited data tables. The appendix contains the comprehensive data tables relevant to the commentary in the chapter. The report is divided into the following chapters:

Chapter 1: Introduction

This chapter provides background information, describes the data sources and the methodology.

Chapter 2: Summary statistics

This chapter provides, for the obstetric and neonatal population at NW, the summary data on principal outcomes.

Chapter 3: Newborn services

This chapter describes interventions and outcomes for the babies cared for in the newborn intensive care unit in 2006. It includes a report of activity of the Child Development Unit.

1.2 Data sources

1.2.1 Neonatology database

The Newborn Unit data are collected prospectively by the Resident Medical Officers and Nurse Specialists - Advanced Neonatal Practice working on the Newborn Intensive Care Unit. The Neonatal Database is used to produce problem lists, flow sheets and letters, so that there are checks of data integrity throughout a baby's stay. Further data are collected and accuracy checked for the Australia and New Zealand Neonatal Network (ANZNN).

1.3 Data quality

1.3.1 Neonatal data quality

Additional checks of the accuracy of the data were made in preparing the Annual Report and prior to sending the data to ANZNN. The clinical records and some original radiology images were checked on all serious adverse outcomes (IVH, PVL, ROP, NEC, death). Laboratory and clinical records were checked on all possible or definite septicaemias or meningitides. Records were checked when the data entered in different fields in the database appeared inconsistent. Maternal and neonatal records were reviewed of all babies with encephalopathy or neonatal seizures.

The introduction of comprehensive computerised clinical records (CRIS, Concerto, Éclair and Impax) by ADHB has aided data collection, checks on data integrity and clinical audit tremendously. Authorised clinical staff can access the complete clinical record 'on-line' so that no clinical record is lost and there are no delays inherent in the old paper-based system.

Chapter **2**

SUMMARY STATISTICS

2 SUMMARY STATISTICS

2.1 Mother and baby numbers: NW 2006

Table 1: Mother and baby numbers: National Women's 2006

Total number of mothers birthing at National Women's	7197
Mothers birthing before arrival* (BBA)	15
Total number of mothers	7212
Total number of babies born at National Women's	7364
Babies born before arrival (BBA)	15
Total number of babies	7379

BBA = Baby born before arrival and is defined as those babies who were born at home or en route to hospital where the intention was to be born in a hospital.

Six women gave birth twice during the calendar year 2006 and are therefore counted twice in the above table and throughout this report.

Table 2: Mother and baby numbers by plurality: National Women's 2006

		Mothers	Babies
National Women's births	Singletons	7035	7035
	Twins	157	314
	Triplets	5	15
Totals (not including BBA)		7197	7364
BBA	Singletons	15	15
	Twins	0	0
	Triplets	0	0
Totals (including BBA)		7212	7364

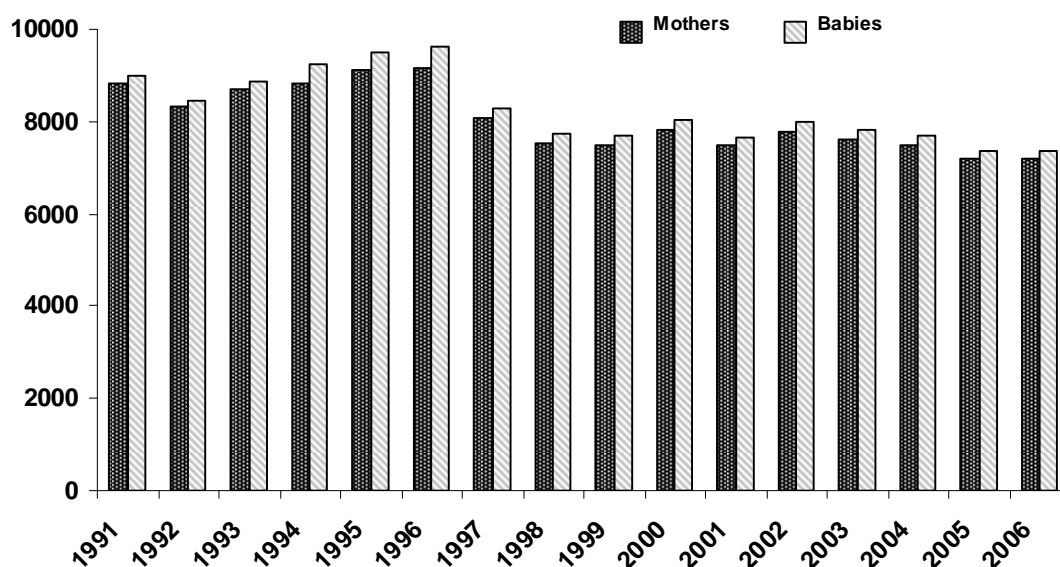


Figure 1: Numbers of women birthing and babies born at National Women's (1991-2006)

2.2 Summary of maternal outcomes 2006

Table 3: Mode of onset of birth

	Birthing Mothers n=7212	
	n	%
Spontaneous onset of labour	4256	59.0
Iatrogenic		
CS elective	924	12.8
Emergency CS before onset of labour	256	3.5
Induction of labour	1776	24.6

Table 4: Mode of birth

	Birthing mothers n=7212		Nullipara n=3499		Multipara n=3713	
	n	%	n	%	n	%
Spontaneous vertex birth	3815	52.9	1484	42.4	2331	62.8
Vaginal breech birth	51	0.7	25	0.7	26	0.7
Operative vaginal birth	956	13.3	737	21.1	219	5.9
Forceps	639	8.9	249	7.1	68	1.8
Ventouse	317	4.4	488	14.0	151	4.1
Caesarean section	2390	33.1	1253	35.9	1137	30.6
CS elective	924	12.8	296	8.5	628	16.9
CS emergency	1466	20.3	957	27.4	509	13.7

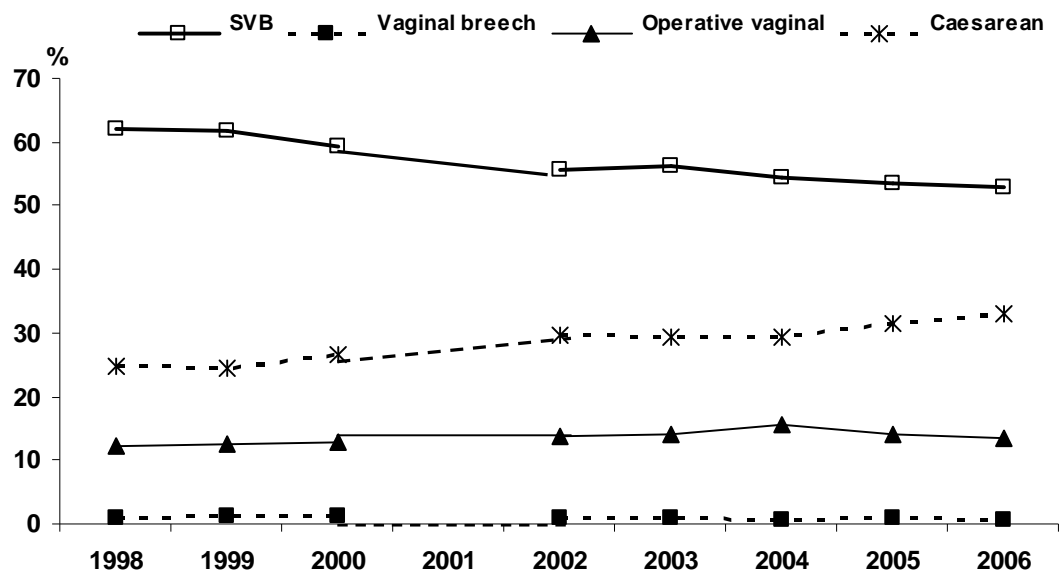


Figure 2: Mode of birth (1998-2006)

Table 5: Maternal postpartum outcomes

	Birthing mothers	n	%
PPH \geq1000mls	7212	554	7.7
SVB	3866	134	3.5
Instrumental vaginal birth	956	37	3.9
Caesarean section	2390	383	16.0
Episiotomy among vaginal births	4822	1103	22.9
Third/ fourth degree tears among vaginal births	4822	103	2.1
Postpartum blood transfusions	7212	150	2.1
Infant Feeding at discharge from NW facility (excludes babies admitted to NICU)			
Exclusive breastfeeding	6158	4546	73.8
Fully breastfeeding	6158	441	7.2
Partial breastfeeding	6158	958	15.6
Artificial feeding	6158	213	3.5

2.3 Summary of neonatal outcomes 2006

Table 6: Neonatal outcomes among babies born at National Women's in 2006

	Babies born n=7379	
	n	%
Gender		
Male	3801	51.5
Female	3578	48.5
Preterm birth		
20-27 weeks	109	1.5
28-31 weeks	136	1.8
32-36 weeks	591	8.0
Term birth		
37-41 weeks	6381	86.5
42+ weeks	162	2.2
5 minute Apgar <7		
Preterm	48	0.7
At term	39	0.5
SGA (by Customised Centile)		
Preterm	238	3.2
At term	651	8.8
Admission to NICU		
Preterm	488	6.6
At term	283	3.8

Table 7: Perinatal mortality 2006

	Babies born n=7379
Number of fetal deaths	74
Number of early neonatal deaths	23
Number of late neonatal deaths	2
Perinatal mortality rate	13.1
Perinatal-related loss rate	13.4
Perinatal mortality rate (excluding lethal and terminated fetal abnormalities)	8.4

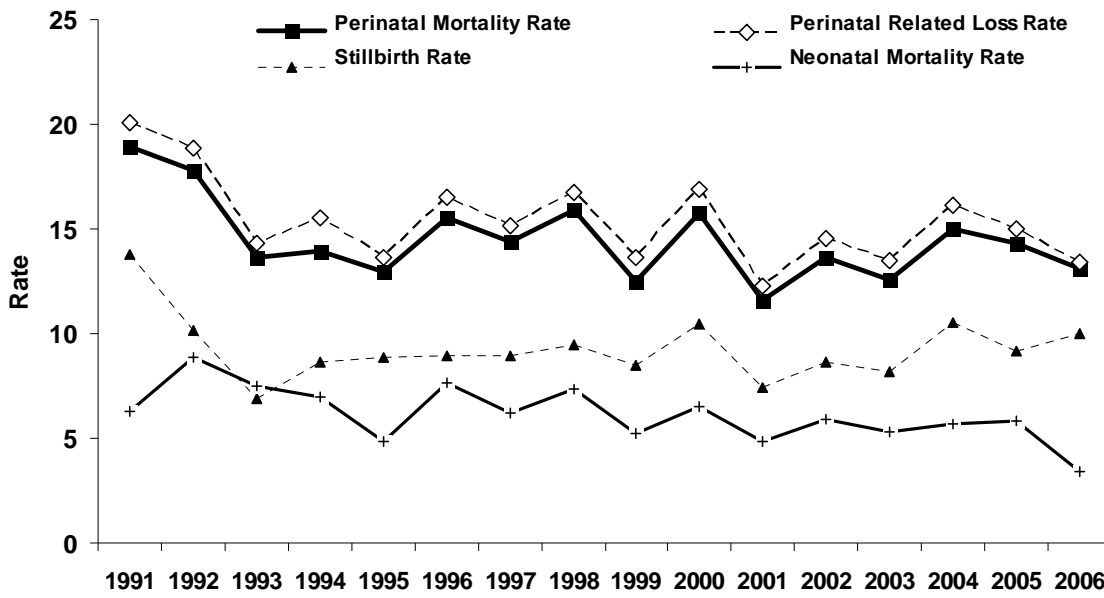


Figure 3: Perinatal mortality rate, perinatal related loss rate, stillbirth rate and neonatal mortality rate 1991-2006 (all rates expressed as deaths/1000 births)

Chapter **3**

NEWBORN SERVICES

3 NEWBORN SERVICES

This chapter provides data on the outcomes of babies cared for at the Newborn Intensive Care Unit. Additional data can be found in Appendix 8.

3.1 Admissions to the Newborn Intensive Care Unit

Newborn unit admissions have been falling for several years. Over the last three years this has been because of the opening of two local Level 2 neonatal units. In July 2004, Waitakere Hospital opened a 10-cot Level II Neonatal Unit. The North Shore Hospital Neonatal Unit opened in October 2003. This resulted in a decreased number of admissions to the NW NICU in 2004-6.

The Waitemata units admit babies >1500 gm and >31 weeks gestation and will administer CPAP. Auckland City Hospital continues to be the level 3 referral unit for the two Waitemata hospitals and for Northland Base Hospital. NW NICU also provides regional neonatal intensive care services for infants undergoing surgical procedures in the newborn period, as well as care for infants with antenatally-diagnosed congenital cardiac disease likely to require intervention soon after birth.

Table 8: Admissions to the Newborn Intensive Care Unit

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Number	1666	1464	1690	1420	1300	1352	1412	1312	1331	1220	975	906	890

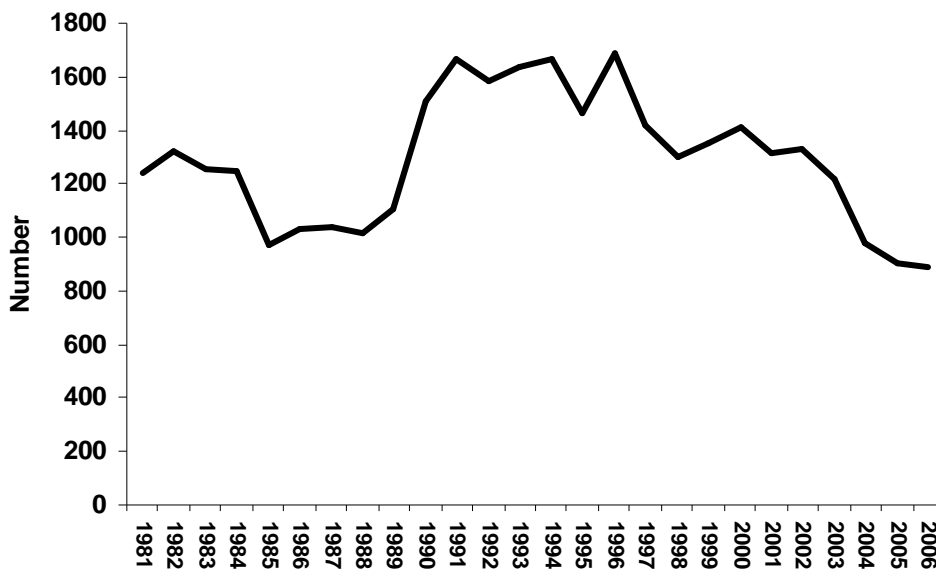


Figure 4: Admissions to NICU 1981-2006

3.1.1 Admissions to the Newborn Intensive Care Unit by gestation and birth weight

The reduction in admissions has occurred in the group of babies ≥ 32 weeks gestation as many of these babies are now being born and stay in North Shore and Waitakere Hospitals.

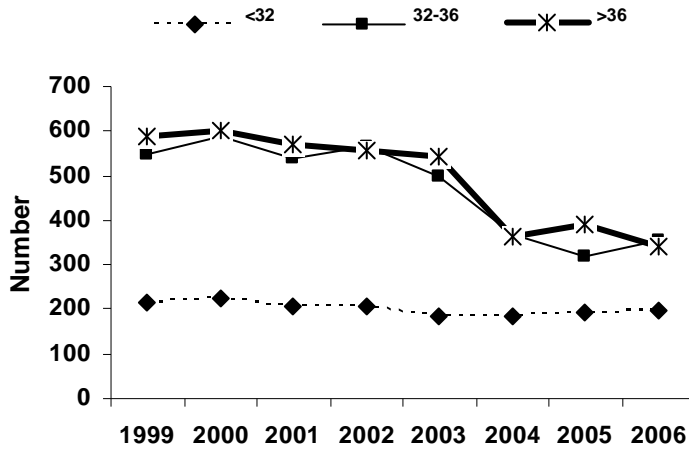


Figure 5: Admissions to NICU by gestational age

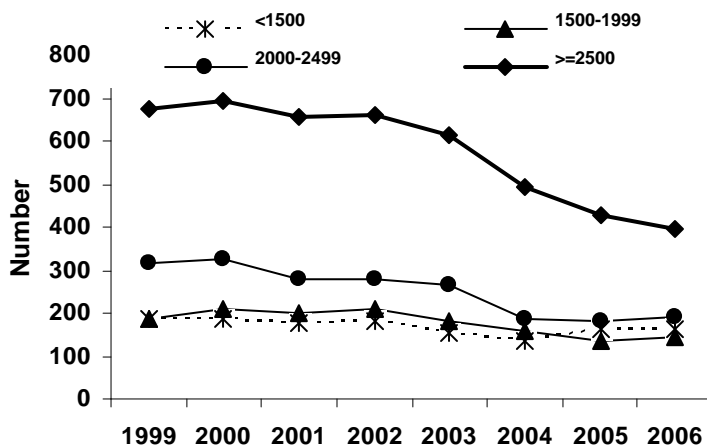


Figure 6: Admissions to NICU by birth weight

3.1.2 Admissions to NICU by domicile of mother

The fall in admissions is mainly from babies whose mothers are domiciled in the Waitemata District Health Board area. However, there is also a slight decline in admissions of babies whose mothers live in the Counties Manukau and Auckland District Health Board areas.

