

Newborn Services National Women's Annual Clinical Report 2004

Contact Details

Carl Kuschel
carlk@adhb.govt.nz

David Knight, Clinical Leader
davidk@adhb.govt.nz

TABLE OF CONTENTS

1.	LIST OF TABLES	4
2.	LIST OF FIGURES	5
3.	INTRODUCTION	6
3.1	Foreword	6
3.2	Newborn Service	6
3.3	Executive Summary	7
3.4	Methodology	8
3.4.1	Neonatal database	8
3.4.2	Neonatal data quality	8
3.5	Acknowledgements	9
4.	NEWBORN SERVICE	10
4.1	Total Admissions to the Newborn Intensive Care Unit	10
4.2	Admissions to the Newborn Intensive Care Unit by gestation and birth weight	11
4.3	Newborn Unit occupancy from 1999 to 2004	14
4.4	Admissions per month to NICU from 1999 to 2004	15
4.5	Ethnicity of mothers.	17
4.6	Reasons for admissions to NICU	18
4.7	Infection	18
4.8	Immunisations	19
4.9	Breastfeeding of NICU admissions	20
4.10	Hypoxic Ischaemic Encephalopathy	22
4.11	Assisted ventilation	23
4.11.1	Number of babies receiving and duration of assisted ventilation	23
4.11.2	Trends of time on assisted ventilation of surviving babies <32 weeks gestation who were born in National Women's	26
4.11.3	Trends in the use of assisted ventilation over the last nine years. Data on all infants born in NW	27
4.11.4	High frequency oscillatory ventilation and inhaled nitric oxide	28
4.11.5	Term/post-term Infants on assisted ventilation from 1995 to 2004	29
4.11.6	Reason for ventilation and CPAP in term and post-term infants	29
4.12	Very low birth weight infants	30
4.12.1	Number of deliveries of inborn live-births 501-1500g birth weight from 1959	30
4.12.2	Neonatal survival (to 28 days) of inborn live-births 501-1500g birth weight from 1959	31
4.13	Survival of babies from 23 to 31 weeks gestational age born in National Women's	32
4.14	Intraventricular haemorrhage in all very low birth weight infants admitted to NICU from 1985 to 2004	34
4.15	Morbidity of inborn very low birth weight infants and babies <32 weeks gestation admitted to NICU	35

4.15.1	Intraventricular haemorrhage.	35
4.15.2	Cystic periventricular leukomalacia.	35
4.15.3	Retinopathy of prematurity.	36
4.15.4	Severe retinopathy of prematurity.	36
4.15.5	Chronic lung disease	37
4.15.6	Necrotising enterocolitis	38
4.15.7	Patent Ductus Arteriosus	39
4.15.8	Pneumothorax needing drainage	40
4.15.9	Antenatal and postnatal steroids	41
5.	CAUSES OF DEATH OF ALL BABIES BORN IN OR ADMITTED TO NATIONAL WOMEN'S IN 2004	43
6.	BENCHMARKING NATIONAL WOMEN'S AGAINST THE AUSTRALIA AND NEW ZEALAND NEONATAL NETWORK	46
7.	RESEARCH, PUBLICATIONS AND PRESENTATIONS	53
7.1	International Research.	53
7.2	Newborn Service Research.	53
7.3	Publications.	53
7.4	Chapters, reviews and commentaries	55
7.5	Abstracts	55
7.6	Letters.	60
8.	CHILD DEVELOPMENT UNIT	61
8.1	Follow up at 18 months of children under 1500 grams born in 2002	61
8.2	Development at 4 years of children under 1500g born in 2000	63
9.	APPENDIX: GLOSSARY OF ABBREVIATIONS	65

1. LIST OF TABLES

Table 1:	Admissions to the Newborn Intensive Care Unit	10
Table 2:	Admissions to NICU by gestational age of babies born in National Women's	11
Table 3:	Admissions to NICU by birth weight of babies born in National Women's	12
Table 4:	Admissions to NICU by gestational age of babies not born in National Women's.	12
Table 5:	Admissions by birth weight of babies not born in National Women's.	13
Table 6:	Domicile of mother of babies admitted to NICU.....	13
Table 7:	Ethnicity of mothers of babies admitted to NICU.....	17
Table 8:	Reason for admission to NICU	18
Table 9:	Organisms causing serious infection	18
Table 10:	Late onset serious infection	19
Table 11:	Breastfeeding at discharge from NICU by birth weight.....	20
Table 12:	Breastfeeding at discharge from NICU by gestational age.....	20
Table 13:	Details of Hypoxic Ischaemic Encephalopathy Stages 2 or 3.	22
Table 14:	Number of babies on assisted ventilation	23
Table 15:	Median days on assisted ventilation by gestational age in inborn survivors	24
Table 16:	High Frequency Oscillatory Ventilation (HFOV)	28
Table 17:	Inhaled Nitric Oxide (iNO).	28
Table 18:	iNO plus HFOV.	28
Table 19:	Reason for ventilation and CPAP in term and post-term infants	29
Table 20:	Number of VLBW who were NW live-births and born elsewhere and admitted to NICU ..	30
Table 21:	Numbers and survival by gestational age of babies <32 weeks gestation in 2004	32
Table 22:	Intraventricular haemorrhage by birth weight	35
Table 23:	Intraventricular haemorrhage by gestation	35
Table 24:	Retinopathy of prematurity by birth weight in surviving babies.....	36
Table 25:	Retinopathy of prematurity by gestational age in surviving babies.....	36
Table 26:	Chronic lung disease by birth weight.....	37
Table 27:	Chronic lung disease by gestational age.....	37
Table 28:	Necrotising Enterocolitis (NEC) by birth weight.....	38
Table 29:	Necrotising enterocolitis by gestational age	38
Table 30:	Patent Ductus Arteriosus by birth weight.....	39
Table 31:	Patent Ductus Arteriosus by gestational age.....	39
Table 32:	Pneumothorax by birth weight	40
Table 33:	Pneumothorax by gestational age	40
Table 34:	Percentage receiving antenatal corticosteroids by birth weight.....	41
Table 35:	Percentage receiving antenatal corticosteroids by gestational age.....	41
Table 36:	Percentage receiving postnatal dexamethasone for chronic lung disease by birth weight	41
Table 37:	Percentage receiving postnatal dexamethasone for chronic lung disease by gestation ..	42
Table 38:	Extremely preterm neonatal and post-neonatal deaths	43
Table 39:	Premature neonatal and post-neonatal deaths	44
Table 40:	Term/post-term neonatal and post-neonatal deaths	44
Table 41:	Major congenital abnormalities of any gestation neonatal and post-neonatal deaths	45
Table 42:	Outcome categories for infants under 30 months of age.....	61
Table 43:	Children under 1500g born in 2002. Outcome at 18 months by gestational age group ..	63
Table 44:	Children under 1500g born in 2002. Outcome at 18 months by birth weight group	63
Table 45:	Outcome categories for assessments at 4 years.....	64

2. LIST OF FIGURES

Figure 1:	Admissions to NICU 1981-2004.....	10
Figure 2:	Occupancy per month (baby-days).....	14
Figure 3:	Occupancy per month (baby-days) according to gestation.....	14
Figure 4:	Occupancy per month (baby-days) according to birth weight.....	15
Figure 5:	Admissions per month.....	15
Figure 6:	Admissions per month by gestation.....	16
Figure 7:	Admissions per month by birth weight.....	16
Figure 8:	Distribution of ethnicity in term babies admitted to NICU.....	17
Figure 9:	Distribution of ethnicity in preterm babies admitted to NICU.....	17
Figure 10:	Median days on IPPV, CPAP and IPPV+CPAP by gestational age in survivors.....	25
Figure 11:	Days on IPPV.....	26
Figure 12:	Days on CPAP.....	26
Figure 13:	Days on CPAP + IPPV.....	26
Figure 14:	Number on IPPV.....	27
Figure 15:	Number on CPAP.....	27
Figure 16:	Number on CPAP + IPPV.....	27
Figure 17:	Number of term and post term babies needing assisted ventilation.....	29
Figure 18:	Number of inborn live-births $\leq 1500\text{g}$ from 1959 to 2004.....	30
Figure 19:	Neonatal survival of $\leq 1500\text{g}$ inborn live-births from 1959 to 2004.....	31
Figure 20:	Percentage survival to discharge home of babies born in 2000-4.....	32
Figure 21:	Numbers of babies born alive at 23 to 31 weeks gestation in 2000-2004.....	32
Figure 22:	Percentage survival of babies born in National Women's and admitted to NICU from 1995 to 2004. (n = 1829).....	33
Figure 23:	Percentage survival by year of babies born in National Women's and admitted to NICU from 1995.....	33
Figure 24:	Intraventricular haemorrhage in all $<1500\text{ gm}$ infants admitted to NICU from 1985.....	34
Figure 25:	Survival at 24-5 wks gestation.....	47
Figure 26:	Survival at 26-7 weeks.....	47
Figure 27:	Antenatal steroids at 24-7 weeks.....	47
Figure 28:	Antenatal steroids at 28-31 weeks.....	47
Figure 29:	Caesarean section at 24-31wks.....	48
Figure 30:	Chronic lung disease at 24-7wks.....	48
Figure 31:	Chronic lung disease at 28-31wks.....	48
Figure 32:	Any IVH at 24-7 weeks.....	49
Figure 33:	Severe (Grade 3-4) IVH at 24-7 weeks.....	49
Figure 34:	IVH at 28-31 weeks.....	49
Figure 35:	Severe (Grade 3-4) IVH at 28-31 weeks.....	49
Figure 36:	ROP at 24-7 weeks.....	50
Figure 37:	ROP at 28-31 weeks.....	50
Figure 38:	HFOV at 24-7 weeks.....	50
Figure 39:	Inhaled nitric oxide at 24-7 weeks.....	50
Figure 40:	Percentage on IPPV at 24-7 weeks.....	51
Figure 41:	CPAP at 24-27 weeks.....	51
Figure 42:	Median days on IPPV at 24-7wks.....	51
Figure 43:	Median days on CPAP at 24-7wks.....	51
Figure 44:	IPPV at 28-31 weeks.....	52
Figure 45:	CPAP at 28-31 weeks.....	52
Figure 46:	Median days on IPPV at 28-31wks.....	52
Figure 47:	Median days on CPAP at 28-31wks.....	52
Figure 48:	Outcomes of children $<1000\text{g}$ born 1985-2002 at 18 months.....	62

3. INTRODUCTION

This is the Newborn Section of the National Women's Annual Clinical Report. The full report is available on the National Women's Website. In addition to being part of this, this section is published separately on the Newborn Website. This version includes details of research and publications not in the whole report. The forward was written for the whole report.

3.1 Foreword

National Women's Health is pleased to publish our 2004 Annual Clinical Report, the twelfth in our series.

2004 has been a tremendous year for National Women's. We celebrated 40 years in the Claude Road complex on 14 February 2004. It is often said that life begins at 40 and for National Women's 40th birthday celebrations were soon after followed by intensification of our pre-migration activities. Migration to the Auckland City Hospital site commenced on 11 October. Inpatient and a small number of outpatient services were settled at Auckland City Hospital by the end of the week. However, it was not until April 2005 that outpatient services which remain at the Greenlane Clinical Centre site were re-housed in their new premises.

Our new facilities are superb and women have been very complimentary and are clearly appreciating the vastly improved environment.

Our primary purpose for producing our Annual Clinical Report is to identify areas where improvements can be made, whilst analysing and reviewing our performance. This report provides an opportunity to both compare National Women's results with others and to share information with other providers of health services to women and the newborn. Through sharing and learning we all improve and this publication provides a further opportunity for us to do so.

Kay Hyman
General Manager,
National Women's Health & Starship Children's Health.

3.2 Newborn Service

In 2004, the Newborn Service staff joined with other Women's Health staff to bid their farewells to the National Women's Hospital built on the Green Lane site in 1964. Progressively over the years the two clinical areas within the Newborn Service, the Newborn Intensive Care Unit (NICU) and the Parent Infant Nursery (PIN), had become cramped and noisy environments, with limited space and resources for parents and families.

In 1995 the planning for a new Newborn Unit on the Grafton site commenced, but it was not until 2000 that timelines and detailed planning became regular agenda items for the Newborn planning team. Many staff contributed to the design and layout, and consumer participation proved to be most valuable. The culmination of intensive planning and design by key staff within the Service, not only ensured a well designed Newborn Intensive Care Unit, but also a

smooth migration process from the Green Lane site to the Grafton site, with minimal disruption to babies and families.

Since the opening of the new Newborn Intensive Care Unit on Level 9 of the Auckland City Hospital in October 2004, the service has received many compliments from national and international experts and visitors on the design of the new Unit and the family friendly environment. Complementing the design and layout, are thirty-two beautiful artworks generously donated to the Unit by leading New Zealand artists.

Regional planning for neonatal services with Waitemata, Counties-Manukau and the Auckland DHB catchment areas continued in 2004. Waitemata increased their child health services to manage their own populations in north and west Auckland. There was a further reduction in cots at National Women's, and a reduction in Neonatal Homecare Services to align with the reduced neonatal volumes. The newly opened National Women's Newborn Unit at Auckland City Hospital has forty-six cots, with two intensive care capable isolation rooms.

Quality Health New Zealand undertook a three year Accreditation Survey at National Women's Hospital just prior to the service migration to the Grafton site. The Newborn Service was awarded a Certificate of Outstanding Achievement for consistently achieving high standards over the past three Accreditation audits. This is the first time this award has been given to a service within the public health system. Quality New Zealand specifically highlighted the value of the "continuum of care" process provided by the Service. The contribution of staff to the many quality improvement projects undertaken, reflects the high professional standards set by staff. Congratulations to all staff on this significant achievement.

Carolynn Whiteman,
Service Manager,
Newborn Services.

3.3 Executive Summary

The end of 2004 marked what was a very productive and challenging year for Newborn Services. Not surprisingly, the event that the service was most focussed on was the migration on October 11, 2004, to level 9 of Auckland City Hospital on the Grafton site. This was the culmination of over 5 years of planning, with a goal of making the neonatal unit environment meet the needs of individual babies, families, and staff. Many staff devoted considerable time and effort into ensuring that the migration was seamless. There was a significant settling in period during which processes were refined to ensure that the service improved further in the new environment. The move has seen a number of changes in relationships with tertiary paediatric subspecialty services based at Starship Children's Health, which has been for the benefit of babies and their families. The change in the demographic of the babies that the service looks after has improved training experience for medical staff, and has provided all staff with exposure to neonatal conditions that previously would not have been dealt with so regularly in the NICU.

Related to the migration were a number of changes regionally that impacted on the service, in particular the expansion of neonatal services at North Shore Hospital. This has led to a

greater need for regional cooperation around infant placement in the Auckland catchment area, and has clearly impacted on occupancy and acuity at National Women's Health NICU.

With impeccable timing, newborn services underwent an accreditation visit by assessors from Quality Health New Zealand only two months prior to migration. Newborn Services received a very favourable report and, indeed, was awarded a Certificate of Outstanding Achievement in recognition of this and the reports from previous accreditation visits. We are the first service within a public health facility to be recognised in this way, and this reflects the high standards that all staff members expect the service to perform at.

We are very pleased to highlight that Newborn Services continues to be very active in research and audit. Staff members were authors of 19 papers published in peer reviewed journals and for five chapters and reviews. More than 60 posters and oral presentations were given by staff members at local and international conferences and meetings. We continue to critically evaluate the outcomes of babies admitted to NICU, comparing our data against those of other neonatal units who submit data to the Australia and New Zealand Neonatal Network. This exercise constantly challenges us with questions of how we may be able to do things differently to achieve better outcomes for babies and their families. As with the previous report for 2001 to 2003, the key outcomes by which we audit our performance are presented in the 2004 report and are compared to network-wide data.

We thank all families and staff for their ongoing support of the Newborn Service.

Dr Carl Kuschel,
Clinical Director,
Newborn Services.

3.4 Methodology

3.4.1 Neonatal database

The Newborn Unit data have been 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 is collected and accuracy checked on 'Network babies' after discharge from hospital.

3.4.2 Neonatal data quality

Additional checks of the accuracy of the data were made in preparing the Annual Report and prior to sending data the Australia and New Zealand Neonatal Network. The clinical records and sometimes original ultrasound and radiological 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 meningitis. Records were checked when the data entered in different fields in the database seemed incompatible (for instance for feeding methods). The 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.

3.5 Acknowledgements

David Knight	Clinical Leader, National Women's and Starship. Checking and analysing data. Producing and commenting on the report
Carl Kuschel	Clinical Director, Newborn Service. Editorial suggestions, checking the report and providing comments
Coila Bevan	Research Nurse. Collecting and checking data throughout the year.
Anne Dezoete	Psychologist, Child Development Unit. Tracing and assessing children. Producing the CDU section of the report

All the Registrars, Nurse Specialists and Ward Clerks on NICU for input of data.

4. NEWBORN SERVICE

4.1 Total Admissions to the Newborn Intensive Care Unit

Table 1: Admissions to the Newborn Intensive Care Unit

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Number	1663	1580	1635	1666	1464	1690	1420	1300	1352	1412	1312	1331	1220	975

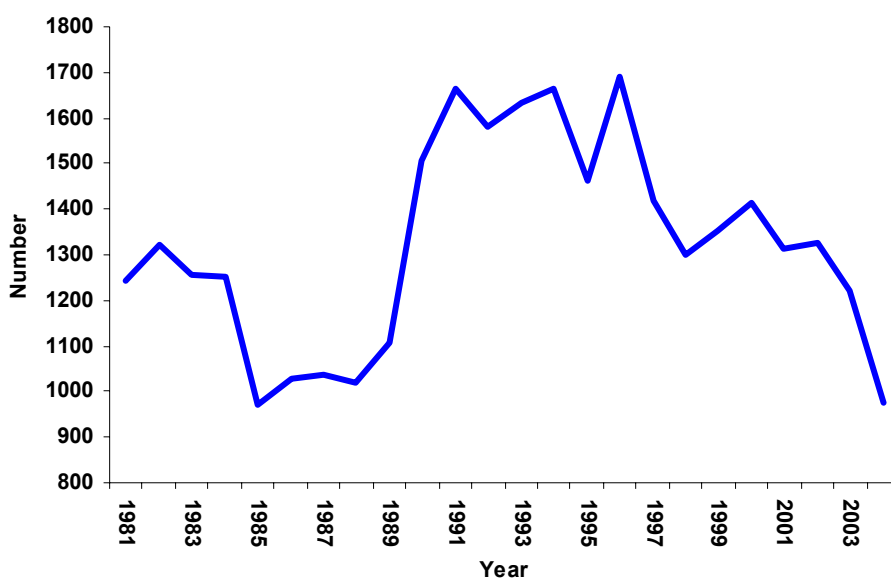


Figure 1: Admissions to NICU 1981-2004

In October 2003, North Shore Hospital opened an 8 cot Level 2 unit, with National Women's decreasing its cot numbers by a similar number. This resulted in a decreased number of admissions to the NW NICU in 2004. However, it did not contribute much to the lower number of admissions in 2003 as that decrease was mainly from babies born in National Women's rather than transfers postnatally from the Waitemata area.

In January 2004, North Shore increased by another 4 cots to a 12 cot unit. Waitakere Hospital has opened a 8 cot Level 2 unit in mid-2005. These units admit babies >1500 gm and >31 weeks gestation and will administer CPAP. National Women's continues to be the level 3 referral unit for the two Waitemata hospitals.

The decrease in admissions in 1985 probably represented a change in emphasis to trying to keep more babies with their mothers. The increase in admissions in 1990 was due to the closure of St Helen's Hospital and the transfer of all its deliveries to National Women's.

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

Table 2: Admissions to NICU by gestational age of babies born in National Women's

Gestation	1999	2000	2001	2002	2003	2004
Total	1108	1154	1104	1098	1004	861
23	3	5	7	1	1	0
24	3	4	10	8	9	3
25	17	21	12	13	10	8
26	10	23	12	15	15	18
27	29	15	14	20	15	24
28	23	18	21	19	18	18
29	28	34	29	32	18	19
30	35	32	36	32	31	35
31	49	54	42	36	43	32
32	73	78	58	67	49	42
33	72	98	77	100	78	65
34	122	135	125	138	137	79
35	138	106	116	125	96	84
36	98	114	112	92	89	79
37	69	88	77	84	71	61
38	100	93	101	98	88	86
39	74	77	88	61	85	68
40	93	109	106	78	90	84
41	57	44	55	66	52	51
42	14	6	6	13	9	5
43	1	0	0	0	0	0

Table 3: Admissions to NICU by birth weight of babies born in National Women's

Birth Weight	1999	2000	2001	2002	2003	2004
Total	1108	1154	1104	1098	1004	861
<500	4	0	1	1	0	0
500-749	16	22	23	14	20	11
750-999	44	41	37	37	32	37
1000-1249	48	45	47	47	31	38
1250-1499	56	64	48	56	53	36
1500-1999	167	193	186	193	164	138
2000-2499	285	291	243	256	238	177
2500-2999	171	182	199	184	156	147
3000-3999	224	239	232	221	237	208
≥4000	93	77	88	89	73	69

Table 4: Admissions to NICU by gestational age of babies not born in National Women's.

Gestation	1999	2000	2001	2002	2003	2004
Total	244	258	209	228	216	114
23	1	0	1	1	0	0
24	1	4	1	3	0	3
25	2	1	1	2	2	0
26	4	0	3	1	2	1
27	0	2	5	2	2	1
28	3	3	2	3	3	3
29	1	1	1	4	7	2
30	4	5	8	12	3	4
31	3	1	3	4	3	5
32	7	2	8	5	8	4
33	4	6	3	1	5	4
34	3	5	10	7	13	10
35	16	9	7	10	5	6
36	17	33	19	19	16	6
37	14	19	17	16	20	6
38	37	38	28	22	23	13
39	30	24	21	35	29	13
40	51	61	42	49	43	19
41	35	33	27	30	30	10
42	10	11	2	2	2	3
43+	1	0	0	0	0	1

Table 5: Admissions by birth weight of babies not born in National Women's.

Birth Weight	1999	2000	2001	2002	2003	2004
Total	244	258	209	228	216	114
500-749	4	3	5	3	2	3
750-999	4	3	6	10	4	4
1000-1249	4	2	3	4	8	3
1250-1499	5	7	6	11	5	5
1500-1999	17	14	15	14	18	18
2000-2499	29	35	34	21	28	11
2500-2999	44	37	32	34	29	13
3000-3999	104	120	87	101	91	43
≥4000	33	37	21	30	31	14

Table 6: Domicile of mother of babies admitted to NICU.

	2001		2002		2003		2004	
	n	%	n	%	n	%	n	%
Northern Region	1274	97	1280	96	1177	96	934	96
Auckland DHB	554	42	515	39	494	40	461	47
Counties Manukau DHB	157	12	179	13	174	14	162	17
Waitemata DHB	524	40	558	42	477	39	275	28
Northland DHB	39	3.0	28	2.1	32	2.6	36	3.7
Midland Region	24	1.8	36	2.7	19	1.6	14	1.4
Central Region	8	0.6	8	0.6	9	0.7	16	1.6
Southern Region	5	0.4	6	0.5	13	1.1	7	0.7
Overseas	2	0.2	1	0.1	4	0.3	4	0.4

4.3 Newborn Unit occupancy from 1999 to 2004

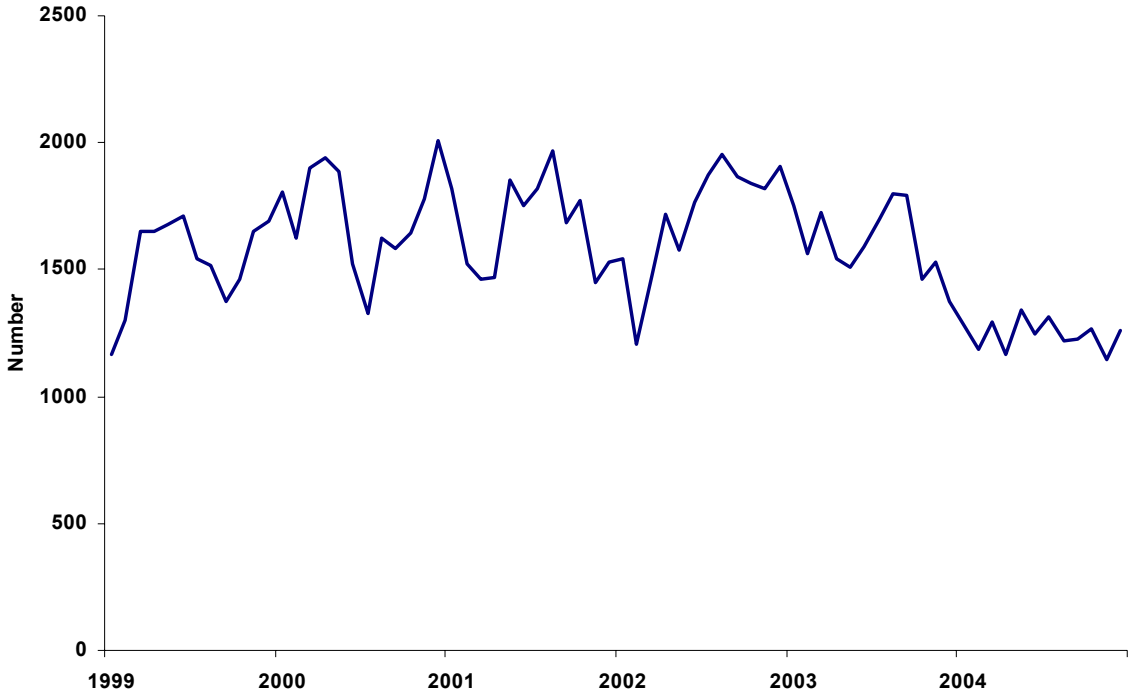


Figure 2: Occupancy per month (baby-days)

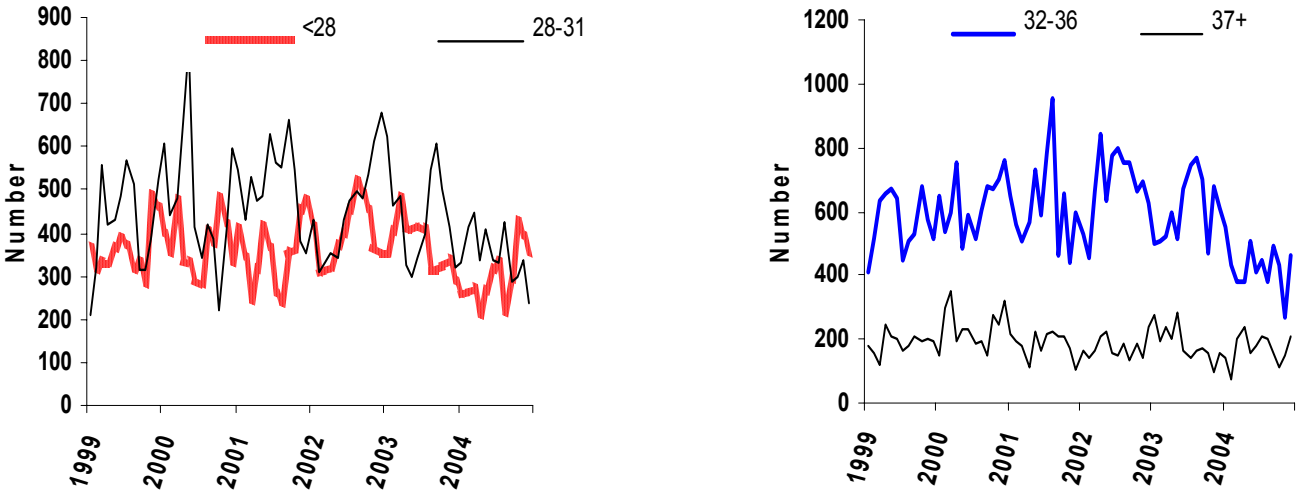


Figure 3: Occupancy per month (baby-days) according to gestation.