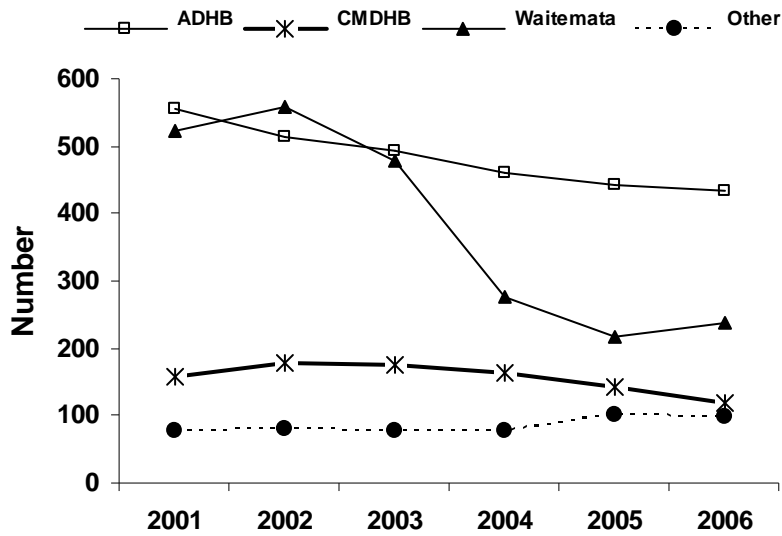


Figure 7: Admissions to NICU by maternal domicile

3.1.3 Newborn Unit occupancy

There has been a 31% decrease in bed occupancy since 2002, both because there are fewer admissions and now many premature babies whose mothers are domiciled in the Waitemata and Counties Manukau DHB areas are transferred to their local level II unit once they are stable and of a certain size and gestation.

Table 9: Occupancy (baby days) on NICU from 1999

	1999	2000	2001	2002	2003	2004	2005	2006
Baby days	18407	20652	20108	20551	19249	14958	14541	14212

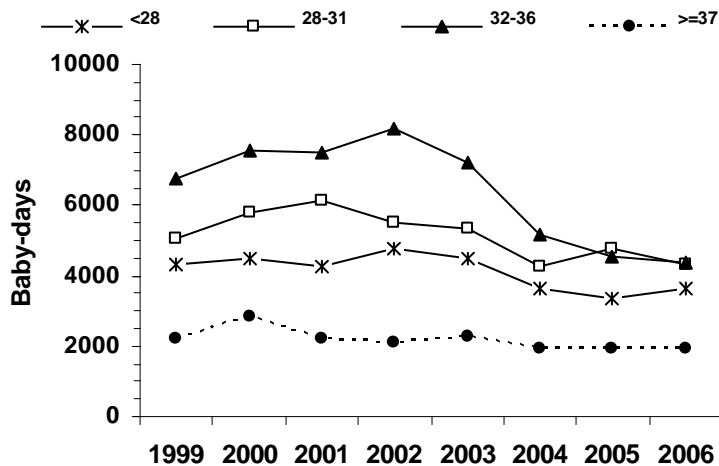


Figure 8: Occupancy (baby days per year) of NICU by gestational age

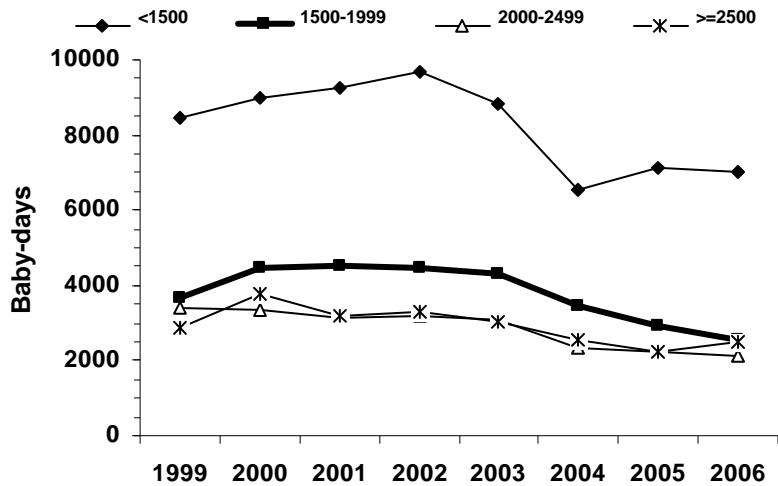


Figure 9: Occupancy (baby days per year) of NICU by birth weight

3.1.4 Ethnicity of mothers

The majority of NICU admissions are European (54%, 57% of preterm and 50% of term infants). The next largest single ethnic group is Maori with 13% of admissions. These are predominantly preterm (16% of preterm admissions compared with only 9% of term admissions).

Grouping ethnicities together, Asian (including Indian) represent 17% of admissions (14% of preterm and 21% of term admissions). Pacific people represent 12%, (10% of preterm and 15% of term admissions).

3.1.5 Reasons for admission to NICU

Prematurity (48%) and respiratory distress (20%) are much the commonest reasons for admission to NICU. Seventy babies (8%) were admitted because of congenital anomalies. Thirty-three babies (4%) were admitted for hypoglycaemia. The full list is presented in the appendix.

3.2 Infection

There were 5 early-onset infections (7 in 2005) (culture proven septicaemia in the 1st 48 hours) and 34 late-onset infections (25 in 2005). The early infection was due to Group B *Streptococcus* (3) and *E. coli* (2). *Staphylococcus epidermidis* and coagulase negative *Staphylococcus* continues to make up the majority of late onset sepsis (38%). However, there were 6 late *S. aureus* and 4 late *E. coli* infections.

Three of the 31 babies who developed serious infections died but of none these deaths was directly related to the infection. These babies were 24 weeks (1) and 25 weeks (2) gestation.

Two early infections were in babies <32 weeks gestation and the other three in term babies. The 34 late infections occurred in 26 babies.

Two babies developed a late culture proven meningitis, with *E. coli* and Group B *Streptococcus*. Two babies had suspected early onset meningitis, one with an *E. coli* septicaemia, and the other with a possible but unproven *Listeria* infection.

3.3 Immunisation

A number of babies are still in NICU when they are due their first immunisation at 6 weeks, and a few when their 2nd immunisation is due at 3 months. In 2006 76 of 86 babies (92%) still in NW on day 42 were immunised before going home. Two babies were very unwell and died within a few days and were not immunised. One family declined to have their babies immunised and one family of twins decided to delay immunisations. One baby was transferred to a level II unit at 46 days of age with the recommendation to obtain parental consent when they were available. Immunisation was contraindicated in one baby with complex haematological problems.

Twelve of 14 babies (86%) still in NICU at 3 months of age received their 2nd immunisation before discharge. Immunisation was contraindicated in one and inadvertently omitted in another.

In 2004, 96% of babies in ACH at 42 days were immunised compared with 86% in 2005 and 92% in 2006. At 3 months, 100% were immunised in 2004 and 89% in 2005.

3.4 Infant feeding in NICU admissions

Data are presented on babies admitted to NICU who were either discharged to an NW postnatal ward or to home. In NICU all VLBW infants receive human milk fortifier as this is considered a 'standard of care' for such infants. According to the Ministry definitions, all these infants should be classified as having received breast milk substitutes and therefore be fully or partially rather than exclusively breast milk fed. However, for this report, human milk fortifier has not been included as a formula supplement. For babies who had very short stays in NICU before transfer to the postnatal ward, the feeding status at hospital discharge has been used.

Overall 91% of babies were discharged receiving some breast milk. Seventy-three percent were discharged receiving only breast milk and 42% were exclusively breast fed (up from 18% in 2004).

There are different challenges to achieve high breastfeeding rates in the different groups of babies. Very preterm infants are in hospital for several months. It is important to achieve maximum growth. Their mothers have to express breast milk for many weeks before their babies are ready to suckle. In this group, 73% are discharged fully or exclusively breastfed. This approximates the breastfeeding rate at 2-4 months of age (the usual age of discharge) and represents a considerable achievement by their mothers and the staff.

Moderately preterm babies are usually not as sick as the less mature infants. The time taken to achieve satisfactory sucking feeds is usually the main determinant of the length of stay. Seventy three percent of babies 32-36 weeks gestation are discharged exclusively or fully breastfeeding and only 12% are not receiving any breast milk. However only 32% of these babies were exclusively breastfed.

As most term infants are only in NICU for a few days, the aim is to get the babies back with their mothers. The mother may be unwell herself and unable to be with her baby as much as desirable. Half of the babies (50%) in this group receive some infant formula but 74% are

exclusively or fully breast fed on discharge. More babies are now discharged exclusively rather than fully breastfed.

Table 10: Breast feeding data of NICU admissions by birth weight

Breast Feeding (%)	<1500gm			1500-2499g			≥2500g		
	2004	2005	2006	2004	2005	2006	2004	2005	2006
Exclusive	19	42	50	11	26	28	21	40	50
Full	58	38	25	57	42	43	31	22	24
Partial	5	0	13	20	20	18	37	27	19
None	17	20	13	11	12	11	12	11	7

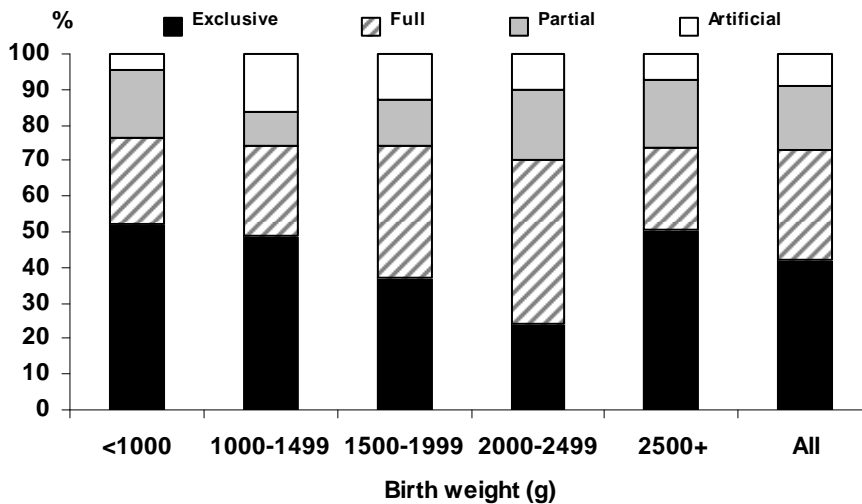


Figure 10: Infant feeding on discharge from NICU by birth weight

Data on babies discharged home or to postnatal wards only. Babies transferring to other units/hospitals excluded.

Exclusive = only received breast milk during stay or received only breast milk plus nutritional supplement such as human milk fortifier. This differs from the MOH definition. By that, all very preterm infants, who receive these supplements, would be classified as fully rather than exclusively breast fed.

Full = received some formula during stay but discharge on breast milk only

Partial = receiving both breast milk and infant formula at discharge.

Table 11: Breast feeding data of NICU admissions by gestational age

Breast Feeding (%)	<32 weeks			32-36 weeks			≥37 weeks		
	2004	2005	2006	2004	2005	2006	2004	2005	2006
Exclusive	18	39	48	10	29	32	24	39	50
Full	58	35	25	55	40	41	25	22	24
Partial	9	3	14	22	21	15	39	27	21
None	15	24	14	13	9	12	12	12	6

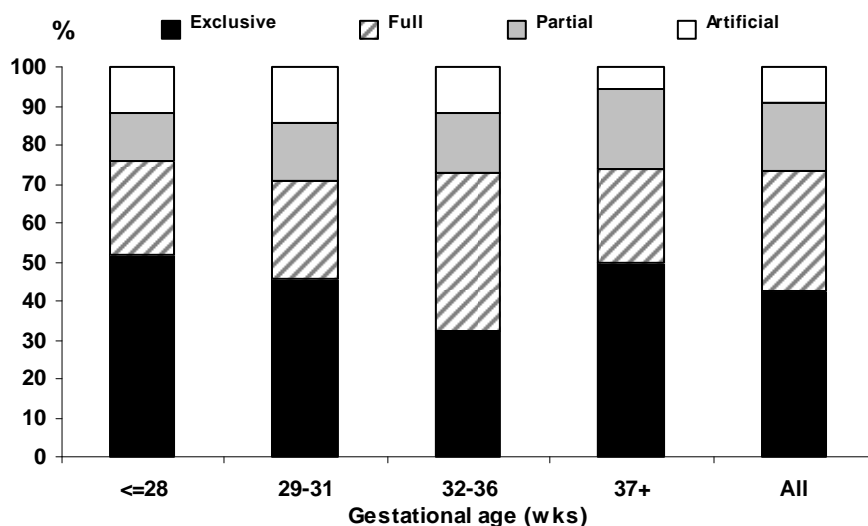


Figure 11: Infant feeding on discharge from NICU by gestational age

3.5 Hypoxic ischaemic encephalopathy (HIE)

Six inborn babies developed significant stage 2 or 3 encephalopathy in 2006, giving an incidence of 0.9/1000 term live-births. The incidences were 0.6, 1.6 and 0.5/1000 term live births in 2003, 2004 and 2005. An unusual feature in 2006 was the four planned home births who had significant HIE. In 2005 one planned home birth was admitted with significant encephalopathy and none in 2004.

Table 12: Details of Hypoxic Ischaemic Encephalopathy Stages 2 or 3.

Born at	Gestation	Birth Weight	HIE stage	Apgar 1/5	Day died	Comment
NW	37	2520	2	3 / 6		Abruptio Em CS
NW	37	3120	2	2 / 6		Listeria infection, fetal distress and impacted head at CS.
NW	39	2822	3	0 / 1		Impacted head at CS for FTP
NW	39	4735	3	0 / 0		Severe shoulder dystocia
NW	40	3115	2	5 / 10		Nuchal cord, perinatal asphyxia
NW	40	3160	2	0 / 3		Placental abruption, CS for no FH
Home	39	2970	2	2 / 4		Depressed at birth
Home	40	3625	2	9 / 9		Deteriorated after birth and collapsed
Home	42	4620	3	6 / 5	1	Failed to establish respiration
North Shore	32	2090	2	3 / 7		Fetal distress
North Shore	41	3200	2	0 / 3		Ruptured uterus, forceps delivery
Waitakere	39	2275	2	9 / 9		Possible HIE or hypoglycaemia
Whangarei	39	2645	3	2 / 3	8	Planned home birth, cord presentation at home.

The care of all babies with significant HIE is reviewed confidentially to try to identify factors that may have contributed to the poor outcome and to attempt to improve care. Educational feedback is given to individual clinicians and to the units involved, as appropriate.

3.6 Assisted ventilation

3.6.1 Number of babies receiving and duration of assisted ventilation

Data in this section are presented for babies born at NW, excluding babies transferred in postnatally. Excluding postnatal transfers allows more meaningful comparisons of postnatal care at NW over the years.

Table 13: Number of babies on assisted ventilation

	2001	2002	2003	2004	2005	2006
CPAP or IPPV	393	446	404	402	395	453
IPPV	126	140	109	123	140	152
CPAP	379	421	388	388	367	428

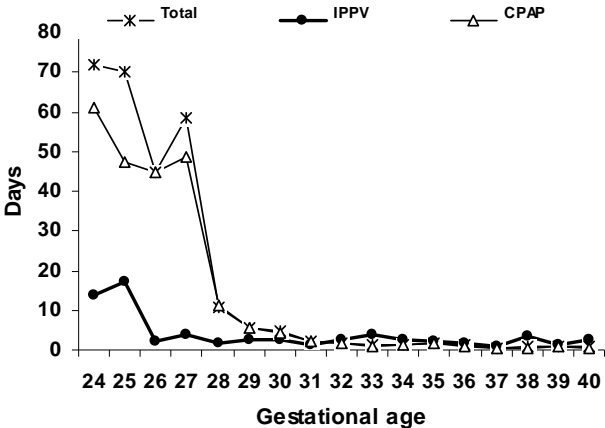


Figure 12: Median ventilation days on IPPV and CPAP and IPPV+CPAP by gestational age among survivors in 2006

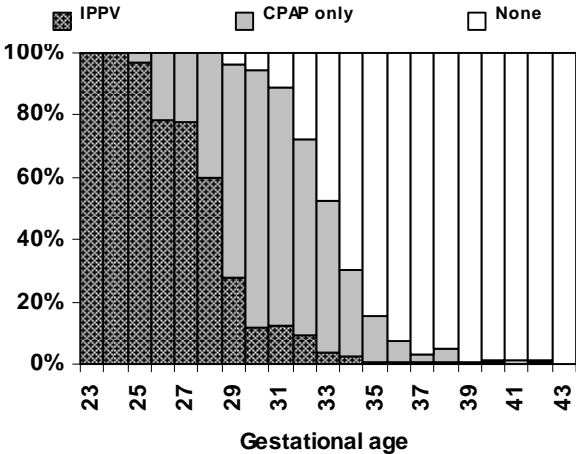


Figure 13: Proportion of babies receiving assisted ventilation (excluding for surgery or a congenital anomaly) 2003-2006

Denominator is all inborn babies from 2003-2006, excluding delivery room deaths. n = 27,317

There is a dramatic reduction in the time on positive pressure ventilation from 26 weeks gestation onwards. There is a similar decrease in the time on CPAP from 28 weeks onwards. These data are important in deciding on timing of delivery for mildly preterm babies.