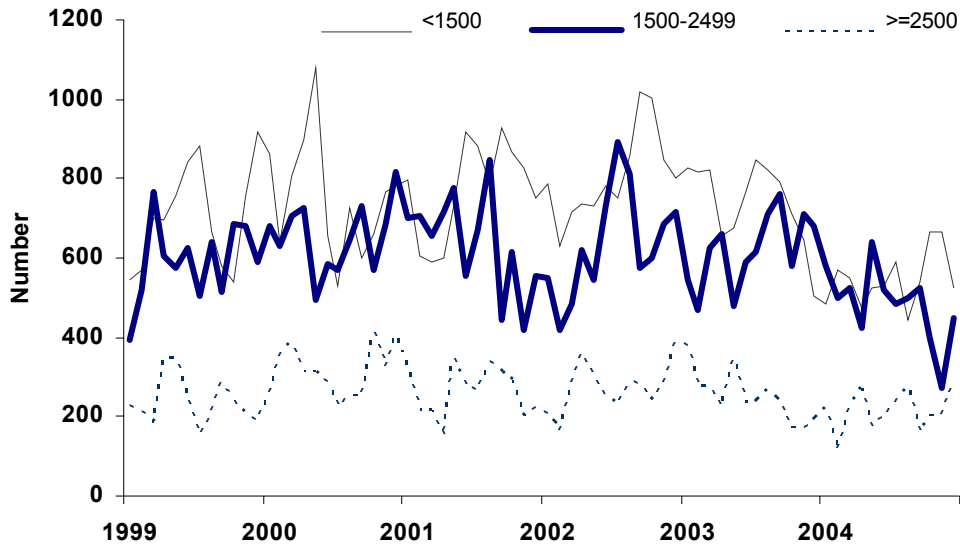


Figure 4: Occupancy per month (baby-days) according to birth weight

4.4 Admissions per month to NICU from 1999 to 2004

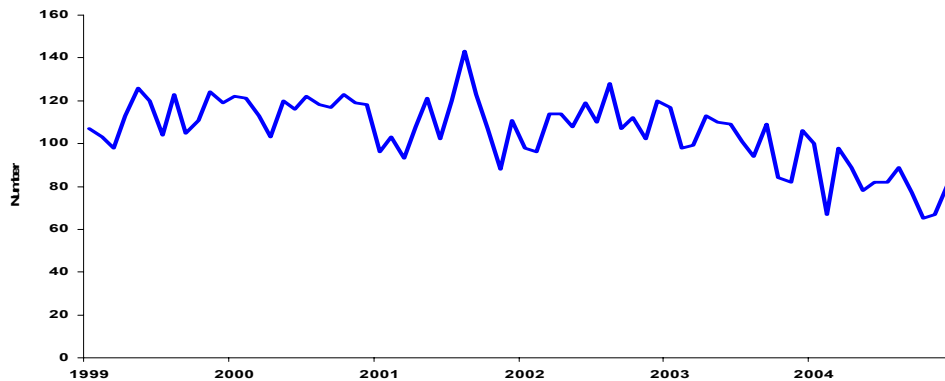


Figure 5: Admissions per month

1st admission only displayed. Re-admissions (mostly for postnatal wards rather than home) are uncommon, accounting for only 1.8% of total admissions

The decrease in number of admissions started before the North Shore Neonatal Unit opened. The major contribution to this has been from more mature infants, from 32 weeks gestation onwards.

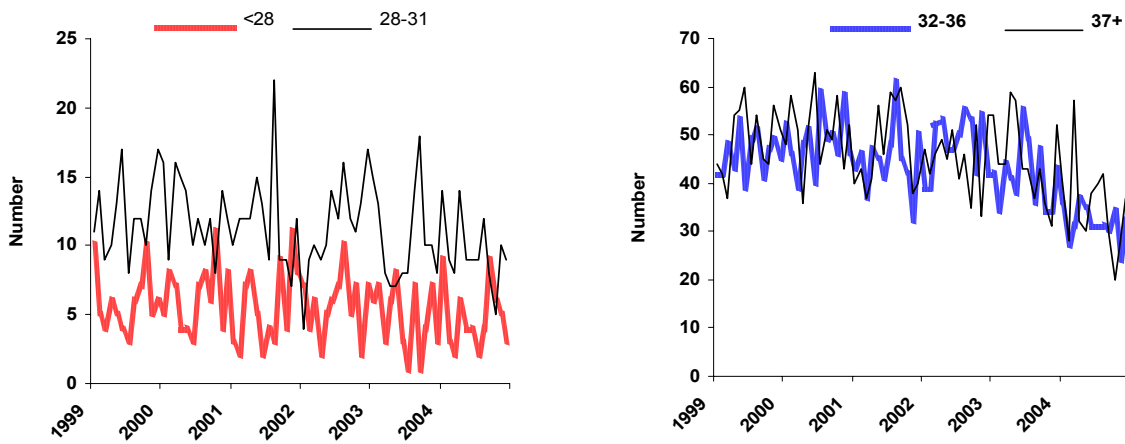


Figure 6: Admissions per month by gestation

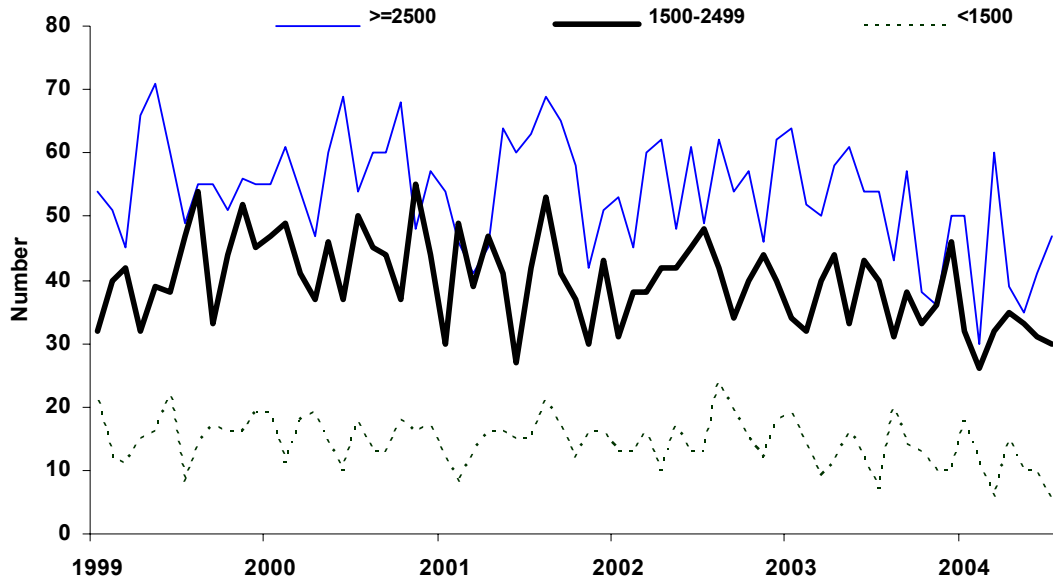


Figure 7: Admissions per month by birth weight

4.5 Ethnicity of mothers.

Table 7: Ethnicity of mothers of babies admitted to NICU

Ethnic group	Preterm	Term	Total	Ethnic group	Preterm	Term	Total
Total	555	420	975				
European	312	186	498	Other	15	14	29
Maori	76	50	126	Cook Island	8	9	17
Indian	36	33	69	Other Pacific	2	7	9
Samoan	30	38	68	Niue	2	5	7
Chinese	34	27	61	Fiji	1	2	3
Tongan	18	32	50	Korean	3	0	3
Other Asian	17	13	30	Not stated	1	4	5

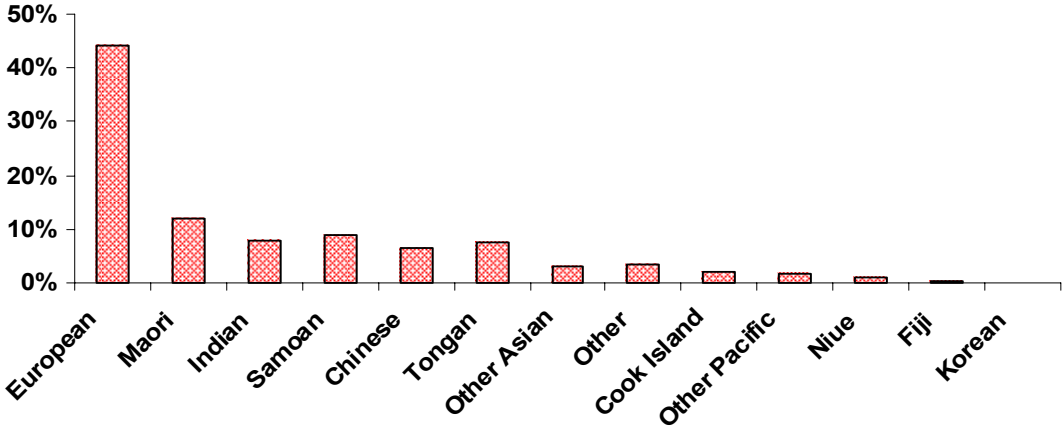


Figure 8: Distribution of ethnicity in term babies admitted to NICU

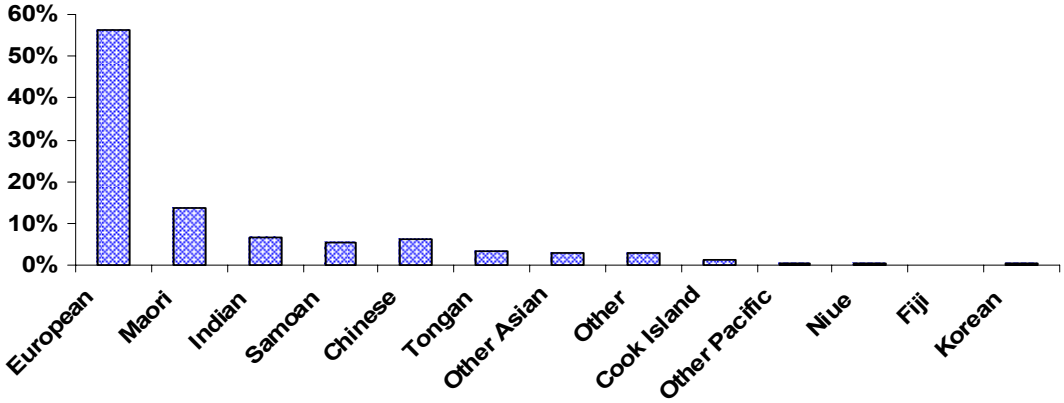


Figure 9: Distribution of ethnicity in preterm babies admitted to NICU

4.6 Reasons for admission to NICU

Table 8: Reason for admission to NICU

Reason	n	Reason	n
Prematurity	398	Jaundice	15
Respiratory distress	232	Feeding difficulty	11
Hypoglycaemia	68	Haemolytic disease	8
Congenital anomaly	67	Neurological problem	5
Depression at birth	41	Vomiting	3
IU growth restriction	33	Bile stained vomiting	2
Other	31	Maternal diabetes mellitus	2
Suspected infection	29	Neonatal abstinence	1
Cyanotic episode	27		

4.7 Infection

Infection reported here is confined to culture proven septicaemia or meningitis. The ANZNN definitions are used and it is classified as 'early' (<48 hours of age) or late (>48 hours).

Table 9: Organisms causing serious infection

Organism	Early Infection	Late Infection
<i>Strep agalactiae</i>	3	6
<i>E Coli</i>	3	5
<i>Staph aureus</i>	0	5
<i>Staph epidermidis</i>	1	3
<i>Coag neg staphylococcus</i>	0	3
<i>Strep pneumoniae</i>	1	0
<i>Pseudomonas</i>	0	1
<i>Klebsiella</i>	0	1

Two early infections were in babies <30 weeks gestation (one died from *E coli* septicaemia). One was in a 34 weeks gestation baby and the remaining five were in term infants. One term infant died from *E coli* septicaemia. The baby with early onset *Staph epidermidis* infection was not particularly unwell but had a very high C-reactive protein and a very abnormal white blood count. This was treated as a genuine infection despite *Staph epidermidis* being an uncommon pathogen at birth.

Table 10: Late onset serious infection

Gestation	Birth Weight	Type	Gestation	Birth Weight	Type
24	590	CNS day 7, died day 10	28	1240	CNS day 22
24	605	GBS day 24 and GBS day 57	28	1240	<i>E coli</i> day 13
24	684	<i>S. epidermidis</i> day 26	28	1250	<i>S. aureus</i> day 4
24	790	CNS day 22, died day 25	29	662	<i>S. aureus</i> day 19
25	500	<i>S. aureus</i> day 38	29	1435	<i>E coli</i> meningitis d 6
25	715	<i>S. aureus</i> day 47	32	2100	<i>S. epidermidis</i> day 12
26	940	<i>S. epi</i> d 42, <i>Pseudomonas</i> d 47	34	1840	<i>E coli</i> day 5
27	910	<i>S. aureus</i> day 38, died day 110	35	2150	GBS day 29
27	1200	<i>E coli</i> day 9	36	1910	<i>Klebsiella</i> day 17
27	1295	GBS meningitis day 9	39	3700	GBS day 5
24	590	CNS day 7, died day 10	40	2915	GBS day 7

CNS = Coagulase negative *Staphylococcus*,

GBS = Group B *Streptococcus* or *Strep agalactiae*

S.epi = *Staph epidermidis*

4.8 Immunisations

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 2004 80 of 84 babies still in NW on day 42 were immunised before going home. Two were transferred to Whangarei on day 44 and day 45 with recommendations that they be immunised there when their parents could give consent. One baby was very unwell at the time the immunisation was due and died a short time later. Only one other baby was not immunised. There was no record as to why this was omitted.

All 13 babies still in NICU on day 90 received their 2nd immunisation before discharge.

4.9 Breastfeeding of NICU admissions

Data are presented on babies admitted to NICU who were either discharged to a NW post-natal ward or to home. In the NICU classification, the use of dietary supplements such as human milk fortifier is not counted as use of milk formula. All very low birth weight infants receive human milk fortifier.

Table 11: Breastfeeding at discharge from NICU by birth weight

Birth weight	N	Exclusive		Full		Partial		None	
		n	%	n	%	n	%	n	%
Total	773	136	18	321	42	217	28	99	13
500-999	26	3	12	16	62	2	8	5	19
1000-1499	46	11	24	26	57	2	4	7	15
1500-1999	114	13	11	65	57	23	20	13	11
2000-2499	161	18	11	84	52	34	21	25	16
3000+	426	91	21	130	31	156	37	49	12

Exclusive = only received breast milk during stay

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

Table 12: Breastfeeding at discharge from NICU by gestational age

Gestation	N	Exclusive		Fully		Partial		None	
		n	%	n	%	n	%	n	%
Total	773	136	18	321	42	217	28	99	13
≤28	39	8	21	20	51	3	8	8	21
29-31	63	10	16	39	62	7	11	7	11
32-36	319	33	10	174	55	69	22	43	13
≥37	352	85	24	88	25	138	39	41	12

Overall, 87% of babies were discharged receiving some breast milk. Sixty percent were discharged receiving only breast milk. However, only 18% were exclusively breast fed.

There are different challenges to achieve high breastfeeding rates in the different groups of babies. The 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. Initially, when put the breast, the babies are poor feeders. In this group, 72% are discharged fully or exclusively breast fed. This approximates the breastfeeding rate at 2-4 months of age (the usual age of discharge). This represents a considerable achievement by their mothers and the staff helping them.

Moderately preterm babies are usually not as sick as the less mature infants. They still have to learn to feed. The clinical choice is often whether to give or continue IV fluids or give milk formula while the mothers are establishing their milk supply. The time taken to achieve satisfactory sucking feeds is usually the main determinant of the length of stay. Sixty-five percent of babies 32-36 weeks gestation are discharged exclusively or fully breastfeeding, and only 13% are not receiving any breast milk.

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. The majority of babies in this group receive some formula feeds.

4.10 Hypoxic Ischaemic Encephalopathy

Data on HIE have been presented in previous annual clinical reports. In these the data on significant HIE of babies born at North Shore and Waitakere Hospitals was complete, as all sick babies for those hospitals were transferred to NW. With the opening of the North Shore Hospital Neonatal Unit, only some of the babies with significant HIE are now transferred to NW, so the data is incomplete. Thus, in 2004 only four babies were transferred into NW because of significant HIE.

Table 13: Details of Hypoxic Ischaemic Encephalopathy Stages 2 or 3.

Born at	Gestation	Birth Weight	HIE Stage	Apgar at 1/5	Day died	Comment
NW	31	2055	Stage 2	1/1		Vasa previa, LSCS
NW	37	3275	Stage 2	2/4		HELLP syndrome, fetal distress pre labour. LSCS
NW	38	2875	Stage 2	9/10	22	Collapse 2 hrs post birth
NW	38	3060	Stage 2	9/10		Dehydration post birth. Readmitted from home.
NW	39	2850	Stage 2	3/9		Fetal distress. LSCS
NW	40	2880	Stage 2	6/9		Failed ventouse. LSCS. Possible longer standing cerebral injury
NW	40	3220	Stage 2	6/8		Shoulder dystocia
NW	40	3430	Stage 2	1/3	15	T/f to NW in labour with fetal bradycardia. LSCS
NW	40	3980	Stage 2	2/5		Cord prolapse LSCS
NW	41	3955	Stage 3	2/6		Ventouse/forceps. Subgaleal bleed
NW	42	3000	Stage 2	3/6		Poor CTG pre-labour LSCS
North Shore	37	2880	Stage 2	3/3	13	2nd twin prolapsed cord. LSCS
Waitakere	38	3640	Stage 2	1/6		Fetal distress on CTG
Waitakere	40	3165	Stage 2	1/5		Feto-maternal. haemorrhage Hb 39g/l
Waitakere	42	3765	Stage 3	7/8	5	Cyanosed 30m post birth. Collapse at 3hrs

In 2004, 10 term babies born in NW developed stage 2 or 3 HIE, giving an incidence of 1.5/1000 term live-births. In 2003 there were five babies (0.6/1000 live-births).

Two of the babies (and one born elsewhere) had complications after birth that led to the encephalopathy. Only one mother had had a complicated pregnancy. Six of the 10 were delivered by Caesarean section. Two of these were without antecedent labour.

The care of all babies with significant HIE is reviewed in the confidential Maternity Morbidity Meeting to try to identify factors that led to the poor outcome and to attempt to improve care. Educational feedback is given to individual clinicians and to the units involved.

4.11 Assisted ventilation

4.11.1 Number of babies receiving and duration of assisted ventilation

Data in this section are presented for babies who were born in NW, excluding babies transferred to NW postnatally. Including inborn babies only allows more meaningful comparisons of postnatal care at NW across the years.

Table 14: Number of babies on assisted ventilation

Gestation	Births	Admit	IPPV		CPAP		IPPV or CPAP		
			n	% of Admits	n	% of Admits	n	% of Admits	% of Births
Total	7551	861	123	14	388	45	402	47	5.3
23	2	0	0		0		0		
24	6	3	3	100	3	100	3	100	50
25	8	8	8	100	7	88	8	100	100
26	18	18	12	67	18	100	18	100	100
27	24	24	20	83	23	96	24	100	100
28	20	18	10	56	17	94	18	100	90
29	19	19	10	53	18	95	18	95	95
30	35	35	6	17	34	97	34	97	97
31	33	32	5	16	31	97	31	97	94
32	42	42	7	17	31	74	32	76	76
33	65	65	1	2	39	60	40	62	62
34	87	79	7	9	29	37	30	38	34
35	148	84	1	1	24	29	24	29	16
36	276	79	5	6	20	25	22	28	8.0
37	511	61	9	15	17	28	18	30	3.5
38	1284	86	8	9	23	27	27	31	2.1
39	1845	68	1	1	12	18	12	18	0.7
40	1878	84	7	8	25	30	26	31	1.4
41	1101	51	2	4	15	29	15	29	1.4
42	149	5	1	20	2	40	2	40	1.3

IPPV = intermittent positive pressure ventilation

CPAP = continuous positive airways pressure.

High frequency oscillatory ventilation (HFOV) is included with IPPV.

The percentages are of those admitted to NICU, except for the last column.

The numbers on IPPV were 126, 140, 109 and 123 (11%, 12%, 11% and 14%) in 2001 - 2004.

The numbers on CPAP per year were 379, 421, 388 and 388 (34%, 37%, 39% and 45%).

The numbers on assisted ventilation (IPPV or CPAP) were 393, 446, 404 and 402 (36%, 39%, 40% and 47%)

Table 15: Median days on assisted ventilation by gestational age in inborn survivors

n = number on IPPV, CPAP or either.

Gestation	IPPV		CPAP		IPPV or CPAP	
	n	Median	n	Median	n	Median
Total	106	2.0	375	1.3	384	1.6
23	0		0		0	
24	1	46.0	1	38.3	1	84.3
25	7	6.3	7	47.6	7	58.9
26	11	2.6	17	43.9	17	45.3
27	17	3.7	21	39.5	21	40.4
28	8	2.4	16	16.3	16	16.7
29	9	2.4	17	4.1	17	6.4
30	6	0.7	34	2.1	34	2.1
31	5	0.5	31	1.6	31	1.8
32	5	0.7	30	2.1	30	2.1
33	1	0.9	39	0.5	40	0.5
34	7	1.9	29	0.6	30	0.8
35	1	3.2	24	1.2	24	1.3
36	4	1.8	19	0.5	20	0.7
37	8	2.1	16	0.7	17	1.3
38	7	1.6	22	0.6	26	0.7
39	1	1.0	12	0.7	12	0.7
40	5	0.9	23	0.5	24	0.6
41	2	2.8	15	0.4	15	0.4
42	1	4.4	2	2.0	2	4.2

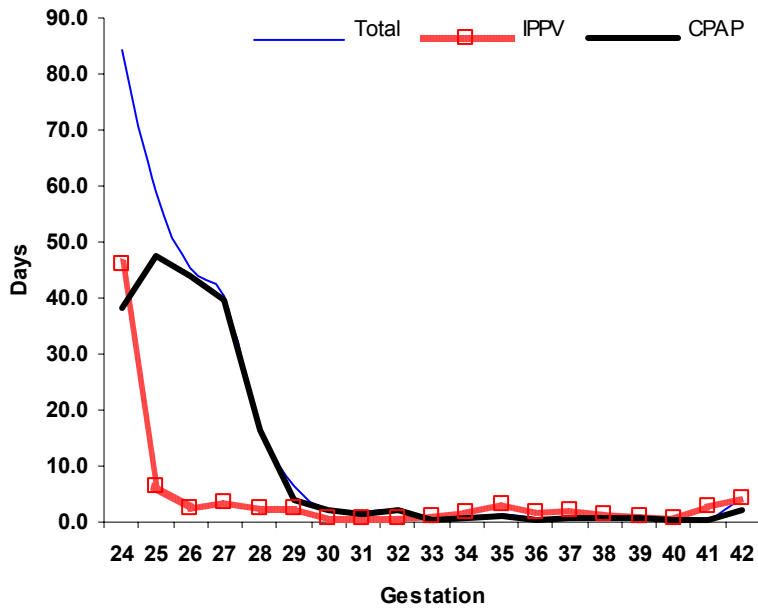
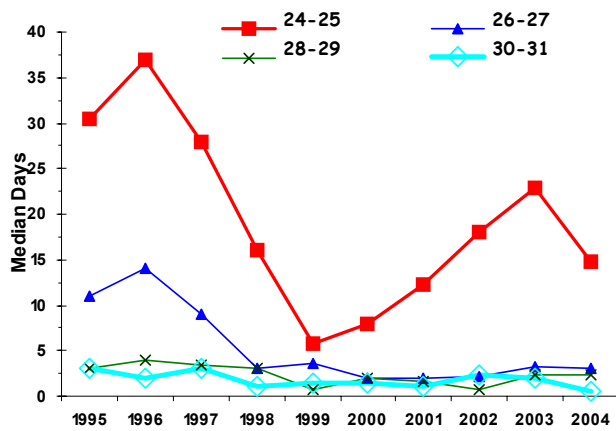


Figure 10: Median days on IPPV and CPAP and IPPV+CPAP by gestational age in survivors

This figure shows the dramatic reduction in the need for intubation and positive pressure ventilation from 26 weeks gestation onwards. There is a similar decrease in the time on CPAP from 29 weeks onwards. These data are important to consider in deciding the timing of delivery for very preterm babies.

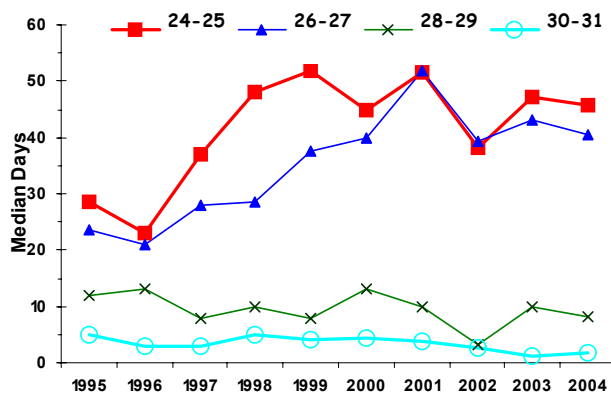
4.11.2 Trends of time on assisted ventilation of surviving babies <32 weeks gestation who were born in National Women's



With the change to a CPAP-based approach in 1997, 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.

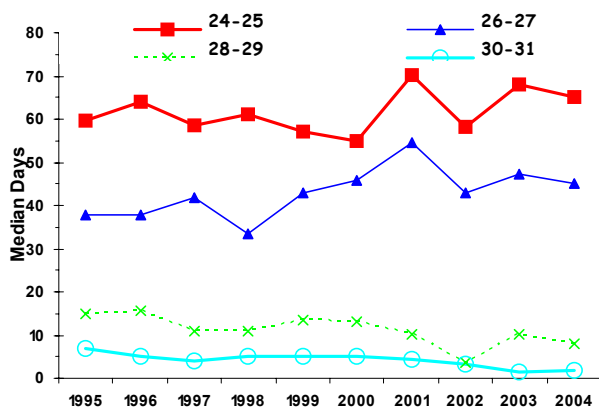
However the median number of days on IPPV has increased to around 20 days in over the last two years in the most immature infants. Numbers in this group are low.