While NICU has adopted CPAP as the primary mode of respiratory support, most babies ≤28 weeks' gestation will receive a period of positive pressure ventilation. There is a steady reduction in the need for positive pressure ventilation from 26 to 32 weeks and for the need for CPAP from 31 to 35 weeks.

3.6.2 Trends in use of assisted ventilation among <32 week survivors (inborn babies only)

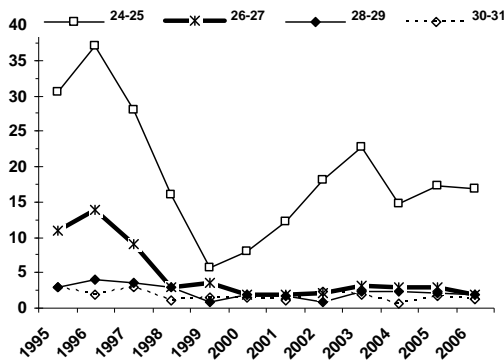


Figure 14: Median days on IPPV

With the change in 1997 to a CPAP-based approach, there was a dramatic decrease in the time ventilated for infants under 28 weeks' gestation. For babies of 24 and 25 weeks' gestation, this fell from a median of 37 days to 6 days by 1999.

However the median number of days on IPPV then increased to 23 days in 2003 and has settled to 17 days in 2006. Numbers in this group are low, with an average of 22 babies per year. This explains some of the year-to-year variation.

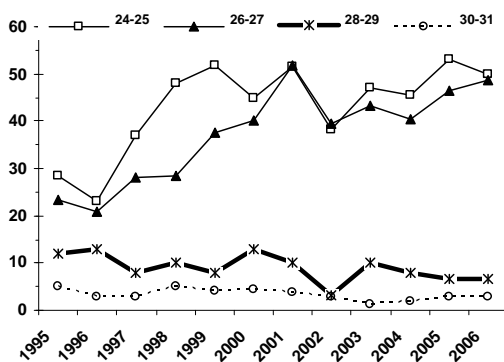


Figure 15: Median days on CPAP

In 2000, two audits of the incidence of chronic lung disease (CLD) were conducted. These showed that the incidence of CLD had not fallen with the change a CPAP based approach.

Time on CPAP has increased in the most immature babies in parallel with the decrease in time on IPPV. There has also been an increase in CPAP time for babies of 26 and 27 weeks gestation.

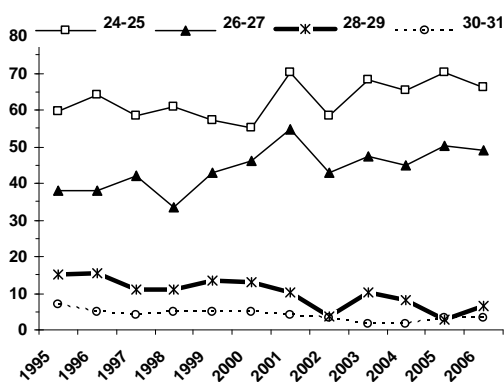


Figure 16: Median days on CPAP + IPPV

Overall there has been no change in total ventilation time, although the balance of types of ventilation has varied over the years.

3.6.3 Trends in the use of assisted ventilation over the last eleven years. Data on all infants born in NW.

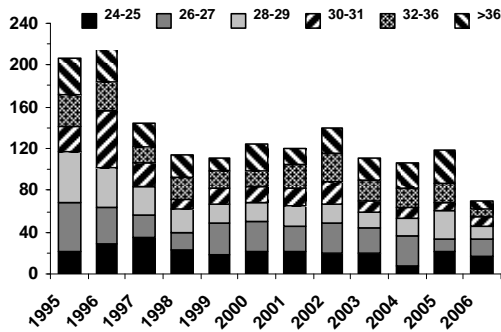


Figure 17: Number on IPPV

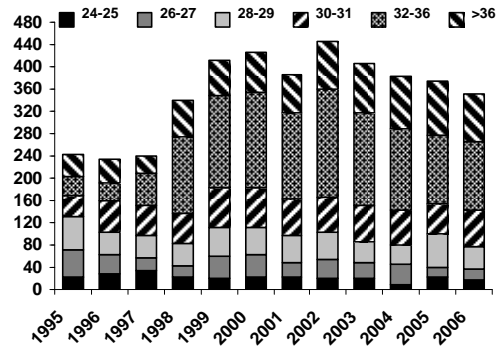


Figure 19: Number on CPAP + IPPV

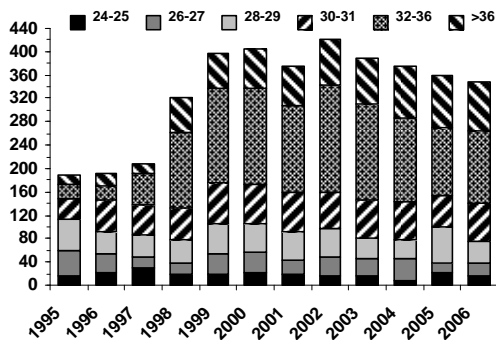


Figure 18: Number on CPAP

These figures show the number of babies requiring assisted ventilation at NW over the last 10 years.

In 1997, double short-pronged Hudson® CPAP was introduced and aspects of the “Columbia approach” to respiratory support were adopted.

This resulted in a dramatic reduction in the number of infants needing intubation and assisted ventilation. There was a concomitant increase in the use of CPAP, particularly in babies from 32-36 weeks gestation.

Head-box oxygen administration was phased out and all babies requiring oxygen were placed on CPAP.

3.6.4 Positive pressure ventilation and CPAP use in NW and across Australia and New Zealand at 24-27 weeks' gestation

These data compare the use of IPPV and CPAP in NW and across the Australia and New Zealand Neonatal Network. The Network collects standardised data from all NICU in Australia and New Zealand.

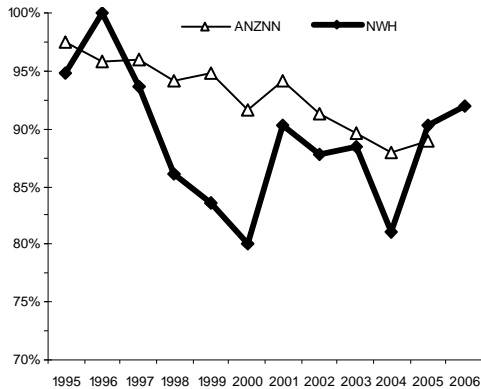


Figure 20: Percentage on IPPV

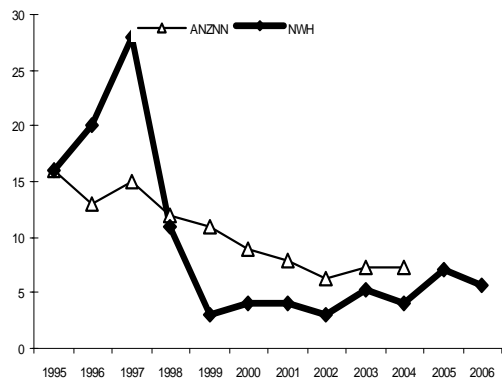


Figure 22: Median days on IPPV

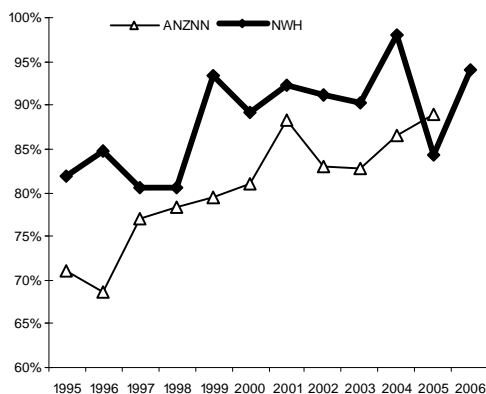


Figure 21: Percentage on CPAP

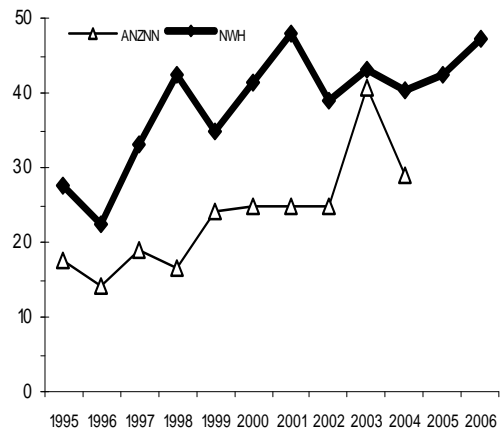


Figure 23: Median days on CPAP

NW changed its policy on ventilatory support of preterm infants in 1997 to put a greater emphasis on CPAP use. The percentage of very immature infants treated with IPPV and the duration on IPPV declined to below the median of the Network overall. However, most of these infants require IPPV at some stage in their hospitalisation.

CPAP use has always been high at NW. There has been a steady increase over the years. Its use in the rest of the Network is comparatively lower.

3.6.5 Positive pressure ventilation and CPAP use in NW and across Australia and New Zealand at 28-31 weeks' gestation

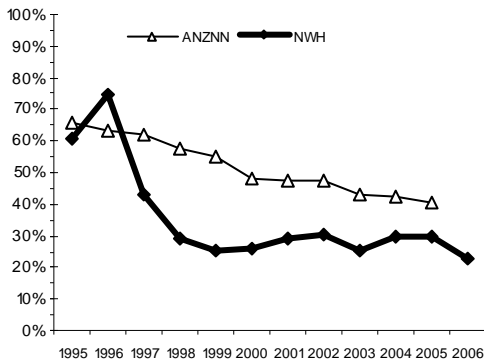


Figure 24: Percentage on IPPV

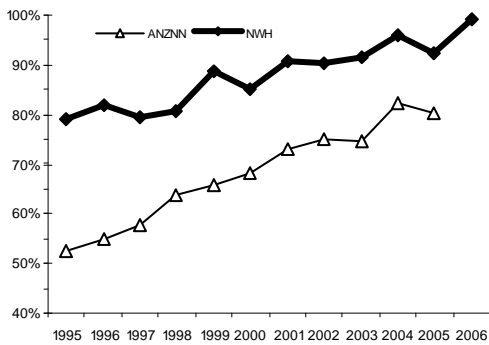


Figure 25: Percentage on CPAP

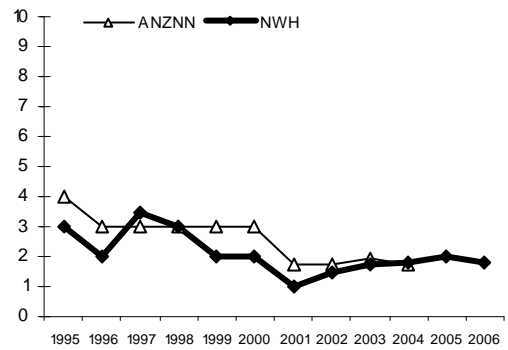


Figure 26: Median days on IPPV

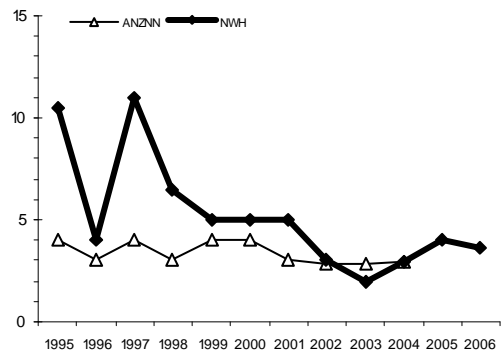


Figure 27: Median days on CPAP

The changing use of assisted ventilation in babies of 28-31 weeks gestation parallels that seen in the less mature babies. Fewer babies are ventilated for a shorter time. CPAP use at NW has always been high. However, the time spent on CPAP in babies of 28-31 weeks gestation has fallen since a peak in 1997.

3.6.6 High frequency oscillatory ventilation and inhaled nitric oxide

These data are on all babies admitted to NICU in each year, including those born in other hospitals or at home.

High frequency oscillatory ventilation (HFOV) is used only for 'rescue' treatment at NW. Hence, babies treated with HFOV are the sickest babies in NICU who would be expected to have a very poor outlook whatever the treatment. At all gestations, mortality in these infants is high. Term babies do better than preterm infants.

Table 14: HFOV and inhaled nitric oxide (iNO) use and survival over the last 10 years

	HFOV		iNO		HFOV + iNO	
	n	% alive	n	% alive	n	% alive
Total	148	56	171	63	76	54
<28 weeks	71	52	31	35	18	28
28-31 weeks	19	58	15	47	7	43
32-36 weeks	15	33	25	48	13	38
≥37 weeks	42	69	100	78	38	74

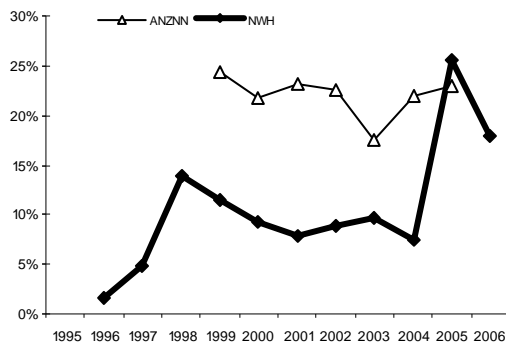


Figure 28: HFOV at 24-7 weeks

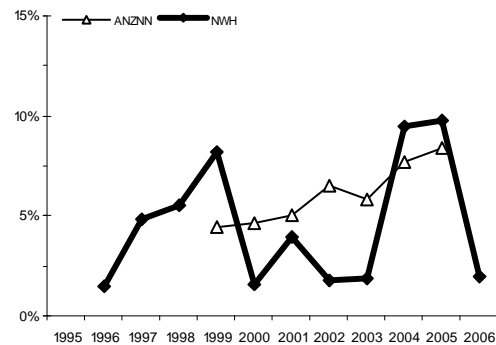


Figure 29: Inhaled nitric oxide at 24-7 weeks

These two figures compare the use of HFOV and iNO at NW with their use across the Australia and New Zealand Neonatal Network. The Network only presents data on preterm infants, despite both treatments being more commonly used in term babies. Generally, use in NW has been low, but there has been an increase since 2003.

3.6.7 Term/post-term infants on assisted ventilation from 1995 to 2005

This figure shows the number of term infants ventilated or treated with CPAP. Inborn and out born infants are included. There has been a significant increase in CPAP use and little change in numbers on IPPV. The high use of CPAP is secondary to the removal of headbox oxygen as a therapy.

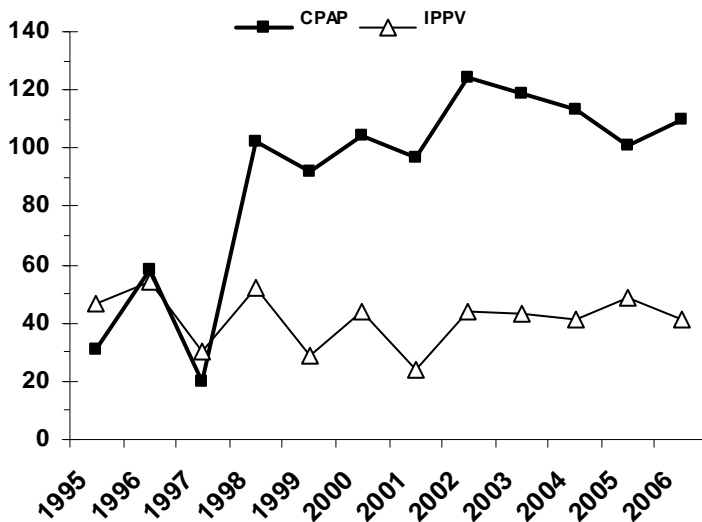


Figure 30: Number of term and post term babies needing assisted ventilation

In 2006, the most common reasons for ventilating term infants were meconium aspiration or persistent pulmonary hypertension of the newborn (PPHN), with 12. This was down from a maximum of 24 infants in 1996.