Figure 11: Days on IPPV



In 2000, two audits of the incidence of chronic lung disease were conducted. These showed that the incidence had not fallen with the change the CPAP based approach. This has resulted in a more relaxed approach to the extubation of the most immature babies. The optimal approach is not clear from the medical literature. 'Clinical experience' with very immature infants has led to a less aggressive approach to extubation.

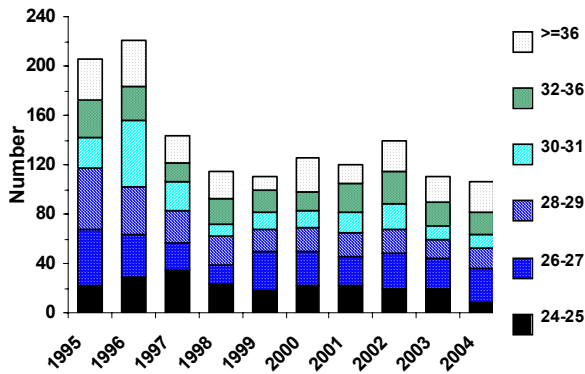
Figure 12: Days on CPAP



The 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. The time overall on respiratory support has increased a little in this group.

Figure 13: Days on CPAP + IPPV

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

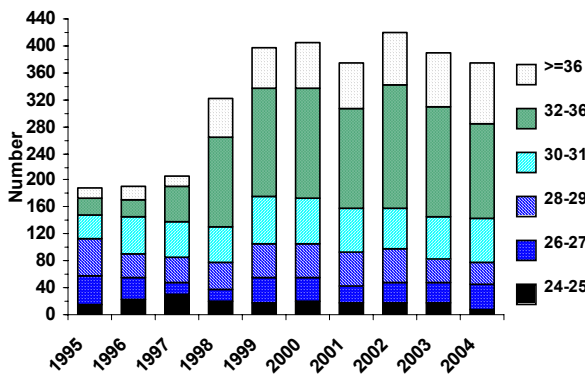


These figures show the number of babies requiring assisted ventilation at NW over the last nine years.

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.

Figure 14: Number on IPPV



Head-box oxygen administration was phased out and any baby requiring oxygen was placed on CPAP.

Comparative data on rates of ventilation and time on ventilation are presented later in this report, benchmarking NW usage with that of the Australia and New Zealand Neonatal Network (ANZNN). Along with these are benchmarked data on survival and the incidences of intraventricular haemorrhage, chronic lung disease and retinopathy of prematurity.

Figure 15: Number on CPAP

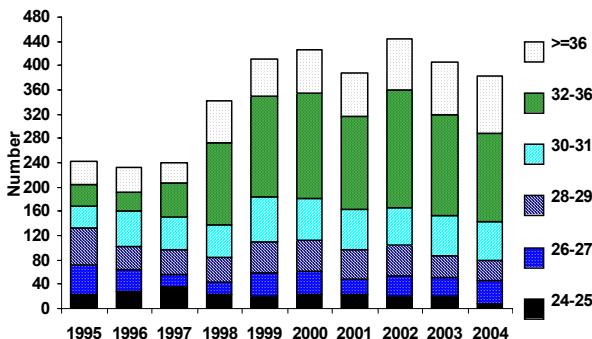


Figure 16: Number on CPAP + IPPV

4.11.4 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.

Table 16: High Frequency Oscillatory Ventilation (HFOV)

Gestation	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Total	%
Total	-	1/3	3/6	8/14	7/18	11/20	3/10	12/25	7/9	5/10	57/115	50
<28	-	0/1	1/3	5/7	2/7	4/8	2/5	2/7	4/5	2/6	22/49	45
28-31	-	1/1	1/1	1/2	2/6	-	1/2	1/3	-	-	7/15	47
32-36	-	-	-	1/2	1/2	2/3	0/2	0/3	-	0/1	4/13	31
≥37	-	0/1	1/2	1/3	2/3	5/9	0/1	9/12	3/4	3/3	24/38	63

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

Table 17: Inhaled Nitric Oxide (iNO).

Gestation	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Total	%
Total	9/11	10/16	11/14	11/22	12/21	16/25	11/16	13/24	6/10	7/13	106/172	62
<28	-	0/1	2/3	0/2	3/6	1/3	1/2	0/1	1/2	1/6	8/26	31
28-31	1/1	-	2/2	0/1	0/3	0/2	2/2	1/3	-	-	6/14	43
32-36	-	2/3	1/1	1/5	2/2	2/3	0/3	1/6	1/1	-	10/24	42
≥37	8/10	8/12	6/8	10/14	7/10	13/17	8/9	11/14	4/7	6/7	81/108	75

Table 18: iNO plus HFOV.

Gestation	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Total	%
Total	-	0/2	3/5	2/5	4/10	8/12	0/4	10/18	3/4	2/6	32/66	48
<28	-	0/1	1/2	0/1	1/4	1/2	0/1	-	-	0/4	3/15	20
28-31	-	-	1/1	-	0/2	-	-	1/3	-	-	2/6	33
32-36	-	-	-	1/2	1/1	2/3	0/2	0/3	-	-	4/11	36
≥37	-	0/1	1/2	1/2	2/3	5/7	0/1	9/12	3/4	2/2	23/34	68

High frequency oscillatory ventilation is used only for 'rescue' treatment at National Women's. Hence, babies treated with HFOV are the sickest babies in NICU who would be expected to have a very poor outlook whatever the treatment.

4.11.5 Term/post-term Infants on assisted ventilation from 1995 to 2004

This figure shows the number of term infants ventilated or treated with CPAP. Inborn and outborn infants are included. There has been a significant increase in CPAP use and a small decrease in numbers on IPPV.

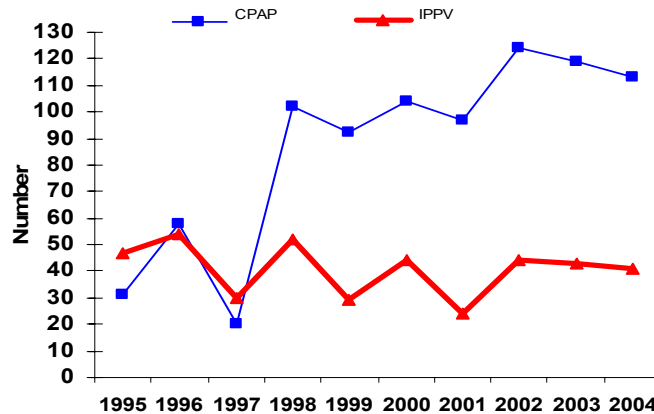


Figure 17: Number of term and post term babies needing assisted ventilation

4.11.6 Reason for ventilation and CPAP in term and post-term infants

In 1995-6, the largest group of term infants needing IPPV was those with meconium aspiration syndrome (MAS) and persistent pulmonary hypertension (PPHN). In 1995-6, 46 infants were ventilated for these indications. This number fell to 26 in 2002-3. However, there was a rise in CPAP use in babies with MAS and PPHN from 28 to 61.

The largest increase in CPAP use is in those infants with transient tachypnoea or respiratory distress syndrome. In 1995-6, 15 infants with these conditions were treated with CPAP and 5 ventilated. In 2002-3, the numbers were 91 babies received CPAP and 5 ventilated.

The unit policy changed from head box oxygen to the administration of oxygen via CPAP in 1997. Hence the numbers on CPAP increased dramatically. Now, all babies needing additional oxygen are placed on CPAP, rather than receiving head box oxygen.

Table 19: Reason for ventilation and CPAP in term and post-term infants

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
TTN/RDS	1/2	4/13	4/7	2/44	4/19	1/24	4/47	2/45	3/46	6/61
Infection	3/6	5/13	4/2	4/14	5/27	3/31	1/17	3/17	0/15	1/12
Meconium	14/6	18/12	1/5	9/18	4/15	7/21	1/15	6/25	9/20	4/13
Anomaly	14/6	12/5	8/0	16/4	8/9	13/9	11/8	14/9	8/5	4/6
PPHN	8/5	6/3	7/4	6/4	6/4	9/5	5/6	9/12	3/4	8/7
Encephalopathy	3/6	8/5	6/1	7/12	1/4	7/1	2/4	1/1	14/7	8/8

Each cell is the numbers on IPPV/CPAP. There are a number of babies each year with non-specific or miscellaneous diagnoses who are not included in this table.

4.12 Very low birth weight infants

Table 20: Number of VLBW who were NW live-births and born elsewhere and admitted to NICU

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Total	200	175	180	196	213	189	178	181	204	210	219	204	175	159
Total Inborn	178	164	164	176	200	173	166	169	186	195	199	176	156	144
<500	2	6	7	14	10	13	11	14	13	13	25	11	12	15
500 – 749	25	31	32	42	34	36	47	28	22	30	36	23	28	17
750 – 999	52	38	51	46	44	50	33	35	45	42	41	37	32	37
1000 -1249	58	47	39	45	46	47	39	37	49	46	48	47	31	39
1250 -1499	63	53	51	49	79	43	36	55	57	64	49	58	53	26
Outborn	22	11	16	20	13	16	12	12	18	15	20	28	19	15

These numbers include babies who were born alive but died at birth, who were either >20 weeks gestation or >400gms birth weight. In 2004, 23 of the 144 inborn infants <1500 grams died at or soon after birth. Eighteen of these 23 were <24 weeks gestation.

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

This includes all babies born alive, including those who died at birth and babies with lethal anomalies.

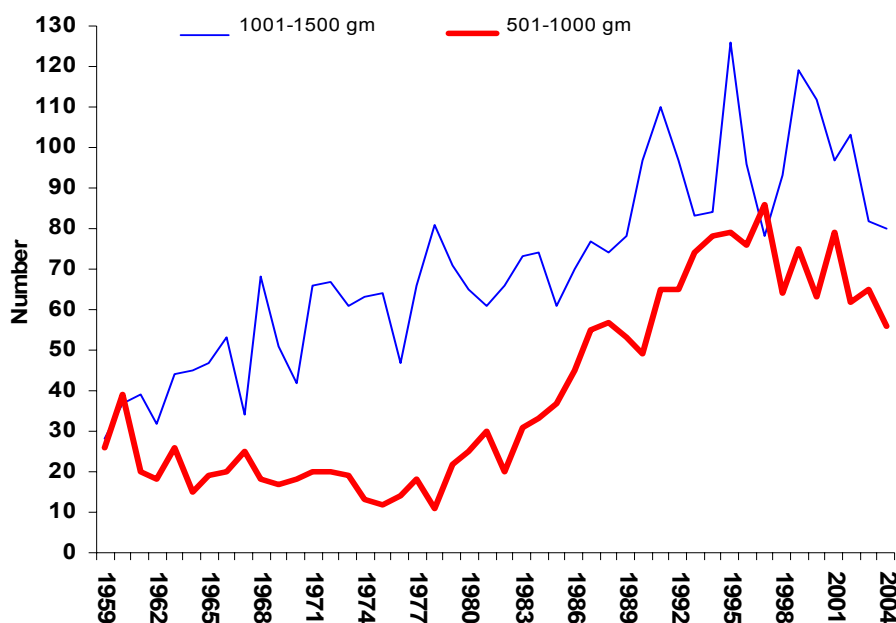


Figure 18: Number of inborn live-births ≤1500g from 1959 to 2004

4.12.2 Neonatal survival (to 28 days) of inborn live-births 501-1500g birth weight from 1959

These data include all babies who died at birth and those with lethal anomalies.

In 2004, 6 of 9 deaths in 501-1000gms babies were at birth. Of the 6 babies who died, 4 were not resuscitated as they were <24 weeks gestation, 1 at 24 weeks was not resuscitated and in 1 at 24 weeks resuscitation failed. However there were 2 late neonatal deaths that are not included in this figure.

Two of the 6 deaths in the 1001-1500gm infants were due to lethal anomalies and occurred at birth.

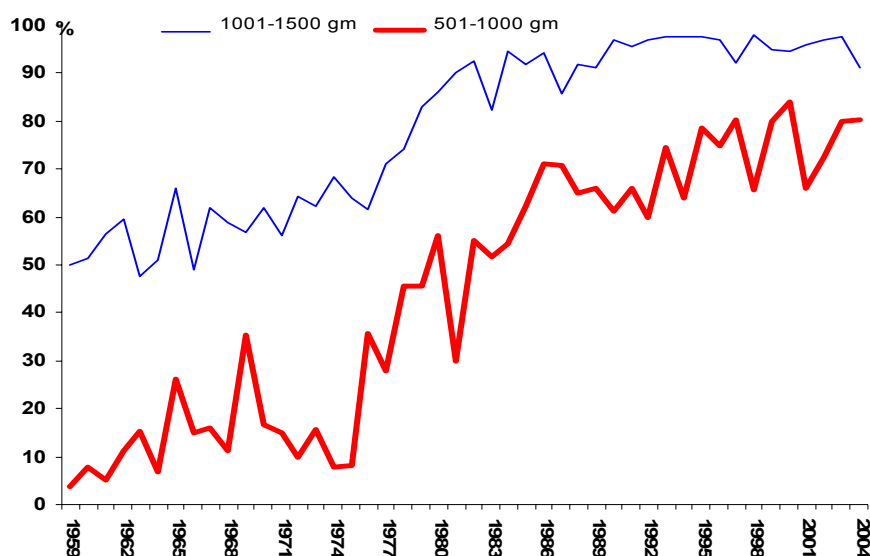


Figure 19: Neonatal survival of ≤1500g inborn live-births from 1959 to 2004

This figure is of neonatal survival of babies born in NW over the last 46 years. A neonatal death is one at <28 days of age. The data were collected initially by Assoc. Prof. Ross Howie. Over the years the definitions used have been the same, with all deaths at birth included if they were live births. The WHO definition of a live birth of ‘any signs of life’ has been used throughout. This meant that, particularly in the early years, some deaths were reclassified from fetal deaths to neonatal deaths as some sign of life was recorded in the clinical records.

The number of babies with anomalies and the number who were not actively treated because of their low gestation vary from year to year, and have a big influence on the overall survival rate, particularly in the extremely low birth weight group (501-1000gms) (ELBW).

The figure shows the enormous improvement in the results of perinatal and neonatal intensive care over this time period. In the first three years (1959-61) 5/85 (6%) ELBW babies survived to 28 days compared to 142/183 (78%) in the last three years.

The biggest improvements happened in the late 1970s and early 1980s with the beginning of modern intensive care and techniques of ventilatory support. The trend of increasing survival in the ELBW group continues over the last 20 years. Artificial surfactant treatment was introduced in 1990.

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

Table 21: Numbers and survival by gestational age of babies <32 weeks gestation in 2004

Gestation	23	24	25	26	27	28	29	30	31
Born Alive in NW	2	6	6	18	24	20	19	35	33
Died at birth	2	3	0	0	0	2	0	0	1
Admitted to NICU	0	3	6	18	24	18	19	35	32
Survived	0	1	5	17	21	17	18	35	32
Outborn Admitted	0	3	0	1	1	3	2	4	5
Outborn Survived		1		0	1	3	2	4	5

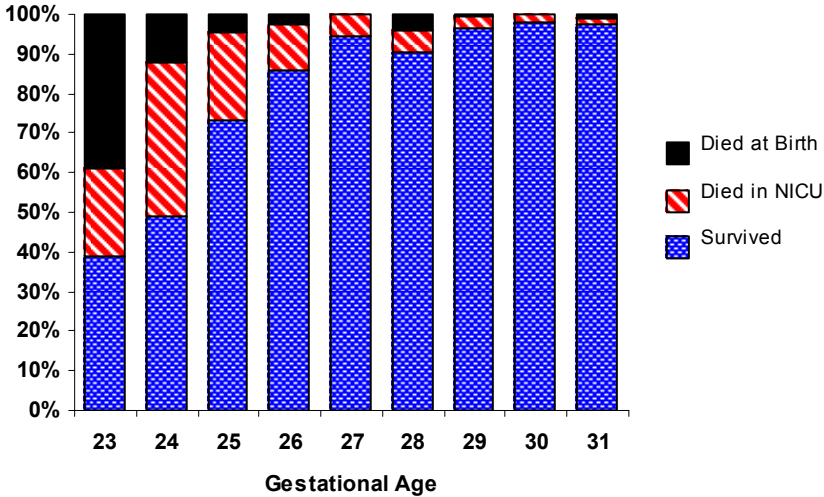


Figure 20: Percentage survival to discharge home of babies born in 2000-4. (n= 929)

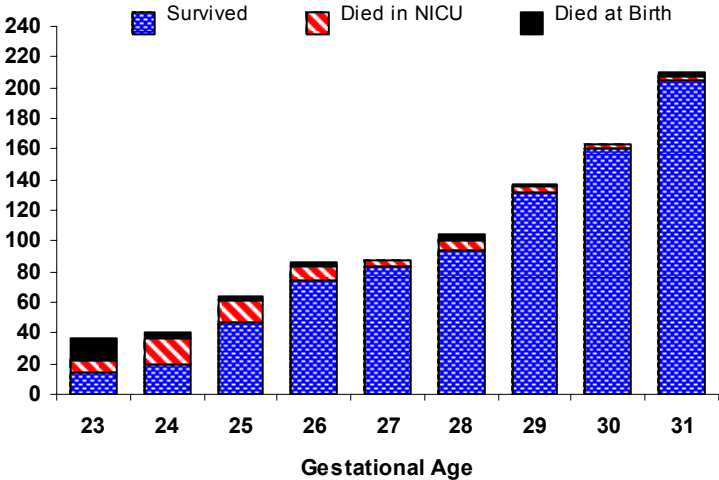


Figure 21: Numbers of babies born alive at 23 to 31 weeks gestation in 2000-2004.

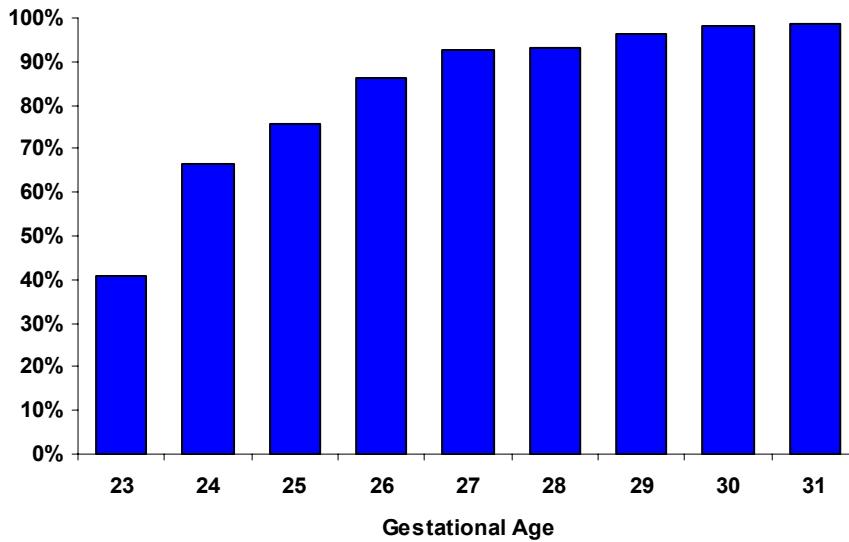


Figure 22: Percentage survival of babies born in National Women's and admitted to NICU from 1995 to 2004. (n = 1829)

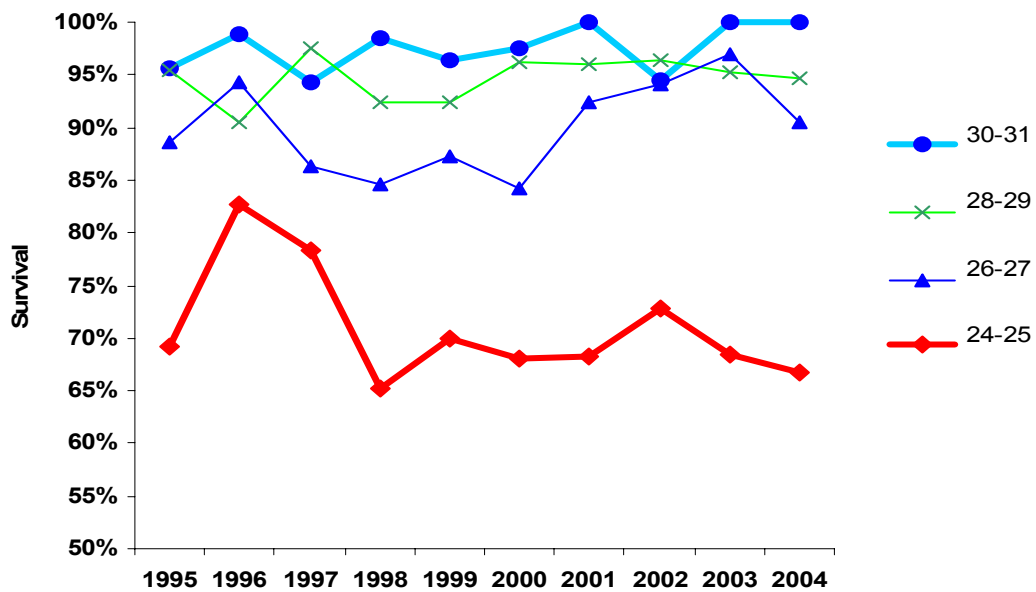


Figure 23: Percentage survival by year of babies born in National Women's and admitted to NICU from 1995 to 2004. (n = 1829)

Survival in very preterm infants has been fairly steady over the last decade. The NW data is confirmed by the Australia and New Zealand Neonatal Network that publishes outcomes that approximate to population data, as every Neonatal Intensive Care Unit in Australia and New Zealand sends its data to the Network.

The number of 24-25 week infants each year is small. There seemed to have been two very good years in 1996-7. The present survival rate is not significantly different to those of earlier years.

4.14 Intraventricular haemorrhage in all very low birth weight infants admitted to NICU from 1985 to 2004

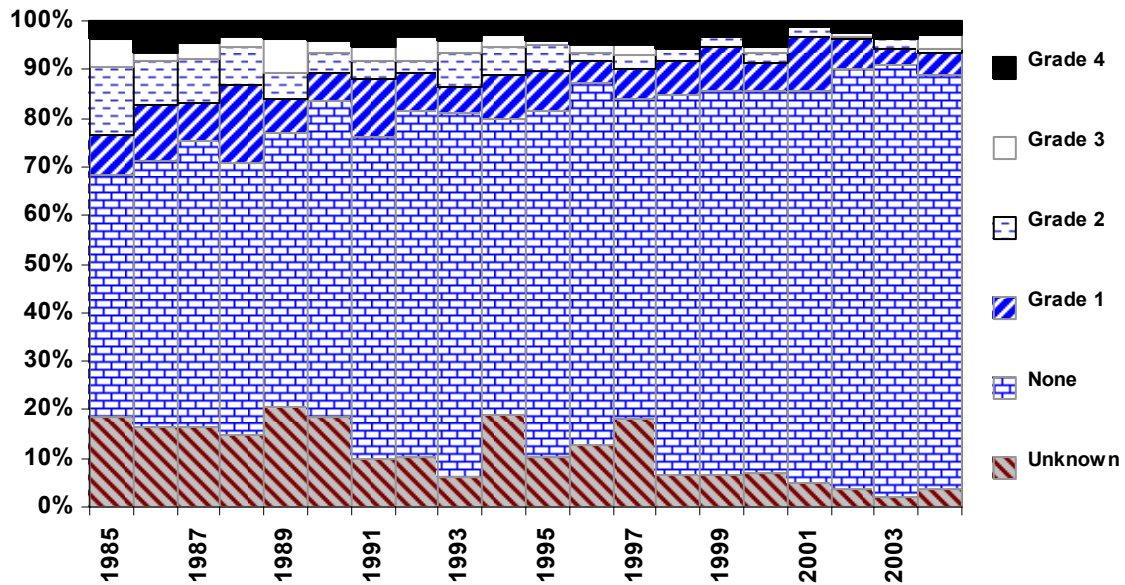


Figure 24: Intraventricular haemorrhage in all <1500 gm infants admitted to NICU from 1985 to 2004

Since 1985, the incidence of IVH has fallen from 39% to 11%, with that of severe IVH (grade III or IV) falling from 9-11% to 3-6% in recent years. The number of unknowns has also fallen from 19% to 2%. Most of the babies with 'unknown' IVH are more mature stable babies at lower risk who have been transferred to Level II hospitals soon after birth. This is particularly the case in recent years (see below for 2004 data). However, a few are the sickest who die soon after birth before ultrasound scans can be done, and in whom post mortem examinations are not performed.

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

4.15.1 Intraventricular haemorrhage.

Table 22: Intraventricular haemorrhage by birth weight

Birth Weight	N	Unknown	None	Grade 1	Grade 2	Grade 3	Grade 4
Total (%)	121	4 (3)	107 (88)	4 (3)	1 (1)	3 (2)	2 (2)
<500	0	0	0	0	0	0	0
500-749	11	0	10	0	0	1	0
750-999	37	0	33	3	1	0	0
1000-1249	38	1	34	0	0	1	2
1250-1499	35	3	30	1	0	1	0

Table 23: Intraventricular haemorrhage by gestation

Gestation	N	Unknown	None	Grade 1	Grade 2	Grade 3	Grade 4
Total (%)	157	5(3)	137(87)	8(5)	2(1)	3(2)	2(1)
24-25	11	0	9	1	0	1	0
26-27	42	0	37	2	1	1	1
28-29	37	1	34	0	0	1	1
30-31	67	4	57	5	1	0	0

There were few serious intraventricular haemorrhages in the inborn very preterm infants in 2004. However, two of the three outborn 24 week gestation babies had Grade 4 IVHs and the other a Grade 3 haemorrhage.

Babies with Grade 1 or 2 IVH have a similar chance of having a normal neurodevelopmental outcome as those with none. Grade 3 and 4 IVH are predictive of a poor outcome.

4.15.2 Cystic periventricular leukomalacia.

No babies developed cystic PVL in 2004.

4.15.3 Retinopathy of prematurity.

It is appropriate to choose survivors as the denominator for this outcome as ROP develops after birth and is not evident until >32 weeks post menstrual age. The increase in the number of larger infants who were not screened is due to a deliberate change in screening policy in 2002. Prior to that, babies <1500gms or <30 weeks were screened. This changed to babies <1500gms or ≤28 weeks gestation.

Table 24: Retinopathy of prematurity by birth weight in surviving babies

Birth Weight	n	Unknown	None	Stage 1	Stage 2	Stage 3	Stage 4
Total (%)	111	17(15)	87(78)	3(3)	3(3)	1(1)	0
500-749	9	1	5	1	1	1	0
750-999	34	0	30	2	2	0	0
1000-1249	34	5	29	0	0	0	0
1250-1499	34	11	23	0	0	0	0

Table 25: Retinopathy of prematurity by gestational age in surviving babies

Gestation	n	Unknown	None	Stage 1	Stage 2	Stage 3	Stage 4
Total (%)	145	51(35)	87(60)	3(2)	3(2)	1(1)	0
24-25	8	0	5	1	2	0	0
26-27	38	2	32	2	1	1	0
28-29	34	1	33	0	0	0	0
30-31	65	48	17	0	0	0	0

Only one baby developed Stage 3 ROP in 2004. The outlook for Stages 1-3 ROP is good, with normal vision although there is an increased chance of myopia. Stage 4 ROP involves retinal detachment, with severely impaired vision. Severe ROP remained uncommon.