The most common reason for using CPAP was transient tachypnoea of the newborn with 55 babies on CPAP (50% of CPAP use at term), followed by meconium aspiration or PPHN with 18 babies (16%).

3.7 Very low birth weight infants

There was a peak of VLBW infants at NW in 2001 and then a reduction over the next three years. That decline in numbers seems to have halted over the last three years. Overall the proportion of out born babies is low, representing only 9% over the entire 10 years but with an increase in 2006. These numbers include out born babies who were transferred to NW, and babies born in NW who were born alive but died at birth and who were either >20 weeks gestation or >400gms birth weight.

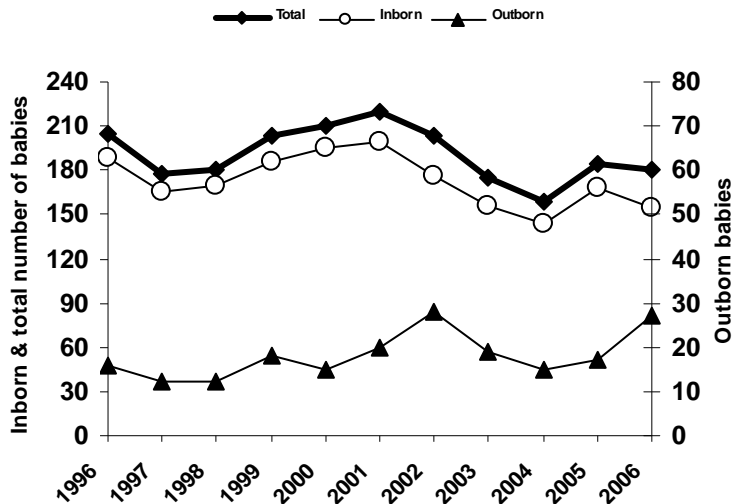


Figure 31: Number of VLBW who were born elsewhere and admitted to NICU, or were born in NW and alive at birth

3.7.1 Number of deliveries of inborn live-births 501-1500g birth weight from 1959

This includes all babies born alive (including those who died at or soon after birth) and babies with lethal anomalies. The weight ranges 501-1000 and 1001-1500 are chosen as these data have been collected prospectively in that way since 1959, initially by Professor Ross Howie.

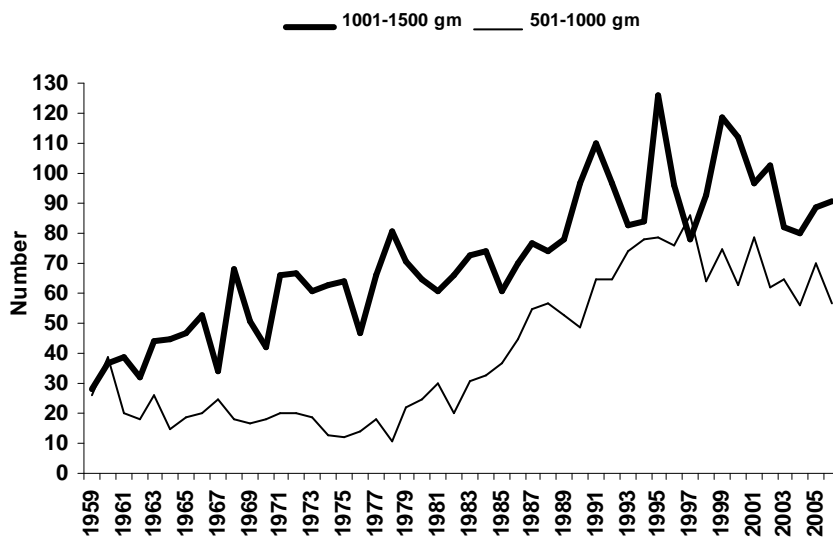


Figure 32: Number of inborn live-births ≤1500g from 1959 to 2006

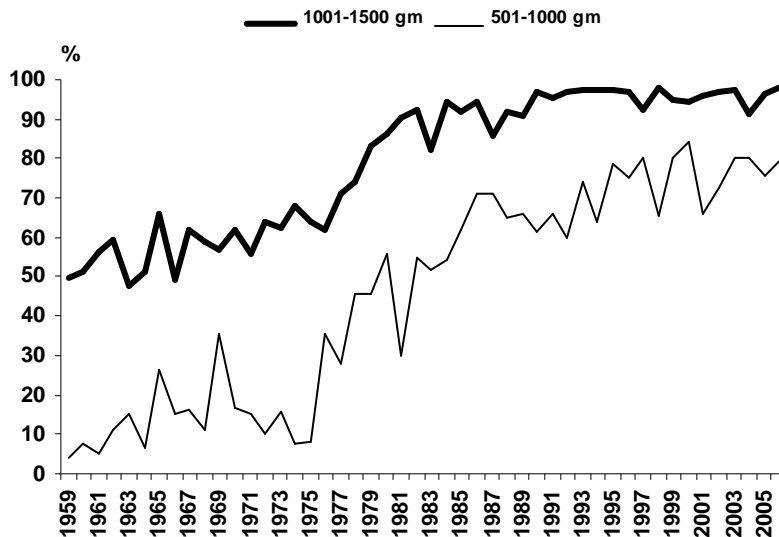


Figure 33: Neonatal survival (0-28 days) of ≤1500g inborn live-births from 1959 to 2006

In 2006, the majority of deaths in infants between 501 and 1000 gm were at birth (9/12, 75%), either from extreme prematurity (7) or a lethal anomaly (2). However there were 2 infant deaths of premature babies who were still in hospital after 28 days that are not included in this figure. Over the years the definitions used have been the same, counting all babies, including those who died soon after birth, if they showed signs of life.

The number of babies with anomalies and the number who were not actively treated because of their low gestation varies from year to year, and has a big influence on the overall survival rate, particularly in the extremely low birth weight group (500-1000gms, ELBW).

There has been an enormous improvement in the results of perinatal and neonatal intensive care over this time period. In the first three years (1959-61) only 5/85 (6%) ELBW babies survived to 28 days compared to 143/183 (78%) in the last three years.

The biggest improvements occurred in the late 1970s and early 1980s with the development of modern intensive care and the introduction of techniques for ventilatory support. The trend of increasing survival in the ELBW group continues over the last 20 years. Surfactant replacement treatment was introduced in 1990.

3.8 Survival of babies from 23 to 31 weeks gestational age born in National Women's

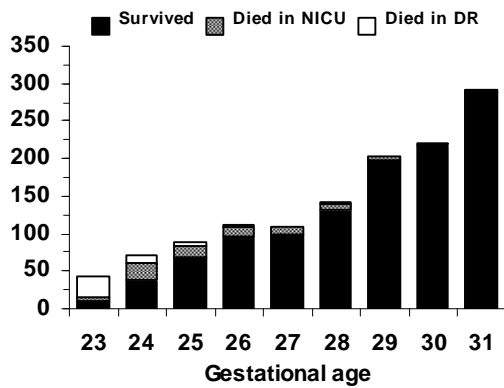


Figure 34: Numbers born alive at 23 to 31 weeks gestation in 2000-2006

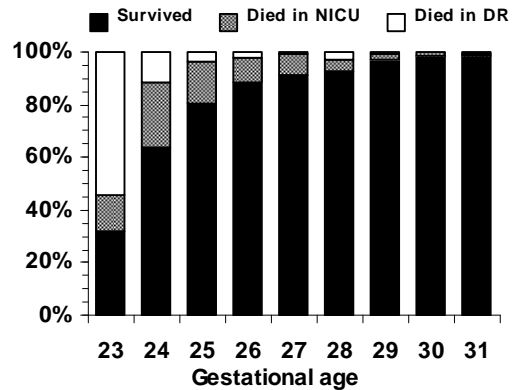


Figure 35: Survival of babies born in 2000-2006. (n = 1282) (DR = delivery room)

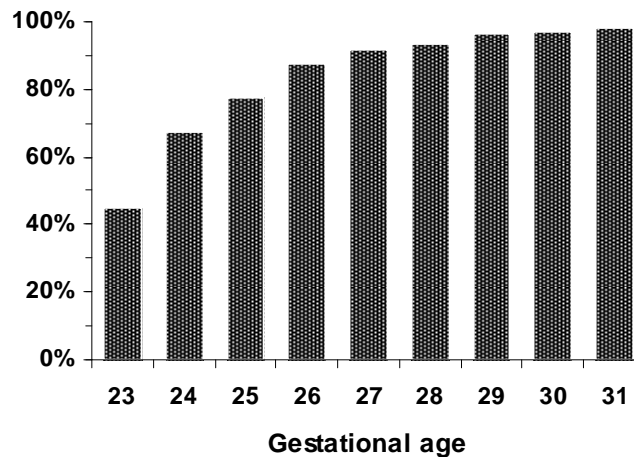


Figure 36: Survival of babies born in National Women's and admitted to NICU from 1995 to 2006 (n = 2168)

Survival in very preterm infants has been steady over the last decade. The NW data is confirmed by outcomes published by the ANZNN, which approximate population data. There is no overall increase in survival of these very preterm infants.

The number of infants in each group in each year is small. The present survival rate is not significantly different to those of earlier years in any gestation category.

3.9 Intraventricular haemorrhage in all very low birth weight infants admitted to NICU from 1985 to 2006

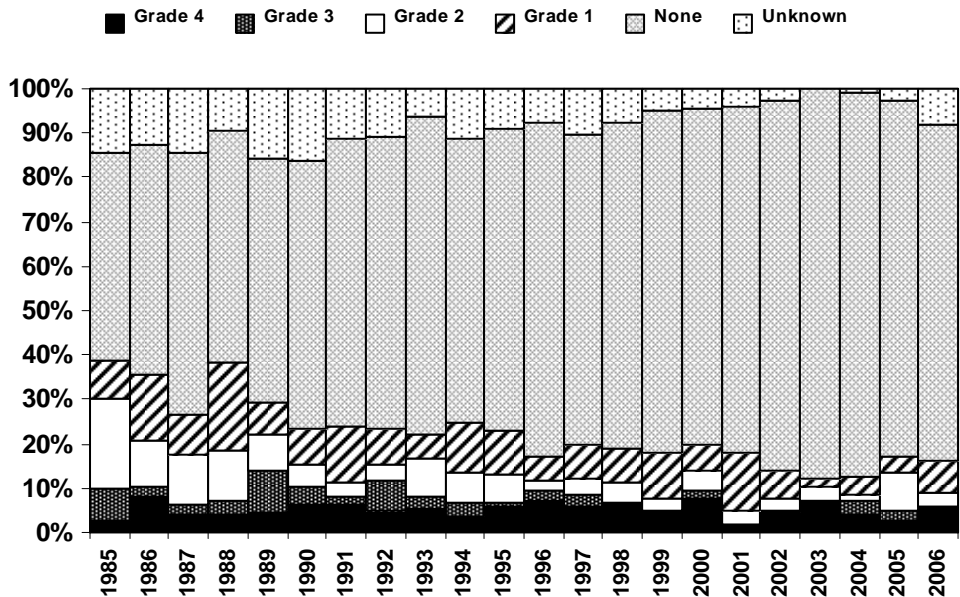


Figure 37: Intraventricular haemorrhage in all <1250 gm infants admitted to NICU from 1985 to 2006

In 2005, the criteria for routine ultrasound scanning in very low birth weight infants changed at NW from scanning all those <32 weeks or <1500gms to only scanning those <30 wks or <1250gms. This was done because the incidence of significant abnormalities in the larger more mature infants was very low.

Since 1985, the incidence of any degree of IVH has fallen from 45% to 16%, with that of severe IVH (grade 3 or 4) falling from 12% to 6% in 2006.

3.10 Morbidity of inborn very low birth weight infants and babies <32 weeks gestation admitted to NICU

The numbers in the following sections and the tables in the appendix are of all inborn very low birth weight infants and babies <32 weeks gestational age. The figures in this section are for babies 'assigned' to NW by the ANZNN (see below).

3.10.1 Benchmarking against the Australia and New Zealand Neonatal Network

In this section, results are benchmarked against the ANZNN. ANZNN collects standardised data from all NICU in Australia and New Zealand. A dataset is collected for each baby admitted to a NICU who is either:

- <1500gm birth weight,
- <32 weeks gestation,
- requires assisted ventilation (IPPV, CPAP or HFOV) or
- has major surgery (defined as opening of a body cavity).

Each infant is assigned to the NICU at which they were originally treated for at least 4 hours, even if that baby was subsequently transferred. Data are collected up to discharge home, even if that care is in several hospitals.

ANZNN was established in 1994. NW has supplied data since 1995. De-identified data is sent electronically to the Sydney secretariat. Prior to NW joining ANZNN, approval to send data was obtained from the North Health Ethics Committee.

An annual report of the combined data from all units is published each year and feedback data are sent to each unit that contributes comparing the outcomes of that unit to those of the Network overall.

The data presented here are from the ANZNN annual reports and the NW NICU database. The ANZNN data include the data from NW.

3.10.2 Survival

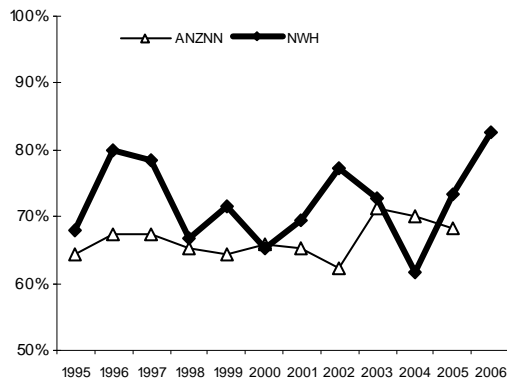


Figure 38: Survival at 24-5 wks gestation

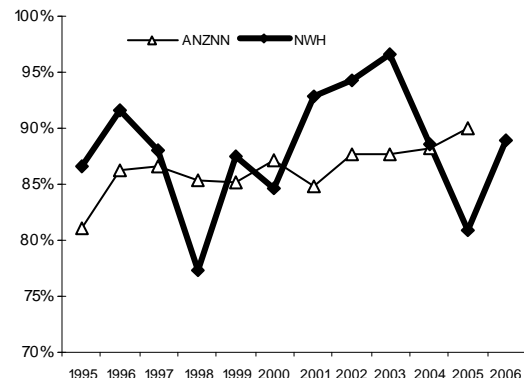


Figure 39: Survival at 26-7 weeks

Survival at NW at these immature gestations is consistently good. The relatively small numbers at 24-25 weeks gestation accounts for the year to year variation at NW. Over the 11 years, there were between 21 and 37 babies per year. These data are for all inborn babies admitted, including those with lethal malformations but excluding deaths in the delivery room.

3.10.3 Intraventricular haemorrhage

Overall, only 5% of inborn VLBW infants had any degree of IVH in 2006 (most of the IVH detailed elsewhere in this report was in out born babies). Because of the change in scanning policy, 26% of the mainly larger infants were not scanned. These babies are unlikely to have had an IVH. Seven percent of the babies who were scanned had an IVH.

In the group under 32 weeks' gestation, the incidence of any degree of IVH was also 4% (7% of those scanned). Thirty eight percent (almost all 30-31 weeks gestation) were not scanned.

Only one inborn baby had more severe grades of IVH (grade 3 or 4).