4.15.4 Severe retinopathy of prematurity.

Two babies needed treatment for ROP in 2004. One was born at NW at 26 weeks gestation weighing 660gms and the other transferred to NW on day 18, born at 24 weeks weighing 684gms.

4.15.5 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 15.9% of survivors to 10.6%.

Babies who were <1500gms birth weight but over 32 weeks gestation have to be in oxygen or on support at 4 weeks of age to be classified as having CLD.

Table 26: Chronic lung disease by birth weight

Birth Weight	N	Dead by 36 weeks	Alive at 36 weeks	In O ₂	CPAP/IPPV	CLD	CLD in All %	CLD if Alive %
Total	121	8	113	12	11	18	15	16
500-749	11	2	9	4	6	6	55	67
750-999	37	2	35	6	1	6	16	17
1000-1249	38	3	35	2	4	6	16	17
1250-1499	35	1	34	0	0	0	0	0

Table 27: Chronic lung disease by gestational age

Gestation	N	Dead by 36 weeks	Alive at 36 weeks	In O ₂	CPAP/IPPV	CLD	CLD in All %	CLD if Alive %
Total	157	8	149	12	11	16	10	11
24-25	11	3	8	5	4	6	55	75
26-27	42	3	39	4	3	6	14	15
28-29	37	2	35	3	4	4	11	11
30-31	67	0	67	0	0	0	0	0

The rate of chronic lung disease has remained remarkably steady over the years, despite changes in treatment and ‘advances’ in care. However, the definition has never been totally satisfactory, as it is defined by the treatment being given. There have been changes in the way those treatments are applied. For instance, in the 1980s the publication of the ‘8 Centre Study’ suggested the superiority of the Columbia approach to ventilatory support of very preterm infant. At that time oxygen was monitored in month old babies by a combination of visual assessment of colour, intermittent arterial stab blood gases and transcutaneous oxygen monitoring (TCM). TCM became increasingly inaccurate as the baby got older.

In the early 1990s, pulse oximetry was introduced. This resulted in accurate assessment of oxygenation and has almost certainly led to the appreciation that many more babies were chronically desaturated and therefore were candidates for oxygen treatment.

In the mid-1990s, the oxygen saturation targets were increased so that by the turn of the century in NW babies had to have saturations of >95% for >90% of the time in air to avoid treatment with oxygen, and therefore to have a diagnosis of CLD.

In early-2002, the BOOST trial was first presented showing no advantage of higher oxygen saturation targeting. Following this, in mid-2002 the saturation targets chosen at NW decreased from >95% to >90% saturation.

Therefore, the use of oxygen has changed with time. This may have had more effect on the 'incidence' of CLD than any change in the incidence or severity of actual lung injury.

Since 2002, there has been a fall in the incidence of CLD, which probably reflects the change in treatment rather than any change in underlying lung pathology. The data presented later in this report looking at CLD in NW and the Australia and New Zealand Neonatal Network from 1995 to 2004 demonstrate the trends.

4.15.6 Necrotising enterocolitis

n is the total number of infants admitted and n the number with each outcome. Proven NEC is defined as either radiological intramural or portal gas or a surgical or pathological diagnosis.

Table 28: Necrotising Enterocolitis (NEC) by birth weight

Birth Weight	2001		2002		2003		2004	
	N	n %	N	n %	N	n %	N	n %
Total	155	1 0.6	157	2 1	136	3 2	121	4 3
500-749	23	1 4	14	0 0	20	1 5	11	0 0
750-999	37	0 0	37	1 3	32	1 3	37	3 8
1000-1249	47	0 0	47	1 2	31	0 0	38	1 3
1250-1499	48	0 0	56	0 0	53	1 2	35	0 0

Table 29: Necrotising enterocolitis by gestational age

Gestation	2001		2002		2003		2004	
	N	n %	N	n %	N	n %	N	n %
Total	183	1 4	175	3 2	160	4 3	121	4 3
24-25	22	1 2	21	1 5	20	1 4	11	1 9
26-27	26	0 1	33	0 0	30	1 3	42	3 7
28-29	50	0 0	52	1 2	36	1 3	37	0 0
30-31	78	0 0	68	1 1	74	1 1	67	0 0

4.15.7 Patent Ductus Arteriosus

Table 30: Patent Ductus Arteriosus by birth weight

Birth Weight	2001			2002			2003			2004		
	N	Indo	Ligate	N	Indo	Ligate	N	Indo	Ligate	N	Indo	Ligate
Total	155	42	4	157	42	4	136	40	7	121	34	2
500-749	23	15	4	14	7	1	20	15	6	11	4	1
750-999	37	19	0	37	19	0	32	11	0	37	18	0
1000-1249	47	7	0	47	9	2	31	10	0	38	11	1
1250-1499	48	1	0	56	7	1	53	4	1	35	1	0

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

In 2004, one infant who had surgical ligation had previously been treated with indomethacin. The ligations were both done at 30 days of age.

Two babies >2kg were treated with indomethacin. In addition, two outborn babies (26 and 27 weeks gestation) were treated.

Table 31: Patent Ductus Arteriosus by gestational age

Gestation	2001			2002			2003			2004		
	N	Indo	Ligate	N	Indo	Ligate	N	Indo	Ligate	N	Indo	Ligate
Total	183	42	4	175	45	4	160	43	6	157	35	2
<24	7	5	1	1	0	0	1	1	1	0	-	
24-25	22	14	2	21	10	1	19	15	4	11	6	1
26-27	26	13	1	33	16	1	30	13	1	42	19	0
28-29	50	9	0	52	16	2	36	6	0	37	7	1
30-31	78	1	0	68	3	0	74	8	1	67	3	0

One infant at 32 weeks gestation was also treated with indomethacin.

Thirty-one of the 36 babies received a long (7 day) course of indomethacin. Two received 5 days and 3 had three days of indomethacin. Two babies received two courses. Indomethacin was started on day 1-2 in 11 babies, day 3-4 in 13 and day 5-6 in 2. Eight babies were first treated in the second week, one at 19 days of age and one at 28 days of age.

4.15.8 Pneumothorax needing drainage

Table 32: Pneumothorax by birth weight

Birth Weight	2001		2002		2003		2004	
	N	n %	N	n %	N	n %	N	n %
500-749	23	1 4	14	2 14	20	2 10	11	0 0
750-999	37	0 0	37	0 0	32	0 0	37	0 0
1000-1249	47	1 2	47	2 2	31	1 3	38	1 3
1250-1499	48	0 0	56	0 0	53	0 0	35	0 0
Total <1500	155	2 1	157	4 3	136	3 2	121	1 1
≥1500	947	7 0.7	944	10 1	868	11 1	740	5 0.7

Table 33: Pneumothorax by gestational age

Gestation	2001		2002		2003		2004	
	N	n %	N	n %	N	n %	N	n %
<24	7	0 0	1	0 0	1	- -	0	- -
24-25	22	1 5	21	2 10	19	2 11	11	0 0
26-27	26	0 0	33	1 3	30	0 0	42	1 2
28-29	50	1 2	52	0 0	36	1 3	37	0 0
30-31	78	1 1	68	2 3	74	0 0	67	2 3
Total <32	183	3 2	175	5 3	160	3 2	157	3 2
≥32	920	6 0.6	924	9 1.0	844	11 1.3	704	3 0.4

Only six babies developed a pneumothorax that needed drainage in 2004. In addition two babies had chest drains inserted to drain pleural effusions.

4.15.9 Antenatal and postnatal steroids

Table 34: Percentage receiving antenatal corticosteroids by birth weight.

Birth Weight	2001			2002			2003			2004		
	N	1-7d	Any	N	1-7d	Any	N	1-7d	Any	N	1-7d	Any
Total	155	59	84	157	64	91	136	42	90	121	54	91
500-749	23	57	83	14	50	93	20	50	95	11	64	91
750-999	37	54	89	37	65	97	32	47	91	37	59	95
1000-1249	47	55	81	47	72	94	31	52	100	38	58	95
1250-1499	48	69	83	56	64	89	53	30	81	35	40	83

Steroids given 1 to 7 days before birth are defined as “Optimal” antenatal steroids by the Australia and New Zealand Neonatal Network. “Any” refers to babies who had steroids at any time before birth and includes those receiving an optimal course. Babies in the ACTORDS randomised trial of repeat antenatal steroids are assigned to having received an optimal course if the repeat course was 1-7 days pre-birth, even though half of these would have received placebo.

Table 35: Percentage receiving antenatal corticosteroids by gestational age

Gestation	2001			2002			2003			2004		
	N	1-7d	Any	N	1-7d	Any	N	1-7d	Any	N	1-7d	Any
Total	183	60	87	175	64	92	160	42	93	157	53	92
<24	7	29	86	1	100	100	1	100	100	-		
24-25	22	68	86	21	62	100	19	53	95	11	73	91
26-27	26	42	85	33	67	97	30	47	93	42	57	93
28-29	50	56	80	52	60	92	36	42	97	37	51	95
30-31	78	69	94	68	66	87	74	36	89	67	48	91

Table 36: Percentage receiving postnatal Dexamethasone for chronic lung disease by birth weight

Birth Weight	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Overall	22	29	35	18	13	11	7	5	5	3
500-749	64	82	76	75	54	56	47	40	36	22
750-999	44	60	53	31	25	18	3	6	4	5
1000-1249	17	5	11	5	6	0	0	2	0	0
1250-1499	1	2	3	2	0	0	0	0	0	0

Table 37: Percentage receiving postnatal Dexamethasone for chronic lung disease by gestational age

Gestation	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Total	20	24	30	16	11	7	4	5	4	3
24-25	68	96	84	74	67	43	39	17	25	30
26-27	46	44	60	30	20	12	0	9	8	2
28-29	5	7	15	5	0	0	0	2	0	0
30-31	0	0	5	1	1	0	0	3	0	0

In the mid-1990s, dexamethasone became an accepted and proven treatment to lessen the severity of chronic lung disease. Then questions were raised as to whether it may increase the rate of cerebral palsy in survivors. Now, when it is used, parents are involved in detailed discussions and give informed consent.

The decreased use of dexamethasone is due both to a greater reluctance to use it and to more emphasis on CPAP rather than IPPV.

The denominator used in the table is the number of babies alive at 1 week of age. Dexamethasone used to treat post-extubation stridor is not included in this table. Postnatal steroids have never been used in the first week of life at National Women's.

5. CAUSES OF DEATH OF ALL BABIES BORN IN OR ADMITTED TO NATIONAL WOMEN'S IN 2004

Deaths are divided into different categories for ease of analysis. Tables are presented for babies <28 weeks gestation ("extremely premature"), 29 to 36 weeks gestation ("premature") and 37 weeks onwards ("term/post-term"). In addition, those with significant congenital malformations are presented in a separate table. All neonatal deaths, and post-neonatal deaths up to hospital discharge (not just NW discharge) are included.

Table 38: Extremely preterm neonatal and post-neonatal deaths (n = 28)

N/R = not resuscitated

Born at	Gestation	Birth Weight	Apgar 1/5	Admit To NICU	Day Died	Cause of Death
NW	21	220	1/1	No	0	N/R, Placental abruption
NW	21	400	1/1	No	0	N/R, MCDA twin, twin-twin transfusion
NW	21	400	1/2	No	0	N/R, DCDA twin 2, Twin 1 PROM, preterm labour
NW	21	401	3/3	No	0	N/R, preterm labour
NW	21	402	1/0	No	0	N/R, preterm labour
NW	21	420	3/0	No	0	N/R, preterm labour
NW	22	380	1/0	No	0	N/R, preterm labour
NW	22	415	3/2	No	0	N/R, placental abruption
NW	22	425	1/0	No	0	N/R, DCDA twin, preterm labour
NW	22	450	1/1	No	0	N/R, DCDA twin, chorioamnionitis
NW	22	460	1/0	No	0	N/R, DCDA twin, preterm labour
NW	22	480	1/1	No	0	N/R, PROM, preterm labour
NW	22	565	3/3	No	0	N/R, PROM, preterm labour
NW	23	600	2/2	No	0	N/R, preterm labour
NW	23	630	4/1	No	0	N/R, preterm labour
NW	24	395	2/0	No	0	N/R, HELLP syndrome.
BBA	24	590	1/1	Yes	10	G4 IVH and <i>E. coli</i> septicaemia
Waitakere	24	620	3/8	Yes	5	G4 IVH
NW	24	650	2/1	No	0	N/R, family choice
NW	24	685	0/2	No	0	Failed resuscitation
NW	24	765	4/8	Yes	68	Chronic lung disease
NW	24	790	1/4	Yes	25	NEC and septicaemia
NW	25	700	7/8	Yes	2	Pulmonary haemorrhage, PPHN
NW	26	695	6/7	Yes	1	Respiratory failure
BBA	26	960	9/9	Yes	16	<i>S. aureus</i> / <i>E. coli</i> septicaemia
NW	27	910	5/8	Yes	110	Hypoxic ischaemic encephalopathy
NW	27	1060	4/6	Yes	25	Necrotising enterocolitis
NW	27	1075	2/7	Yes	10	G3 IVH, multi-system failure

Table 39: Premature neonatal and post-neonatal deaths (n = 4)

Born at	Gestation	Birth Weight	Apgar 1/5	Admit To NICU	Day Died	Cause of Death
NW	28	1350	0/0	Yes	3	Perinatal Asphyxia
NW	28	1540	1/2	No	0	Failed resus, MCMA twin, Cord entanglement
NW	29	1200	3/6	Yes	1	<i>E. coli</i> septicaemia
Northland	32	1575	9/10	Yes	32	Volvulus and malrotation

Table 40: Term/post-term neonatal and post-neonatal deaths (n = 6)

Born at	Gestation	Birth Weight	Apgar 1/5	Admit To NICU	Day Died	Cause of Death
NW	37	2875	9/10	Yes	22	Collapse post birth and encephalopathy
NSH	37	2880	3/3	Yes	13	Perinatal asphyxia
NW	38	2800	9/10	Yes	1	Pulmonary haemorrhage/ <i>E coli</i> septicaemia
NW	40	3430	0/3	Yes	15	Hypoxic ischaemic encephalopathy
NW	41	3180	1/1	No	0	Failed resuscitation, fetal distress, meconium
Waitakere	42	3765	7/9	Yes	5	Hypoxic ischaemic encephalopathy

Table 41: Major congenital abnormalities of any gestation neonatal and post-neonatal deaths (n = 12)

Born at	Gestation	Birth Weight	Apgar 1/5	Admit To NICU	Day Died	Cause of Death
NW	21	400	1/1		0	N/R, skeletal anomaly
NW	21	401	2/1		0	N/R, Chondroectodermal dysplasia
NW	22	540	2/2		0	N/R, Trisomy 21, complex CHD
NW	28	1330	1/1	No	0	Primary myopathy, pulm hypoplasia, failed resus
NW	31	1190	7/0	No	0	N/R, Trisomy 18
NW	32	2205	9/10	Yes	34	Hydrops secondary to Trisomy 21
NW	32	2760	1/4	Yes	1	Cardiomyopathy and non-immune fetal hydrops
NW	36	1940	5/7	Yes	3	Hypoplastic left heart syndrome
NW	36	2400	4/6	Yes	9	Fetal akynesia syndrome and hypoxic brain injury
NW	38	3540	6/8	Yes	3	Complex CHD, perinatal asphyxia
NW	40	2915	9/10	Yes	11	Ornithine transcarbamalase deficiency
NW	40	3860	6/8	Yes	84	Multiple anomalies, pulmonary haemorrhage

Forty-four of the 50 infants who died were born in National Women's. The majority were extremely premature, accounting for 28 (56%) of the deaths.