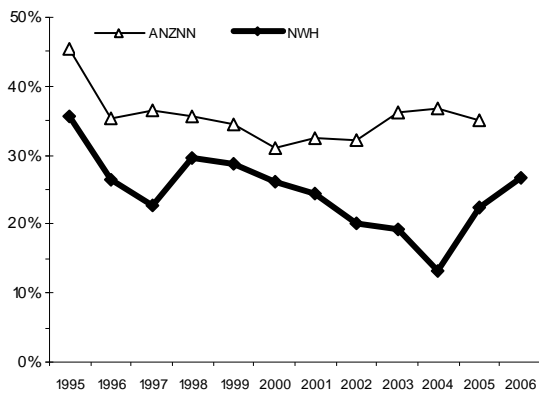


Figure 40: Any IVH at 24-7 weeks

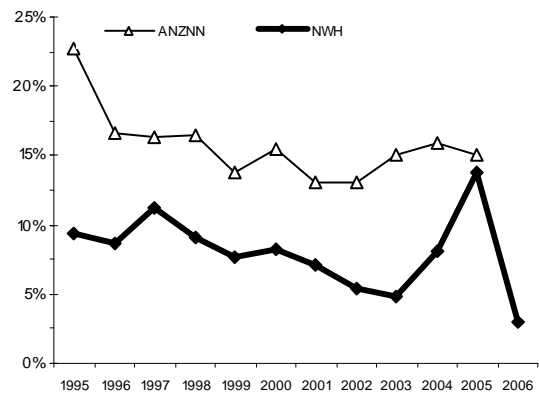


Figure 42: Any IVH at 28-31 weeks

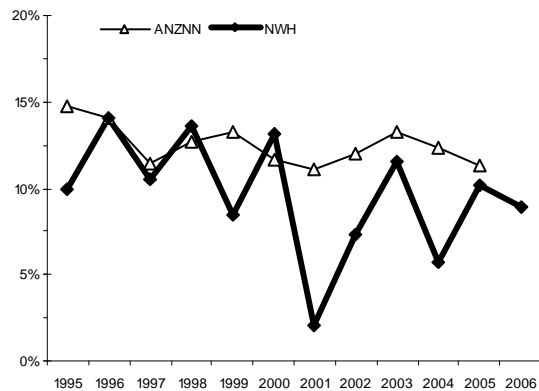


Figure 41: Severe (G3-4) IVH at 24-7 weeks

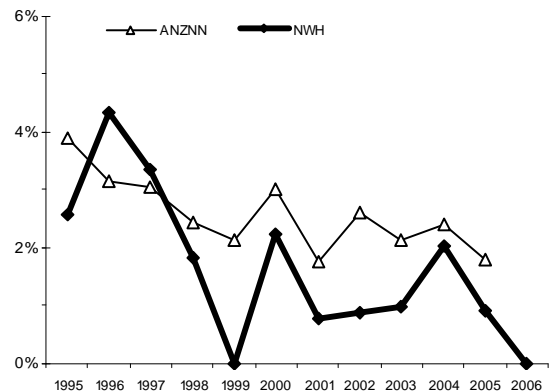


Figure 43: Severe (G3-4) IVH at 28-31 weeks

3.10.4 Cystic periventricular leukomalacia

One baby, weighing 560g and born at 25 weeks, had classical cystic PVL in 2006.

3.10.5 Retinopathy of prematurity

There has been a dramatic rise in the incidence of ROP in 2006. This is likely due to a different screening technique undertaken by a new ophthalmologist. Although the increase appears dramatic, the rise is largely due to increased detection of milder grades (Stage 1 and 2) that do not have any short- or long-term consequences. In 2006, 58% of infants screened had Stage 1 or 2 ROP, compared with 4% and 6% in 2005 and 2004, respectively. However, the rates of significant (Stage 3 or 4) ROP also increased to 6% in 2006, compared with 1% in both 2005 and 2004.

Eleven babies had laser therapy for advanced ROP. This is also an increase on previous years, and relates to both an increase in more severe grades of ROP as well as lower treatment thresholds in response to results from the ET-ROP study. The NICU at Auckland City Hospital also provides a regional service for babies requiring laser treatment, and three infants were transferred specifically for treatment with established ROP. Six of the 8 babies

receiving all their care at NW were inborn. Of the eleven babies, 2 were 24 weeks gestation, 5 were 25 weeks, and one was 27 weeks and three 28 weeks gestation. One baby developed aggressive posterior ROP and progressed to complete retinal detachment despite treatment.

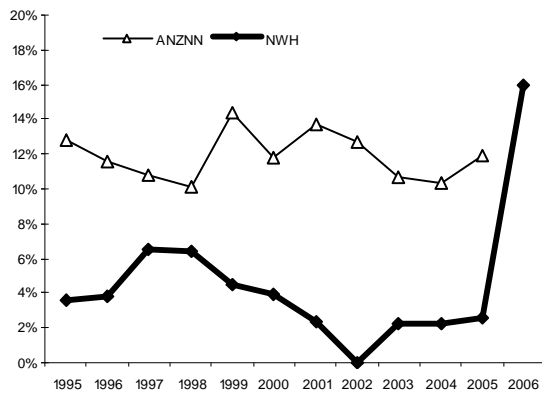


Figure 44: ROP at 24-7 weeks

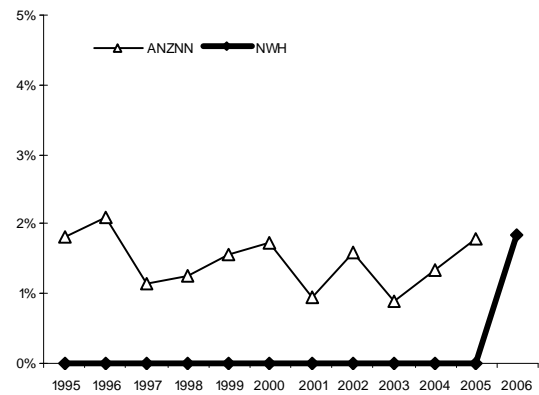


Figure 45: ROP at 28-31 weeks

3.10.6 Chronic lung disease

The ANZNN definition of chronic lung disease is used. CLD is the requirement for oxygen or any form of respiratory support (CPAP or IPPV) at 36 weeks post menstrual age. In some publications, the definition is only a requirement for supplemental oxygen. Including respiratory support in the definition increases the incidence. If the definition of “in oxygen” was used, the incidence of CLD in the <1500gm infants would fall from 16% of survivors to 14%.

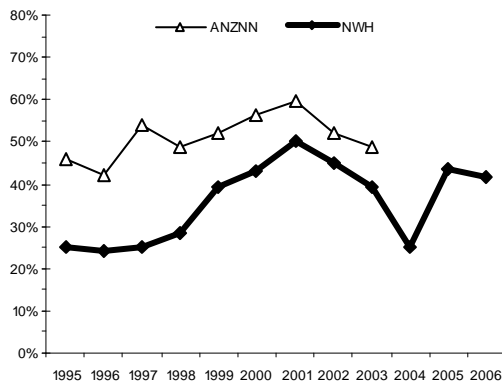


Figure 46: Chronic lung disease at 24-27wks

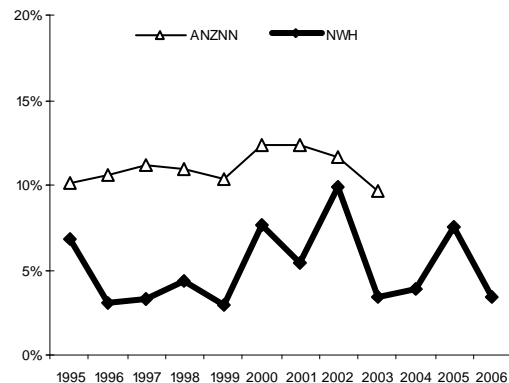


Figure 47: Chronic lung disease at 28-31wks

The rate of CLD seems to have increased over the 1990s, despite changes in treatment and ‘advances’ in care. The incidence fell from 2002-3, probably related to a change in oxygen saturation targets. The low rate in 2004 was due to a higher proportion of more mature babies in this 24-27 week cohort.

The incidence of CLD in 28-31 week gestation infants is lower at NW than in the rest of the Network, although the Network rate is falling. Unfortunately the Network is now reporting CLD in different groups of infants so its data for 2004-5 cannot be included in these graphs.

The definition of CLD has never been totally satisfactory, as the condition is defined by the treatment being given. There have been changes in the way these treatments have been applied. In early years oxygen requirement was determined by a variety of inaccurate methods. Pulse oximetry was introduced in the early 1990s. The oxygen saturation level targets increased in the late 1990s, only to fall again in 2002 with the presentation of the BOOST trial of oxygen saturation in CLD. It is likely that much of the temporal trend in the incidence of CLD is due to change in treatment used rather than any changes in underlying lung disease.

3.10.7 Necrotising enterocolitis

In 2005 4% of VLBW infants and 3% of <32 week gestation infants developed NEC. Although the incidence remains low overall, there seems to have been an increase in the incidence over the last three years. This is particularly evident in infants under 28 weeks' gestation. In 2006, two of the seven deaths in admitted babies at 23-27 weeks' gestation were due to NEC.

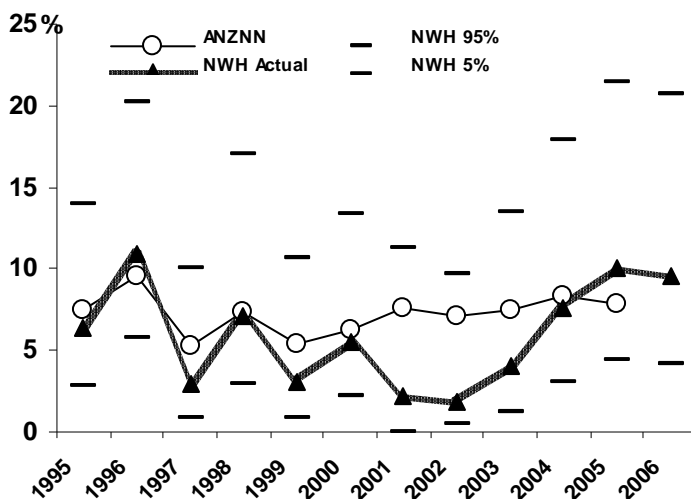


Figure 48: NEC in babies under 28 weeks gestation (with 95% confidence intervals) compared with the incidence in the ANZNN 1995-2006

In view of this apparent increase, in mid-2006 a detailed case-controlled study was undertaken to attempt to identify factors associated with NEC. Concurrent and historical controls were used to try to identify any changes in treatment that may be important. This study showed few changes in care. Some babies who developed NEC had a more rapid increase in enteral feeds (all breast milk). It is unclear whether there is a causal relationship between this and the occurrence of NEC. However, the number of premature babies who developed NEC fell from 10 in the 12 months before, to 2 in the 12 months after the study. The number of deaths from NEC fell from 5 to 1.

3.10.8 Patent Ductus Arteriosus

The incidence of PDA that was treated fell in 2006. In VLBW infants, 18% of babies were treated, down from 29% in 2003. In infants <32 weeks, the treatment rate has fallen from 27% to 15%. However, in the most immature babies under 26 weeks gestation, 74% were treated.

In 2006, 25 inborn and 7 out born babies were treated with indomethacin. No babies over 31 weeks' gestation or 1500gm birth weight were treated.

Seventeen babies received an initial long (7-day) course of indomethacin. Thirteen received a short course. Six babies received two courses. Indomethacin was started on day 1-2 in 3 babies, day 3-4 in 19 babies and day 5-7 in 7 babies. Three babies were first treated in the second week.

In 2006, six babies had PDA ligated. Only two of these were inborn. One out born baby was admitted on the first day but the other three out born babies were admitted late, two specifically to have their PDA ligated.

3.10.9 Pneumothorax needing drainage

Four inborn babies developed a pneumothorax that needed drainage in 2006. An additional four out born babies had pneumothoraces drained. Four of the eight babies were born at <28 weeks gestation.

3.10.10 Antenatal corticosteroids

Antenatal steroid use is high in the Network and NW. In babies <32 weeks' gestation, 94% receive corticosteroids before birth. However, only half (48%) receive an optimally timed course starting between 24 hours and seven days before delivery.

There is a pleasing increasing trend in the use of antenatal steroids, both at NW and in ANZNN.

The ANZNN defines corticosteroids given 1 to 7 days before birth as "optimal" antenatal corticosteroids. Any corticosteroid refers to babies who had corticosteroids at any time before birth and includes those receiving an optimal course.

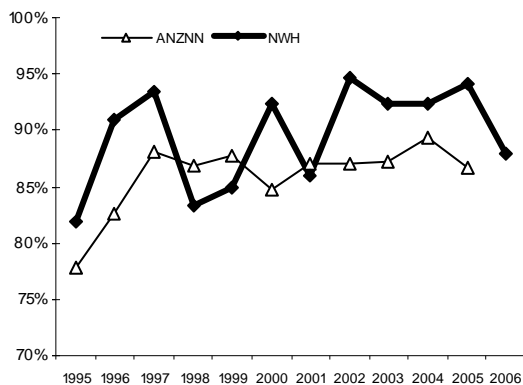


Figure 49: Any antenatal corticosteroids at 24-7 weeks

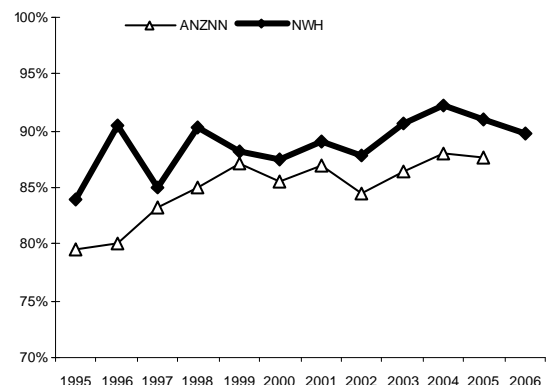


Figure 50: Any antenatal corticosteroids at 28-31 weeks

3.10.11 Postnatal corticosteroids

These data are on the use of postnatal corticosteroids to treat CLD. Data on steroid use to facilitate extubation are excluded. The denominator used in the figures is the number of babies alive at 1 week of age.

In the mid-1990s, dexamethasone became an accepted and proven treatment to lessen the severity of CLD. However, use then declined when concerns were raised as to whether dexamethasone may increase the rate of cerebral palsy in survivors. In the last few years it has become clearer which babies may benefit from postnatal dexamethasone. With this, the use of dexamethasone has increased slightly.

In 2006, only 4% of inborn babies <32 weeks gestation were treated with dexamethasone, with the rates decreasing with advancing gestational age from 32% in those of 23-25 weeks gestation to none over 26 weeks gestation.

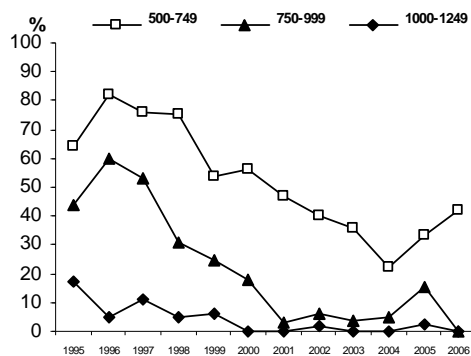


Figure 51: Percentage receiving postnatal dexamethasone by birth weight

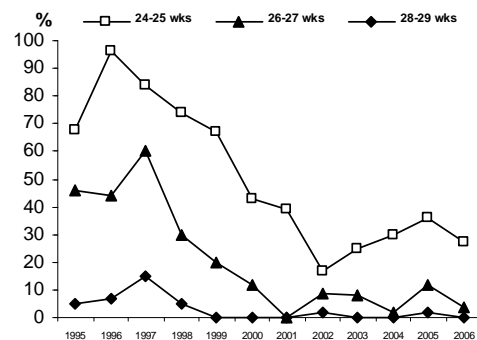


Figure 52: Percentage receiving postnatal dexamethasone by gestational age

3.10.12 Caesarean section for babies <32 weeks gestation

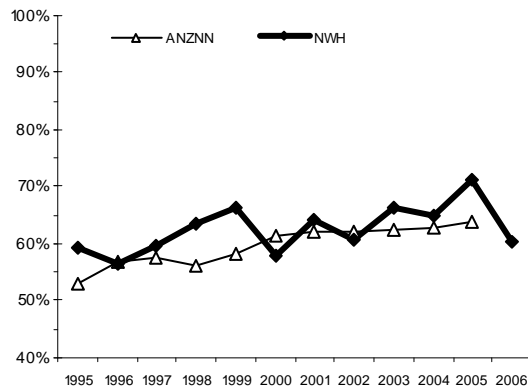


Figure 53: Caesarean section at 24-31wks

Approximately 60% of these very immature infants are delivered by Caesarean. Caesarean section rates have slowly increased in both the Network and at NW but were lower in NW in 2006.

3.11 Death of babies born in or admitted to National Women's in 2005

There were 36 neonatal and infant deaths in 2006. These include all deaths before 28 days or up to hospital discharge (whichever is the greater) of babies born in NW or admitted to NICU. Twenty-nine of the 36 infants who died were born in NW.

Twenty-six deaths (72%) occurred in babies of <28 weeks' gestation, seven in babies with serious anomalies. Ten of the 19 (53%) infants without serious anomalies died in the delivery room and were not resuscitated because of their extreme prematurity. Resuscitation was unsuccessful in two babies who were not admitted to NICU.

Only seven of the 26 extremely premature infants who died were actively treated and admitted to NICU.

At NW, parents who are expected to deliver very preterm are counselled about the likelihood of survival and long term problems. The guidelines used to counsel parents are available on the Newborn website¹. Parents are advised that the outcomes of babies at 23 weeks' gestation are poor, both in terms of a low chance of survival and high chance of survivors having significant developmental problems. The recommended action is that such babies are not actively treated. Treatment is not offered at 22 weeks' gestation. At 24 weeks' gestation the outcomes are better and most parents elect to have their baby actively treated at birth.

The second largest group of babies who died are the 14 infants with serious congenital anomalies. Seven of these were terminations of pregnancy at 21-26 weeks gestation.

Only one moderately premature infant (28-36 weeks' gestation) died. That baby had severe pulmonary hypoplasia from oligohydramnios sequence. The two term infants without malformations who died were both outborn infants with severe hypoxic-ischaemic encephalopathy.

¹ (<http://www.adhb.govt.nz/newborn/Guidelines/Admission/BorderlineViability.htm>)

3.12 Child Development Unit

3.12.1 Follow up at 18 months of children under 1500 grams born in 2004

There were 136 VLBW infants admitted to NICU in this calendar year. One hundred and twenty-two infants survived to discharge from the Newborn Service. Forty-five (37%) weighed <1000 grams at birth.

Two infants with congenital abnormalities were assessed but were excluded from the following tables.

Four infants died after discharge from NW: one at Waikato Hospital at 24 days, one in PICU at 4.5 months with complications of bronchiolitis, and two at home (7.5 and 8 months), leaving 116 infants who were potentially eligible for follow-up.

Twelve (10%) children were lost to follow-up, of whom three weighed less than 1000 grams. Six were from other centres in New Zealand, three lived overseas, and three were in Auckland but did not attend appointments. Data were obtained for 104 (90%) children.

Children received individual assessment at the Child Development Unit, and when this was not possible (mainly because of distance from home to NW), reports were obtained from professionals monitoring their progress.

The *Bayley Scales of Infant Development-II* were administered by a registered psychologist as close as possible to the child reaching 18 months of age (from October 2005 this was changed to 18 months corrected age). Mental and Motor scores were adjusted/corrected for the length of time the child was born preterm. Neurological examinations were carried out by paediatricians. Children were placed in outcome categories as set out in the table below.

Table 15: Outcome Categories for infants under 30 months of age

Category I	(Severe disability): one or more of the following
(i)	Sensorineural deafness (requiring hearing aids)
(ii)	Bilateral blindness
(iii)	Severe cerebral palsy
(iv)	Developmental delay (Bayley* Mental Score 2 or more standard deviations below mean)
Category II	One or more of the following
(i)	Bayley* mental Score between 1 & 2 standard below mean
(ii)	Mild-moderate cerebral palsy without developmental (cognitive) delay
(iii)	Impaired vision requiring spectacles
(iv)	Conductive hearing loss requiring aids
Category III**	Presence of tone disorder or motor delay
	(Bayley* Motor Score more than 1 standard deviation below mean) but adjusted Mental score within average range
Category IV	Normal development
(i)	No apparent tone disorder, and
(ii)	No apparent developmental delay (Bayley* Mental and Motor Scores within average range or above)

Note: Outcome categories modified from Kitchen et al, 1984, 1987.

* Bayley Scales of Infant Development II – all scores adjusted for gestational age.

** Category III is included to signal that a number of preterm infants tested at an early age have minor tone disorders or motor delay. These may improve as the children mature with age and experience.

Table 16: Outcome Categories at 18 months for children under 1500g

	Number	Description
Category I	5 (4.8%)	1 with slow cognitive and motor development and profound bilateral sensorineural hearing loss with bilateral aids 1 with low cognitive and motor scores and hemiplegia 1 with tonal abnormality and low cognitive and motor scores 2 with low cognitive and motor scores
Category II	11 (10.6%)	1 with low cognitive and motor scores, hypertonia and bilateral squint 1 with low motor score and hemiplegia 3 with low cognitive and motor scores; 6 with low cognitive scores.
Category III	9 (8.6%)	1 with low motor scores and tonal abnormality, 8 with motor delay.
Category IV	79 (76.0%)	

Table 17: Outcome of children <1500g born in 2004 at 18 months by gestational age groups (n = 104)

Outcome Category	Gestational age (weeks)				Total n=104	
	24-27 weeks n=57		28 – 36 weeks n=47		n	%
	n	%	n	%		
I	5	8.8	0		5	4.8
II	7	12.3	4	8.5	11	10.6
III	7	12.3	2	4.3	9	8.7
IV	38	66.7	41	87.2	79	76.0

Table 18: Outcome of children <1500g born in 2004 at 18 months by birth weight groups (n=104)

Outcome Category	Birthweight (grams)				Total n=104	
	<1000gms n=40		1000 – 1499 gms n=64		n	%
	n	%	n	%		
I	5	12.5	0		5	4.8
II	5	12.5	6	9.4	11	10.6
III	4	10.0	5	7.8	9	8.7
IV	26	65.0	53	82.8	79	76.0

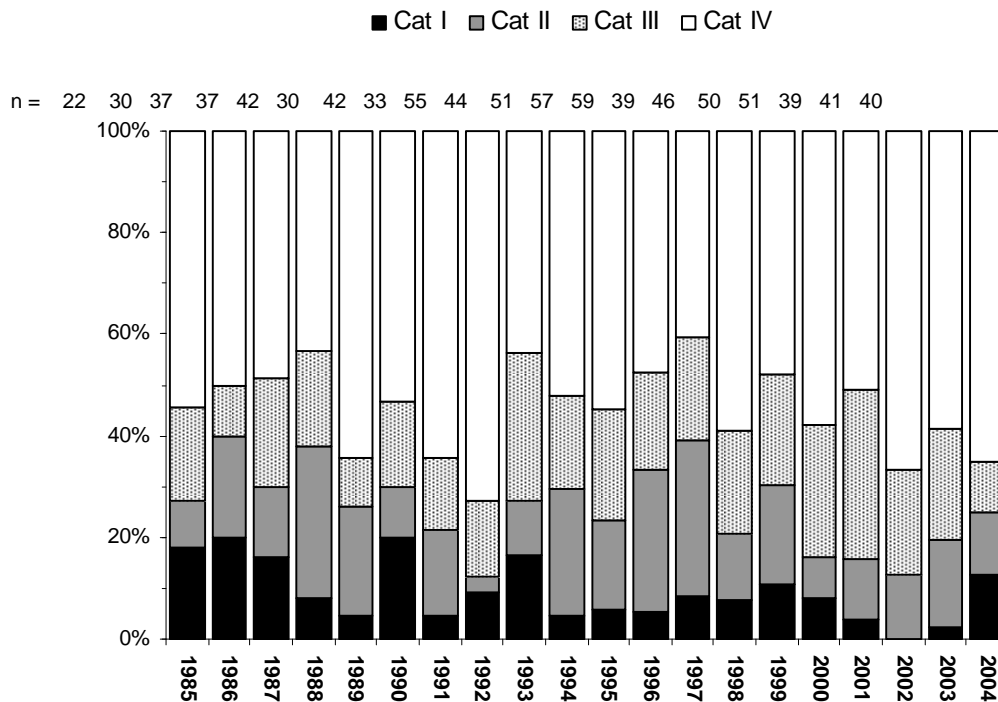


Figure 54: Outcome at 18 months of children <1000g birth weight with known outcomes born 1985-2004

Over the last 20 years, an average 42 babies a year have been assessed. An average of 4 babies a year has had severe disability (category 1). Five of 40 babies born in 2004 had severe disability.

3.12.2 Development at 4 years of children under 1500g born in 2002

One hundred and fifty-two children born in 2002, who weighed less than 1500 grams and were cared for in the Newborn Service, survived to hospital discharge. Twelve children had congenital abnormalities and were not included in the analyses of data.

Two infants died (SIDS) after discharge from hospital at 6 weeks and 5 months respectively.

At 4 years, data were obtained for 102 (73%) children. Of the 36 not seen, 29 (81%) were known to be overseas or in other centres in New Zealand.

At 4 years a registered psychologist interviewed parents, administered standardised tests and carried out clinical assessments with the children on an individual basis. Accordingly, they were placed in Outcome Categories as set out in the next table

Table 19: Outcome categories at 4 years

Category I	(Severe disability): one or more of the following
	(i) Sensorineural deafness (requiring hearing aids)
	(ii) Bilateral blindness
	(iii) Severe cerebral palsy
	(iv) Stanford-Binet* Composite Score (Full Scale IQ) 2 or more standard deviations below mean
Category II	One or more of the following:
	(i) Mild-moderate cerebral palsy
	(ii) Stanford-Binet* Composite Score (Full Scale IQ) between 1 & 2 standard deviations below mean.
Category III	Motor Skills [†] Standard Score more than one standard deviation below mean
Category IV	Normal development i.e. none of the above

* The Stanford-Binet Intelligence Scale 4th edition.

† Vineland Adaptive Behaviour Scales, 1984: Motor Skills Domain.

Table 20: Outcome categories at 4 years for children under 1500g born 2002 (n = 102)

	Number	Description
Category I	8 (7.8%)	1 child with spastic quadriplegia and cognitive impairment 7 children with cognitive impairment and low motor scores.
Category II	15 (14.7%)	2 with low cognitive scores and bilateral conductive hearing loss with hearing aids 6 with low cognitive and motor scores 7 with low cognitive scores and motor skills within the average range
Category III	13 (12.8%)	When tested, these children were within the average range for cognitive performance but below average for motor ability.
Category IV	66 (64.7%)	

Table 21: Comparison of outcomes at 4 years with those at 18 months for children under 1500g born 2002

	18 months (2004 report) n=130	4 years (2006 report) n=102
Category I	0 infants (0%)	8 children (7.8%)
Category II	13 infants (10.0%)	15 children (14.7%)
Category III	23 infants (17.7%)	13 children (12.8%)
Category IV	94 infants (72.3%)	66 children (64.7%)

Allowing for the variation in cohort size over the various years, there has been little change in outcomes over time. The majority of children born weighing less than 1500g will have a normal assessment at both 18 months and 4 years of age. Infants with a birth weight less than 1000g have a higher risk of developmental problems than those infants who weigh between 1000g and 1499g.

Chapter **4**

NEWBORN PUBLICATIONS

4 NEWBORN PUBLICATIONS

4.1 Papers

1. Budden A, Wilkinson L, Buksh MJ, McCowan L. Pregnancy outcome in women presenting with pre-eclampsia at <25 weeks gestation. *Aust NZ J Obstetr Gynaecol* 2006; 46: 407-412.
2. Bloomfield FH, van Zijl PL, Bauer MK, Phua HH, Harding JE. Effect of pulsatile growth hormone administration to the growth-restricted fetal sheep on somatotrophic axis gene expression in fetal and placental tissues. *American Journal of Physiology – Endocrinology and Metabolism* 2006;291:E333-E339.
3. Cormack BE, Bloomfield FH. An audit of feeding practices in babies <1200 g or 30 weeks gestation during the first month of life. *J Paediatr Child Health* 2006;42:453-8.
4. Dalziel SR, Fenwick S, Cundy T, Parag V, Beck TJ, Rodgers A, Harding JE. Peak bone mass following exposure to antenatal betamethasone and prematurity: Follow-up of a randomised controlled trial. *J Bone Mineral Research* 2006;21:1175-86.
5. Dalziel SR, Rea HH, Walker NK, Parag V, Mantell C, Rodgers A, Harding JE. Long term effects of antenatal betamethasone on lung function: 30 year follow up of a randomised controlled trial. *Thorax* 2006;61:678-83.
6. Harris DL, Teele RL, Bloomfield FH, Harding JE, on behalf of the Australian and New Zealand Neonatal Network. Variable interpretation of ultrasonograms may contribute to variation in the reported incidence of white matter damage between newborn intensive care units in New Zealand. *Arch Dis Child Fetal Neonatal Ed* 2006;91(1):F11-6.
7. Jaquiere AL, Oliver MH, Bloomfield FH, Connor KL, Challis JR, Harding JE. Fetal exposure to excess glucocorticoid is unlikely to explain the effects of periconceptual undernutrition in sheep. *J Physiol* 2006; 572(Pt 1):109-18.
8. Mildenhall LF, Battin MR, Morton SM, Bevan C, Kuschel CA, Harding JE. Exposure to repeat doses of antenatal glucocorticoids is associated with altered cardiovascular status after birth. *Arch Dis Child Fetal Neonatal Ed* 2006;91(1):F56-60.
9. West CR, Groves AM, Williams CE, Harding JE, Skinner JR, Kuschel CA, Battin MR. Early low cardiac output is associated with compromised electroencephalographic activity in very preterm infants. *Pediatr Res* 2006;59 610-5.
10. West CR, Harding JE, Williams CE, Gunning MI, Battin MR. Quantitative electroencephalographic patterns in normal preterm infants over the first week after birth. *Early Hum Dev* 2006;82(1):43-51

4.2 Chapters, Reviews and Commentary

1. Bloomfield FH, Harding JE. Fetal Nutrition. In: *Neonatal Nutrition and Metabolism*. Eds: Hay WW Jr, Thureen PJ. Cambridge University Press, Cambridge. 2006, pp1-22.
2. Bloomfield FH, Harding JE. Evidence for fetal glucocorticoid excess as a cause of adult cardiovascular disease. *Current Opinion in Endocrinology and Diabetes* 2006; 13:523-529.
3. Bloomfield FH, Oliver MH, Harding JE. Late effects of fetal growth patterns. *Arch Dis Child* 2006; Jul;91(4):F299-304.
4. De Boo HA, Harding JE. The Developmental Origins of Adult Disease (Barker) hypothesis. *Aust NZ J Obstetr Gynaecol* 2006;46:4-14.
5. Groves AM, Kuschel CA, Skinner JR. The neonatologist as an echocardiographer. *NeoReviews* 2006;7(8):e391 (<http://intl-neoreviews.aappublications.org/cgi/content/short/7/8/e391>).

6. Harding JE, Bloomfield FH, Oliver MH. Maternal nutrition and later disease risk. In: Perinatal programming: early life determinants of adult health and disease. Hodgson DM, Coe C (Eds). Taylor and Francis Medical Books, London. 2006, pp17-29.
7. Harding JE, Jaquier AL, Rumball CWH, Oliver MH, Bloomfield FH. The impact of fetal undernutrition on the hypothalamic-pituitary-adrenal axis. *Obesity Reviews* 2006;7(s2):1-34 doi 10.1111/j.1467-7881.2006.00279.x.

4.3 Invited Lectures

1. Bloomfield FH. Programming influences of periconceptual undernutrition. International Congress of Neuroendocrinology, Pittsburgh, USA, June 2006.
2. Bloomfield FH. In utero administration of somatotrophic hormones to the IUGR fetus – a potential therapeutic stratagem? International Federation of Placental Associations, Kobe, Japan, September 2006.

4.4 Collaborative Studies

1. Crowther CA, Haslam RR, Hiller JE, Doyle LW, Robinson JS; Australasian Collaborative Trial of Repeat Doses of Steroids (ACTORDS) Study Group. Neonatal respiratory distress syndrome after repeat exposure to antenatal corticosteroids: a randomised controlled trial. *Lancet*. 2006 Jun 10;367(9526):1913-9.
2. Doyle LW, Davis PG, Morley CJ, McPhee A, Carlin JB, DART study investigators. Low-dose dexamethasone facilitates extubation among chronically ventilator-dependent infants: a multicenter, international, randomized, controlled trial. *Pediatrics* 2006;117(1):75-83.

4.5 Abstracts

1. Bach KP, Kuschel CA, Bloomfield FH. Cardiorespiratory effects of altering ventilator gas flow rates. Perinatal Society of Australia and New Zealand 10th Annual Congress. Perth, April 2006.
2. Bach KP, Kuschel CA, Page B, Battin MR. The utility of ultrasound to localize percutaneous central venous lines in neonates. Perinatal Society of Australia and New Zealand 10th Annual Congress. Perth, April 2006.
3. Battin M, Bevan C, Knight D. Utilization of neonatal care by infants born to women aged 40 years and over: a ten year review. Perinatal Society of Australia and New Zealand, Perth April 2006.
4. Bevan C, Battin MR, Mildenhall LFJ, Harding JE. Effects of repeated courses of antenatal steroids on growth and development at two years of age; a non-randomised cohort study. Perinatal Society of Australia and New Zealand 10th Annual Congress, Perth, April 2006. P79, p360.
5. Bloomfield FH, Oliver MH, Harding JE. In utero administration of somatotrophic hormones to the IUGR fetus – a potential therapeutic stratagem? *Placenta* 2006; 27(9-10):w10.4.
6. Bloomfield FH, Oliver MH, Rumball CWH, Jaquier AL, Challis JRG, Harding JE. Programming influences of periconceptual undernutrition. Proceedings of the 6th International Congress of Neuroendocrinology, Pittsburgh, June 2006.
7. Brabyn C, O'Donnell C, Beca J, Kuschel C, Finucane K. The management and outcomes of neonates in New Zealand with congenital cardiac lesions weighing less than 2.5kg. Paediatric Society of New Zealand, Nelson, October 2006.
8. Buksh M, Clarke D, Kluckow M. Use of high flow humidified oxygen device (Vapotherm®) for weaning from CPAP. Perinatal Society of Australia and New Zealand 10th Annual Congress, Perth, 2006. P16.

9. Clarke D, Buksh M, Kluckow M. Comparison of noise levels from two respiratory delivery systems. Perinatal Society of Australia and New Zealand 10th Annual Congress, Perth, 2006. PS1.11
10. Clarke D, Buksh M, Kluckow M. CPAP weaning : Can this be a science?. Perinatal Society of Australia and New Zealand 10th Annual Congress, Perth, 2006. FC14.5
11. Connor KL, Jaquiere AL, Oliver MH, Bloomfield FH, Harding JE, Challis JRG. Periconceptional undernutrition reduces placental 11 β HSD2 activity in early gestation in ewes carrying twin pregnancies. *Journal of the Society for Gynecologic Investigation* 2006;13(2, supplement):758A.
12. Dalziel SR, Parag V, Rodgers A, Harding JE. Cardiovascular risk factors at age 30 following preterm birth. *Proceedings of the European Academy of Paediatrics*, 2006;p38.
13. Dalziel SR, Lim VK, Lambert A, McCarthy D, Parag V, Rodgers A, Harding JE. Psychological functioning and health related quality of life in adulthood following preterm birth. *Proceedings of the European Academy of Paediatrics*, 2006;p152.
14. Fantauzzi MR, Connor KL, Oliver MH, Bloomfield FH, Harding JE, Gibb W, Challis JRG. The effect of periconceptional undernutrition on PGE2 receptor protein expression and localization in late gestation ovine placentomes. *Journal of the Society for Gynecologic Investigation* 2006;13(2, supplement):767A.
15. Harding JE. Antenatal steroids: What do we know 35 years on? *Human Reproductive Health Through the Ages*, Adelaide, 2006.
16. Harding JE. Intrauterine treatment for the growth restricted fetus. *Human Reproductive Health Through the Ages*, Adelaide, 2006.
17. Harding JE, Dalziel SR. Clinical use of glucocorticoids in Perinatal Medicine. Programme of the 4th World Congress on the Developmental Origins of Health and Disease, 2006;p37.
18. Harding JE, Jaquiere AL, Bloomfield FH, Oliver MH. The effects of maternal nutrition around conception on the health of her offspring. 7th International Ruminant Reproduction Symposium, Wellington, 2006. p49.
19. Harding JE. Body composition in early growth: Lessons from domestic animals. *Proceedings of the European Academy of Paediatrics*, 2006;p1.
20. Jaquiere AL, Buckley AJ, Oliver MH, Harding JE. Effect of periconceptional undernutrition on milk intake and early postnatal growth in lambs. Perinatal Society of Australia and New Zealand 10th Annual Congress, Perth, 2006, FC13.3, p134.
21. Jenkinson CMC, Blair HT, Kenyon PR, Harding JE, Bloomfield FH, Breier BH, Gluckman PD. Maternal constraint in sheep breeds with diverse birth weight. Perinatal Society of Australia and New Zealand 10th Annual Congress, Perth, April 2006. FC15.5, p152.
22. Kennedy AM, Perry D, Siriwardena K, Battin MR. Congenital cutis verticis gyrata in Noonan Syndrome. Perinatal Society of Australia and New Zealand, Perth April 2006.
23. Kuschel CA. What's in store for preterm infants? Outcomes into childhood. Children's Therapy Conference. Auckland, September 2006.
24. Kuschel CA. Do ventilator gas flow rates matter? The 8th Neonatal Respiratory Care and Monitoring Forum. Nagano, Japan, February 2006.
25. Lamb HW, Knight DB. What can be done to avoid necrotising enterocolitis? Perinatal Society Annual Meeting, Wellington, September 2006.
26. Lamb HW, Knight DB. Chorioamnionitis and neonatal outcome in preterm infants. Perinatal Society of Australia and New Zealand 10th Annual Congress. Perth, April 2006.
27. Mildenhall LJ, Battin MR, Bevan CJ, Kuschel CA, Harding JE. Repeat doses of antenatal corticosteroids do not alter neonatal cardiovascular status after birth: a randomised controlled trial. Perinatal Society of Australia and New Zealand 10th Annual Congress. Perth, April 2006. FC1.2, p55.
28. Rumball CWH, Van Zijl P, Harding JE, Bloomfield FH. Effects of twinning and periconceptional undernutrition on the HPA axis of the late gestation sheep fetus. *Early Human Development* 2006; 82: 554.

29. Rumball CWH, Thorstensen E, Bloomfield FH, Harding JE. Twin fetal sheep have decreased insulin response to arginine but not glucose compared with singletons. Perinatal Society of Australia and New Zealand 10th Annual Congress, Perth, April 2006. FC13.1, p132.
30. van den Boom J, Bach K, Battin M. Twin-to-twin transfusion syndrome – an explanation for coarctation of the aorta in smaller twins in monochorionic pregnancies? Perinatal Society of Australia and New Zealand, Perth April 2006.
31. West CR, Nolan MA, Williams CE, Harding JE, Dezoete JA, Battin MR. Analysis of cotside EEG recordings in preterm infants.. International Child Neurology Congress, Ottawa, June 2006.
32. West CR, Battin MR, Williams CE, Harding JE. Can cotside electroencephalography assist with outcome prediction in preterm infants? (poster) Pediatric Academic Societies, San Francisco, May 2006.
33. West CR, Nolan MA, Williams CE, Harding JE, Dezoete JA, Battin MR. Analysis of cotside EEG recordings in preterm infants.. Perinatal Society of Australia and New Zealand 10th Annual Congress, Perth, April 2006. FC3.5, p70.
34. West C, Nolan M, Williams C, Harding J, Dezoete JA, Battin M. Comparison of quantitative measures and neurophysiologist assessment using cotside electroencephalography monitors to predict outcome in preterm infants.. Perinatal Society of Australia and New Zealand, Perth April 2006.
35. Wilkinson RC. Changing Rooms in NICU. Combined Meeting of Perinatal Society and Neonatal Nurses Association Annual meeting, Wellington, September 2006.
36. Wood A, Kuschel CA, Gentles T. Are echocardiograms performed by neonatologists reliable at detecting neonatal cardiac disease? Paediatric Society of New Zealand, Nelson, October 2006.

4.6 Letters

1. Aftimos S, Battin M. Familial congenital non-immune hydrops. Am J Med Genetics 2006; Part A. 140(15):1709.
2. Kuschel CA, Cormack B, Morreau P. It's difficult being green (as in vomit). BMJ 2006;332:1510-1 (24 June) (first published as: It's not easy being green (e-Response). BMJ 2 June, 2006. <http://bmj.bmjournals.com/cgi/eletters/bmj.38859.614352.55v1>

5 APPENDIX 1. NEWBORN SERVICES

5.1 Admissions to NICU

Table 22: Admissions to NICU by gestational age of babies born in National Women's

Gestation (weeks)	2000	2001	2002	2003	2004	2005	2006
Total	1154	1104	1098	1004	861	825	791
23	5	7	1	1	0	1	1
24	4	10	8	9	3	15	9
25	21	12	13	10	8	14	9
26	23	12	15	15	18	11	13
27	15	14	20	15	24	9	12
28	18	21	19	18	18	23	16
29	34	29	32	18	19	41	25
30	32	36	32	31	35	29	29
31	54	42	36	43	32	33	49
32	78	58	67	49	42	42	63
33	98	77	100	78	65	38	50
34	135	125	138	137	79	83	88
35	106	116	125	96	84	70	82
36	114	112	92	89	79	62	48
37	88	77	84	71	61	70	58
38	93	101	98	88	86	83	69
39	77	88	61	85	68	72	52
40	109	106	78	90	84	80	78
41	44	55	66	52	51	39	37
42	6	6	13	9	5	9	3
43	0	0	0	0	0	1	0

Table 23: Admissions to NICU by birth weight of babies born in National Women's

Birth Weight (gms)	2000	2001	2002	2003	2004	2005	2006
Total	1154	1104	1098	1004	861	825	791
<500	0	1	1	0	0	0	0
500-749	22	23	14	20	11	25	19
750-999	41	37	37	32	37	34	24
1000-1249	45	47	47	31	38	47	34
1250-1499	64	48	56	53	36	42	57
1500-1999	193	186	193	164	138	120	130
2000-2499	291	243	256	238	177	170	182
2500-2999	182	199	184	156	147	119	125
3000-3999	239	232	221	237	208	215	183
≥4000	77	88	89	73	69	53	37

Table 24: Admissions to NICU by gestational age of babies transferred postpartum to National Women's

Gestation (weeks)	2000	2001	2002	2003	2004	2005	2006
Total	258	209	228	216	114	81	99
23	0	1	1	0	0	0	0
24	4	1	3	0	3	3	3
25	1	1	2	2	0	0	8
26	0	3	1	2	1	2	5
27	2	5	2	2	1	1	3
28	3	2	3	3	3	4	2
29	1	1	4	7	2	3	6
30	5	8	12	3	4	3	4
31	1	3	4	3	5	3	2
32	2	8	5	8	4	7	5
33	6	3	1	5	4	7	1
34	5	10	7	13	10	5	6
35	9	7	10	5	6	4	9
36	33	19	19	16	6	2	2
37	19	17	16	20	6	7	3
38	38	28	22	23	13	5	5
39	24	21	35	29	13	8	9
40	61	42	49	43	19	12	17
41	33	27	30	30	10	3	8
42	11	2	2	2	3	2	1
43+	0	0	0	0	1	0	0

Table 25: Admissions by birth weight of babies transferred postpartum to National Women's

Birth Weight (gms)	2000	2001	2002	2003	2004	2005	2006
Total	258	209	228	216	114	81	99
500-749	3	5	3	2	3	2	10
750-999	3	6	10	4	4	5	5
1000-1249	2	3	4	8	3	4	7
1250-1499	7	6	11	5	5	6	5
1500-1999	14	15	14	18	18	15	13
2000-2499	35	34	21	28	11	10	8
2500-2999	37	32	34	29	13	10	15
3000-3999	120	87	101	91	43	22	26
≥4000	37	21	30	31	14	7	9

Table 26: Domicile of mother of all babies admitted to NICU

	2002		2003		2004		2005		2006		% change
	n	%	n	%	n	%	n	%	n	%	
Total	1331		1222		975		906		890		-30
Northern Region	1280	96	1177	96	934	96	833	92	826	92.8	-33
Auckland	515	39	494	40	461	47	441	49	435	48.9	-16
Counties Manukau	179	13	174	14	162	17	144	16	120	13.5	-29
Waitemata	558	42	477	39	275	28	217	24	237	26.6	-54
Northland	28	2.1	32	2.6	36	3.7	32	3.5	34	3.8	+3
Midland Region	36	2.7	19	1.6	14	1.4	34	3.8	34	3.8	+29
Central Region	8	0.6	9	0.7	16	1.6	23	2.5	17	1.9	+104
Southern Region	6	0.5	13	1.1	7	0.7	8	0.9	12	1.3	+50
Overseas	1	0.1	4	0.3	4	0.4	5	0.6	1	0.1	-57

Change is from the average of 2001-2003 to 2006 admission numbers.

Table 27: Ethnicity of mothers of babies admitted to NICU

	Preterm	Term	Total		Preterm	Term	Total
European	313	170	483	Other	11	15	26
Maori	87	31	118	Cook Island	13	4	17
Indian	29	36	65	Niue	2	5	7
Chinese	35	17	52	Other Pacific	2	1	3
Samoan	29	21	50	Fiji	2	1	3
Tongan	11	23	34	Korean	0	1	1
Other Asian	15	16	31				

Table 28: Occupancy (baby days) for NICU by gestational age

Gestation (weeks)	1999	2000	2001	2002	2003	2004	2005	2006
Total	18407	20652	20108	20551	19249	14958	14541	14212
<28	4337	4471	4237	4772	4466	3639	3328	3612
28-31	5054	5807	6159	5483	5331	4265	4774	4322
32-36	6776	7543	7496	8198	7204	5150	4535	4326
≥37	2240	2831	2216	2098	2248	1904	1904	1952

Table 29: Occupancy (baby-days) for NICU by birth weight

Weight(gms)	1999	2000	2001	2002	2003	2004	2005	2006
Total	18407	20652	20108	20580	19249	14958	14505	14212
<1500	8444	9003	9281	9658	8837	6563	7115	7034
1500-1999	3669	4485	4526	4460	4295	3457	2942	2568
2000-2499	3427	3362	3135	3173	3097	2360	2221	2111
≥2500	2867	3802	3166	3289	3020	2578	2227	2499

Table 30: Reason for admission to NICU

Reason	n	Reason	n
Prematurity	427	Jaundice	17
Respiratory distress	182	Haemolytic disease	8
Congenital abnormality	70	Feeding difficulty	8
Hypoglycaemia	33	Bile stained vomiting	6
Depression at birth	30	Neurological problem	6
IU growth restriction	27	Neonatal abstinence syndrome	4
Other	25	Vomiting	2
Cyanotic episode	24	Maternal diabetes mellitus	1
Suspected infection	19		

5.2 Infection

Table 31: Organisms causing serious infection

Organism	Early Infection	Late Infection
<i>Strep agalactiae</i>	3	5
<i>E Coli</i>	2	4
<i>Staph aureus</i>	0	6
<i>Staph epidermidis</i>	0	7
Coagulase negative <i>staphylococcus</i>	0	9
<i>Strep viridans</i>	0	1
<i>Enterococcus</i>	0	1
<i>Klebsiella</i>	0	1

Table 32: Late onset serious infection (septicaemia)

Gestation (weeks)	Birth Weight (gms)	Type	Gestation (weeks)	Birth Weight (gms)	Type
24	660	<i>Klebsiella</i> d12	27	710	CONS d16
24	670	<i>St aureus</i> d21	27	1040	<i>E coli</i> d14
24	720	<i>St epi</i> d8	27	1255	GBS d40
24	720	<i>St epi</i> d19	28	850	<i>St aureus</i> d15
25	560	CONS d12	28	1360	CONS d9
25	560	CONS d48	29	1480	GBS d22
25	610	<i>St epi</i> d6	30	1550	GBS d11
25	610	<i>St epi</i> d7	30	1550	GBS d25
25	610	CONS d14	33	1390	<i>St epi</i> d55
25	610	<i>St epi</i> d55	34	2310	CONS d8
25	610	<i>E coli</i> d76	34	2310	CONS d22
25	685	<i>St viridans</i> d244	37	3480	<i>E coli</i> d15
25	770	CONS d10	38	2950	<i>E coli</i> d3
25	1100	GBS d33	38	3015	CONS d46
25	1100	<i>St aureus</i> d64	39	3665	<i>Enterococcus</i> d14
26	1000	<i>St epi</i> d10	40	3430	<i>St aureus</i> d5
27	550	<i>St aureus</i> d8	41	3500	<i>St aureus</i> d44

(All septicaemias) CONS = Coagulase negative *Staphylococcus*, GBS = Group B *Streptococcus* or *Strep agalactiae* *S.epi* = *Staph epidermidis*, d=day

5.3 Infant feeding in babies discharged from NICU

Note: human milk fortifier has not been included as a supplement in the definition used for NICU babies

Table 33: Infant feeding in babies discharged either directly home or to a post-natal ward by gestational age

Gestation (weeks)	N	Exclusive		Fully		Partial		Artificial	
		n	%	n	%	n	%	n	%
Total	586	248	42%	180	31%	103	18%	54	9%
≤28	25	13	52%	6	24%	3	12%	3	12%
29-31	48	22	46%	12	25%	7	15%	7	15%
32-36	245	79	32%	99	40%	37	15%	29	12%
>36	268	134	50%	63	24%	56	21%	15	6%

Table 34: Infant feeding in babies discharged either directly home or to a post-natal ward by birth weight

Birthweight (gms)	N	Exclusive		Fully		Partial		Artificial	
		n	%	n	%	n	%	n	%
Total	586	248	42%	180	31%	103	18%	54	9%
500-999	21	11	52%	5	24%	4	19%	1	5%
1000-1499	43	21	49%	11	26%	4	9%	7	16%
1500-1999	70	26	37%	26	37%	9	13%	9	13%
2000-2499	142	34	24%	66	46%	28	20%	14	10%
2500+	310	156	50%	72	23%	58	19%	23	7%

5.4 Assisted ventilation

Table 35: Proportion of babies needing assisted ventilation (excluding for surgery or a congenital anomaly) 2003-2006

Gestation (weeks)	No support		CPAP only		IPPV	
	n	%	n	%	n	%
23	0	0	0	0	3	100
24	0	0	0	0	45	100
25	0	0	1	2	47	98
26	0	0	11	17	54	83
27	0	0	12	18	54	82
28	0	0	31	36	55	64
29	4	3	76	63	40	33
30	7	5	106	79	22	16
31	18	11	124	74	25	15
32	59	27	133	61	25	12
33	114	47	118	48	13	5
34	303	69	121	27	18	4
35	491	83	87	15	11	2
36	967	93	66	6	10	1
37	2240	97	54	2	20	1
38	1974	95	77	4	25	1
39	7227	99	48	1	26	0
40	7269	98	87	1	38	1
41	4170	98	47	1	17	0
42	676	98	5	1	6	1
43	40	100	0	0	0	0

Denominator is all inborn babies from 2003-2006, excluding delivery room deaths. n = 23089

Table 36: High Frequency Oscillatory Ventilation

Gestation (weeks)	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Total	%
Total	3/6	8/14	7/18	11/20	3/10	12/25	7/9	5/10	15/21	12/15	83/148	56
<28	1/3	5/7	2/7	4/8	2/5	2/7	4/5	2/6	9/14	6/9	37/71	52
28-31	1/1	1/2	2/6	-	1/2	1/3	-	-	3/3	2/2	11/19	58
32-36	-	1/2	1/2	2/3	0/2	0/3	-	0/1	0/1	1/1	5/15	33
≥37	1/2	1/3	2/3	5/9	0/1	9/12	3/4	3/3	3/3	2/2	29/42	69

The numbers in each cell are survivors/totals. The last column is the percentage survival over the last 10 years.

Table 37: Inhaled Nitric Oxide (iNO)

Gestation (weeks)	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Total	%
Total	11/14	11/22	12/21	16/25	11/16	13/24	6/10	7/13	13/16	8/10	108/171	63
<28	2/3	0/2	3/6	1/3	1/2	0/1	1/2	1/6	2/5	0/1	11/31	35
28-31	2/2	0/1	0/3	0/2	2/2	1/3	-	-	1/1	1/1	7/15	47
32-36	1/1	1/5	2/2	2/3	0/3	1/6	1/1	-	3/3	1/1	12/25	48
≥37	6/8	10/14	7/10	13/17	8/9	11/14	4/7	6/7	7/7	6/7	78/100	78

The numbers in each cell are survivors/totals. The last column is the percentage survival over the last 10 years.

Table 38: iNO plus HFOV

Gestation (weeks)	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Total	%
Total	3/5	2/5	4/10	8/12	0/4	10/18	3/4	2/6	6/8	3/4	41/76	54
<28	1/2	0/1	1/4	1/2	0/1	-	-	0/4	2/3	0/1	5/18	28
28-31	1/1	-	0/2	-	-	1/3	-	-	1/1	-	3/7	43
32-36	-	1/2	1/1	2/3	0/2	0/3	-	-	0/1	1/1	5/13	38
≥37	1/2	1/2	2/3	5/7	0/1	9/12	3/4	2/2	3/3	2/2	28/38	74

The numbers in each cell are survivors/totals. The last column is the percentage survival over the last 10 years.

Table 39: Reason for ventilation and CPAP in term and post-term infants

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
TTN/RDS	4/7	2/44	4/19	1/24	4/47	2/45	3/46	6/61	2/42	3/55
Infection	4/2	4/14	5/27	3/31	1/17	3/17	0/15	1/12	2/8	2/10
Meconium	1/5	9/18	4/15	7/21	1/15	6/25	9/20	4/13	7/16	8/15
Anomaly	8/0	16/4	8/9	13/9	11/8	14/9	8/5	4/6	9/10	7/7
PPHN	7/4	6/4	6/4	9/5	5/6	9/12	3/4	8/7	4/6	3/3
Encephalopathy	6/1	7/12	1/4	7/1	2/4	1/1	14/7	8/8	9/4	4/1

Numbers in each cell are IPPV/CPAP. Some babies each year with other diagnoses are not included in this table.

5.5 Very low birth weight infants

Table 40: Number of VLBW who were born elsewhere and admitted to NICU, or were born in ACH and alive at birth

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Total	178	181	204	210	219	204	175	159	185	180
Total Inborn	166	169	186	195	199	176	156	144	168	153
<500 gms	11	14	13	13	25	11	12	15	9	8
500–749 gms	47	28	22	30	36	23	28	17	34	28
750–999 gms	33	35	45	42	41	37	32	37	35	25
1000-1249 gms	39	37	49	46	48	47	31	39	48	35
1250-1499 gms	36	55	57	64	49	58	53	36	42	57
Outborn	12	12	18	15	20	28	19	15	17	27

Table 41: Numbers and survival by gestational age of babies <32 weeks gestation in 2006

Gestation (weeks)	23	24	25	26	27	28	29	30	31
Born Alive in NW	4	12	9	14	13	16	25	29	49
Died at birth	3	3	0	1	1	0	0	0	0
Admitted to NICU	1	9	9	13	12	16	25	29	49
Survived	1	8	8	13	10	16	24	29	49
Outborn Admitted	0	3	8	5	3	2	6	4	2
Outborn Survived	-	2	7	4	3	1	6	4	1

5.6 Morbidity of inborn very low birth weight infants and babies <32 weeks gestation admitted to NICU

Table 42: Intraventricular haemorrhage by birth weight

Birth Weight (gms)	n	Unknown	None	Grade 1	Grade 2	Grade 3	Grade 4
Total (%)	134	35 (26)	92 (69)	4 (3)	2 (1)	0	1 (0.7)
500-749	19	0	17	0	2	0	0
750-999	24	1	21	1	0	0	1
1000-1249	34	3	29	2	0	0	0
1250-1499	57	31	25	1	0	0	0

Comment: The rate of severe IVH in babies born in NW in 2006 was very low. Some outborn babies had severe IVH and these are included in the Newborn Section of the report

Table 43: Intraventricular haemorrhage by gestation

Gestation (weeks)	n	Unknown	None	Grade 1	Grade 2	Grade 3	Grade 4
Total	163	63 (39)	93 (57)	4 (2)	2 (1)	0	1 (0.6)
<24	1	0	1	0	0	0	0
24-25	18	0	14	1	2	0	1
26-27	25	1	22	2	0	0	0
28-29	41	3	38	0	0	0	0
30-31	78	59	18	1	0	0	0

Table 44: Retinopathy of prematurity by birth weight in babies surviving to 36 weeks' gestation

Birth Weight(gms)	n	Unknown	None	Stage 1	Stage 2	Stage 3	Stage 4
Total	130	41	36	23	25	4	1
500-749	17	0	4	1	9	2	1
750-999	23	0	3	6	12	2	0
1000-1249	33	1	18	11	3	0	0
1250-1499	57	40	11	5	1	0	0

Table 45: Retinopathy of prematurity by gestational age in babies surviving to 36 weeks' gestation

Gestation (weeks)	n	Unknown	None	Stage 1	Stage 2	Stage 3	Stage 4
Total	158	70	32	26	25	4	1
<24	1	0	0	0	1	0	0
24-25	16	0	2	2	9	3	0
26-27	23	0	6	6	10	1	0
28-29	40	2	18	15	4	0	1
30-31	78	68	6	3	1	0	0

Table 46: Chronic lung disease by birth weight

Birth Weight (gms)	n	Dead by 36 wks	Alive at 36 wks	In O ₂	CPAP/ IPPV	CLD	CLD in All	CLD if Alive
Total	134	4	130	18	10	21	16%	16%
500-749	19	2	17	7	5	7	37%	41%
750-999	24	1	23	5	2	5	21%	22%
1000-1249	34	1	33	3	3	6	18%	18%
1250-1499	57	0	57	3	0	3	5%	5%

Table 47: Chronic lung disease by gestational age

Gestation (weeks)	n	Dead by 36 wks	Alive at 36 wks	In O ₂	CPAP/ IPPV	CLD	%CLD in All	%CLD if Alive
Total	163	5	158	17	10	20	12%	13%
<24	1	0	1	1	1	1	100%	100%
24-25	18	2	16	6	3	6	33%	38%
26-27	25	2	23	7	5	10	40%	43%
28-29	41	1	40	3	1	3	7%	8%
30-31	78	0	78	0	0	0	0%	0%

Table 48: Necrotising enterocolitis (NEC) by birth weight

Weight (gms)	2002			2003			2004			2005			2006		
	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%
Total	157	2	1	136	3	2	121	4	3	148	6	4	134	3	2
500-749	14	0		20	1	5	11	0	0	25	4	16	19	2	10
750-999	37	1	3	32	1	3	37	3	8	34	1	3	24	0	0
1000-1249	47	1	2	31	0		38	1	3	47	1	2	34	1	3
1250-1499	56	0		53	1	2	35	0		42	0		57	0	0

Table 49: Necrotising enterocolitis by gestational age

Gestation (weeks)	2002			2003			2004			2005			2006		
	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%
Total	175	3	25	160	4	3	121	4	3	176	6	3	163	3	2
<24	1	0		1	0		0			1	1		1	0	0
24-25	21	1	5	20	1	4	11	1	9	29	4	14	18	1	6
26-27	33	0		30	1	3	42	3	7	20	0		25	2	8
28-29	52	1	2	36	1	3	37	0		64	0		41	0	0
30-31	68	1	1	74	1	1	67	0		62	1	2	78	0	0

Table 50: Patent Ductus Arteriosus by birth weight

Indo = treated with indomethacin. Ligate = surgical ligation of PDA.

Birth weight (gms)	2002			2003			2004			2005			2006		
	N	Indo	Ligate	N	Indo	Ligate	N	Indo	Ligate	N	Indo	Ligate	N	Indo	Ligate
Total	157	42	4	136	40	7	121	34	2	148	39	0	134	25	2
500-749	14	7	1	20	15	6	11	4	1	25	20	0	19	10	2
750-999	37	19	0	32	11	0	37	18	0	34	15	0	24	9	0
1000-1249	47	9	2	31	10	0	38	11	1	47	3	0	34	4	0
1250-1499	56	7	1	53	4	1	35	1	0	42	1	0	57	2	0

Table 51: Patent Ductus Arteriosus by gestational age

Gestation (weeks)	2002			2003			2004			2005			2006		
	N	Indo	Ligate	N	Indo	Ligate	N	Indo	Ligate	N	Indo	Ligate	N	Indo	Ligate
Total	175	45	4	160	43	6	157	35	2	176	41	1	163	25	2
<24	1	0	0	1	1	1	0			1	1	0	1	1	0
24-25	21	10	1	19	15	4	11	6	1	29	23	0	18	13	2
26-27	33	16	1	30	13	1	42	19	0	20	8	0	25	9	0
28-29	52	16	2	36	6	0	37	7	1	64	6	0	41	1	0
30-31	68	3	0	74	8	1	67	3	0	62	3	1	78	1	0

Table 52: Pneumothorax by birth weight

Birth weight (gms)	2002		2003		2004		2005		2006	
	N	n %	N	n %	N	n %	N	n %	N	n %
500-749	14	2 14	20	2 10	11	0	25	1 4	19	0 0
750-999	37	0	32	0	37	0	34	1 3	24	0 0
1000-1249	47	2 2%	31	1 3	38	1 3	47	3 6	34	0 0
1250-1499	56	0 -	53	0	35	0	42	3 7	57	1 2
Total <1500	157	4 3%	136	3 2	121	1 1	148	8 5	134	1 0.7
≥1500	944	10 1%	868	11 1	740	5 0.7	677	5 0.7	657	3 0.5

Table 53: Pneumothorax by gestational age

Gestation (weeks)	2002			2003			2004			2005			2006		
	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%
<24	1	0	0	1			0			1	0		1	0	0
24-25	21	2	10	19	2	11	11	0	0	29	1	3	18	0	0
26-27	33	1	3	30	0	0	42	1	2	20	3	15	25	0	0
28-29	52	0	0	36	1	3	37	0	0	64	5	8	41	1	2
30-31	68	2	3	74	0	0	67	2	3	62	2	3	78	0	0
Total <32	175	5	3	160	3	2	157	3	2	176	11	6	163	1	0.6
≥32	924	9	1.0	844	11	1.3	704	3	0.4	649	2	0.3	628	3	0.5

Table 54: Percentage receiving antenatal corticosteroids by birth weight

Birth weight (gms)	2002			2003			2004			2005			2006		
	N	1-7d	Any	N	1-7d	Any	N	1-7d	Any	N	1-7d	Any	N	1-7d	Any
Total	157	64	91	136	42	90	121	54	91	148	57	95	134	74	128
500-749	14	50	93	20	50	95	11	64	91	25	52	100	19	12	18
750-999	37	65	97	32	47	91	37	59	95	34	56	94	24	11	23
1000-1249	47	72	94	31	52	100	38	58	95	47	57	98	34	20	34
1250-1499	56	64	89	53	30	81	35	40	83	42	60	90	57	31	53

Table 55: Percentage receiving antenatal corticosteroids by gestational age

Gestation (weeks)	2002			2003			2004			2005			2006		
	N	1-7d	Any	N	1-7d	Any	N	1-7d	Any	N	1-7d	Any	N	1-7d	Any
Total	175	64	92	160	42	93	157	53	92	176	55	94	163	79	154
<24	1	100	100	1	100	100	0			1	0	100	1	0	0
24-25	21	62	100	19	53	95	11	73	91	29	55	97	18	10	18
26-27	33	67	97	30	47	93	42	57	93	20	55	100	25	11	25
28-29	52	60	92	36	42	97	37	51	95	64	47	94	41	23	40
30-31	68	66	87	74	36	89	67	48	91	62	40	94	78	35	71

5.7 Details of babies who died

Table 56: Extremely preterm neonatal and post-neonatal deaths (n = 19)

Born at	Gest age	Birth Weight	Apgar 1/5	Twin	Admit NICU	Day died	Cause of death
NW	20	385	2/1	No	No	0	Not resuscitated
NW	21	370	?/?	No	No	0	Not resuscitated
NW	21	515	2/2	No	No	0	Resuscitation abandoned
NW	22	500	2/1	No	No	0	Not resuscitated
NW	22	605	3/2	No	No	0	Not resuscitated
NW	22	735	1/	Twin1	No	0	Not resuscitated, TTTS
NW	23	340	1/0	No	No	0	Not resuscitated
NW	23	520	1/0	Twin1	No	0	Not resuscitated
NW	23	600	1/1	No	No	0	Not resuscitated
NW	24	340	2/3	No	No	0	Not resuscitated
NW	24	530	2/3	No	No	0	Failed resuscitation
NW	24	660	1/1	No	No	0	Not resuscitated
BBA	24	685	?/?	No	Yes	1	Pneumothorax, Grade 4 IVH
NW	24	720	5/9	No	Yes	66	Chronic lung disease
North Shore	25	560	2/4	No	Yes	55	Necrotising enterocolitis
NW	25	610	4/8	No	Yes	70	Chronic Lung Disease
Hastings	26	1134	6/7	No	Yes	2	G4 IVH, pulm. haemorrhage
NW	27	900	4/5	No	Yes	1	Respiratory failure
NW	27	1130	9/9	No	Yes	35	Necrotising enterocolitis

Table 57: Premature neonatal and post-neonatal deaths (n = 1)

Born at	Gest age	Birth Weight	Apgar 1/5	Twin	Admit NICU	Day died	Cause of death
NW	29	1715	?/?	No	Yes	0	pulmonary hypoplasia, pneumothoracies

Table 58: Term/post-term neonatal and post-neonatal deaths (n = 2)

Born at	Gest age	Birth Weight	Apgar 1/5	Twin	Admit NICU	Day died	Cause of death
Whangarei	39	2645	2/3	No	Yes	8	Birth Asphyxia /PPHN/MAS
Home	42	4620	6/5	No	Yes	1	Perinatal asphyxia

Table 59: Babies with significant anomalies (n=14)

Born at	Gest age	Birth Weight	Apgar 1/5	Twin	Admit NICU	Day died	Cause of death
NW	21	425	1/1	No	No	0	TOP, double outlet RV with LV hypoplasia
NW	21	430	2/?	No	No	0	TOP, Potter's syndrome
NW	21	435	2/2	No	No	0	TOP, Trisomy 21
NW	22	460	?/?	No	No	0	TOP, Multiple anomalies
NW	22	505	2/2	No	No	0	TOP, diaphragmatic hernia
NW	22	855	2/2	No	No	0	TOP, Noonan's syndrome
NW	26	1060	2/2	No	No	0	TOP, Jeune's asphyxiating thoracic dystrophy
Overseas	28	1455	1/5	No	Yes	6	Omphalocele + cardiac
MMH	31	1150	3/7	No	Yes	25	Toriello-Carey syndrome
NW	32	1500	8/10	Twin 2	Yes	14	Heterotaxy syndrome
NW	34	2385	6/8	No	Yes	0	Laryngeal atresia
Invercargill	35	2308	4/9	No	Yes	15	Hypoplastic L heart
MMH	36	2580	8/9	No	Yes	124	Liver failure, ?cause
NW	38	3740	6/8	No	Yes	20	Mitochondrial cytopathy