Of the 28 extremely preterm infants, 18 were not admitted to NICU, with 17 not being resuscitated either because of they were <24 weeks gestation or, in one, because of parental choice.

The guidelines that are used to counsel parents are on the Newborn Website (<http://www.adhb.govt.nz/newborn/Guidelines/Admission/BorderlineViability.htm>). 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 not be 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.

Of the 28 extremely preterm infants who died, only 10 were admitted to NICU. Only seven of these were inborn.

Five of the six deaths at term or post-term were related to perinatal asphyxia (three inborn) and the other to infection. The baby who died of infection had no antenatal risk factors and was well until a sudden collapse at a day of age.

6. BENCHMARKING NATIONAL WOMEN'S AGAINST THE AUSTRALIA AND NEW ZEALAND NEONATAL NETWORK

The Australia and New Zealand Neonatal Network (ANZNN) collects standardised data from all neonatal intensive care units 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 ≥ 4 hrs) even if that baby was subsequently transferred. Data are collected up to discharge home, again 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 the ANZNN, approval to send data was obtained from the North Health Ethics Committee.

All the New Zealand level 2 units also contribute to the ANZNN. One Australian level 2 unit contributes.

An annual report of the combined data from all units is published each year and feedback data are sent to each unit that contributes. This feedback consists of the outcomes of that unit compared 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.

The ANZNN has not highlighted temporal trends in its annual reports. The following figures show ANZNN and NW data in two groups of babies: those between 24 and 27 weeks gestation and those between 28 and 31 weeks gestation. The figures display outcomes from 1995 to 2002 for the Network (the latest ANZNN report available at the time of producing this NW report is that of 2002) and from 1995 to 2004 for NW.

There are interesting trends demonstrated of stable survival rates, increasing rates of antenatal steroid use and less intraventricular haemorrhage. The incidence of chronic lung disease increased up to 2001 and has then decreased, possibly as a result of decreased oxygen targets following the publication of the BOOST trial. There have been significant changes in the use of ventilatory support.

The numbers each year from NW in the following figures are fairly small. For outcomes (rather than treatments) the numbers from 1995 to 2002 for the Network and for NW have been totalled and confidence intervals (95%CI) of the NW outcomes calculated.

These comparisons are univariate comparisons only. They indicate that the NW outcomes are good compared with those of the Network. However, this may reflect population differences or other factors that are not controlled for.

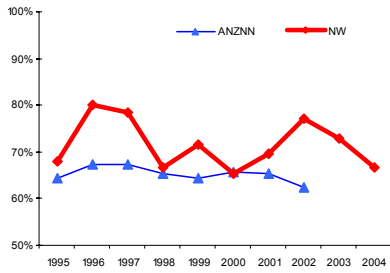


Figure 25: Survival at 24-5 wks gestation

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 10 years, there were between 21 and 37 babies per year. These data are for all babies admitted, including those with lethal malformations but excluding deaths at birth.

1995-2002 ANZNN 65%.
 NW 73% (95%CI 66%-78%).

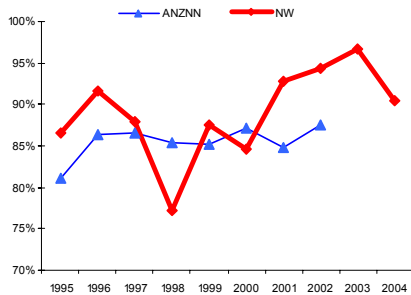


Figure 26: Survival at 26-7 weeks

At 26-27 weeks gestation survival is also good.

1995-2002 ANZNN 86%.
 NW 88% (95%CI 84%-91%).

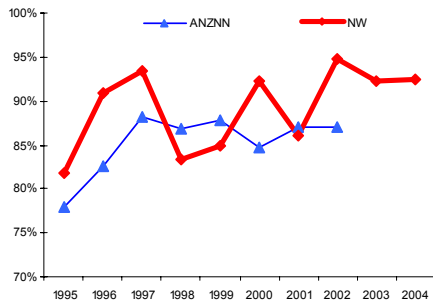


Figure 27: Antenatal steroids at 24-7 weeks

Antenatal steroid use is high in the Network and NW. There is a pleasing increasing trend. These data are for any steroids, however long before birth.

1995-2002 ANZNN 87%.
 NW 88% (95%CI 85%-90%).

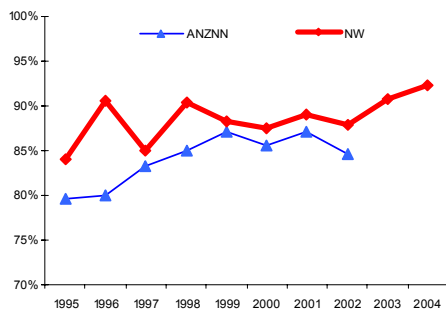


Figure 28: Antenatal steroids at 28-31 weeks

Antenatal steroid use is high in babies born between 28 and 31 weeks gestation.

1995-2002 ANZNN 84%.
 NW 88% (95%CI 86%-90%).

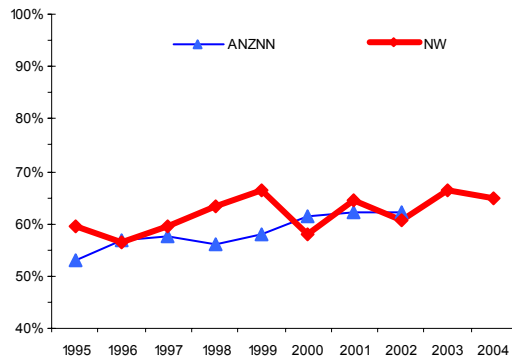


Figure 29: Caesarean section at 24-31wks

The issues surrounding caesarean section rates in preterm infants differ from those in term infants. The mothers of many preterm infants have serious complications of pregnancy and there can be a clear advantage of Caesarean birth. Around 60% of these very immature infants are delivered by Caesarean. The rates are slowly increasing.

1995-2002 ANZNN 59%.
 NW 61% (95%CI 59%-63%).

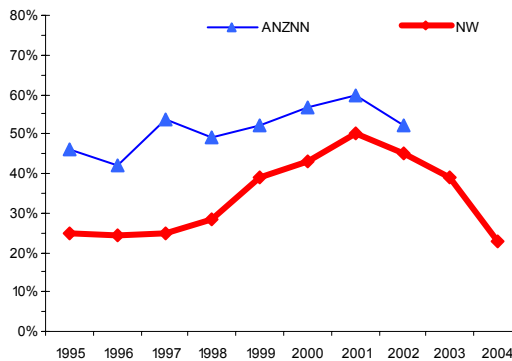


Figure 30: Chronic lung disease at 24-7wks

The major problem with reporting the incidence of chronic lung disease is that the diagnosis of CLD is based on the treatment chosen, rather than any underlying pathology. The incidence increased up to 2001 then has started to fall, probably as a result of lower oxygen saturation targeting following the presentation of the BOOST trial in 2002.

1995-2002 ANZNN 52%.
 NW 34% (95%CI 30%-39%).

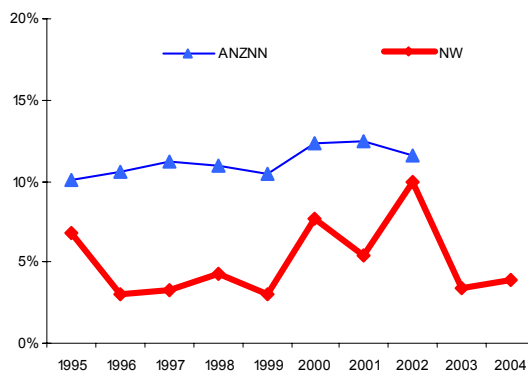


Figure 31: Chronic lung disease at 28-31wks

The incidence of chronic lung disease in these slightly more mature infants is consistently lower at NW than in the rest of the Network overall.

1995-2002 ANZNN 11%.
 NW 5% (95%CI 4%-7%).

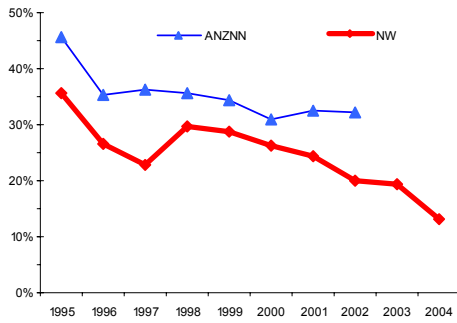


Figure 32: Any IVH at 24-7 weeks

Intraventricular haemorrhage is shown on this page. The incidence of all grades is falling both in the Network and at NW. NW rates are consistently lower than the overall rate in the rest of the Network.

1995-2002 ANZNN 35%.

NW 27% (95%CI 23%-31%).

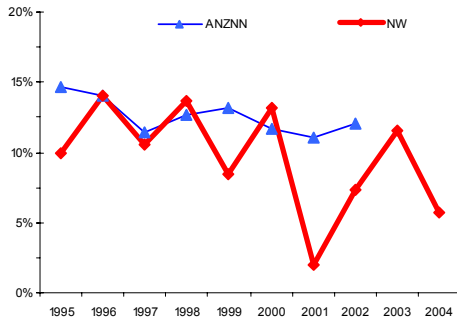


Figure 33: Severe (G3-4) IVH at 24-7 weeks

The rate of severe (Grade 3 or 4) IVH in these very immature infants is between 10 and 15%. While this compares well internationally, it is still higher than should be accepted, as the long-term developmental outcome of most survivors with Grade 3 or 4 IVH is not good.

1995-2002 ANZNN 15%.

NW 10% (95%CI 8%-13%).

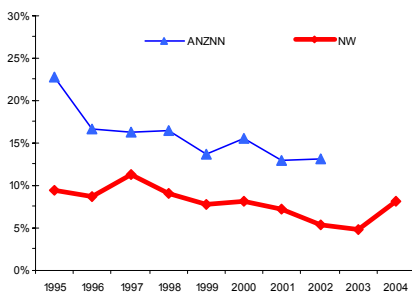


Figure 34: IVH at 28-31 weeks

The incidence of all grades of IVH in these more mature babies is low and is falling. The NW incidence is consistently lower than the overall incidence in the rest of the Network.

1995-2002 ANZNN 16%.

NW 8% (95%CI 7%-10%).

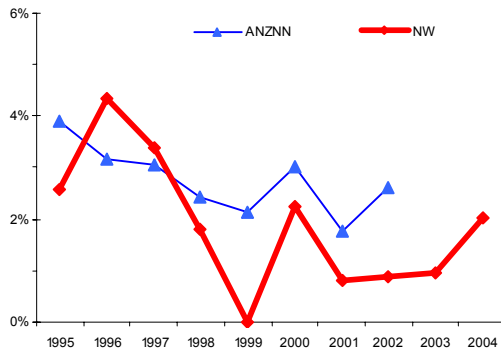


Figure 35: Severe (G3-4) IVH at 28-31 weeks

Grade 3 and 4 IVH is uncommon in babies at 28-31 weeks gestation.

1995-2002 ANZNN 2.7%.

NW 1.9% (95%CI 1.2%-3.0%).

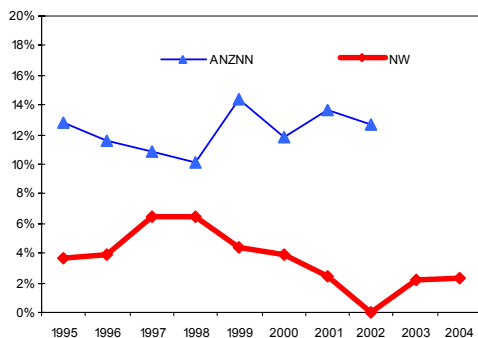


Figure 36: ROP at 24-7 weeks

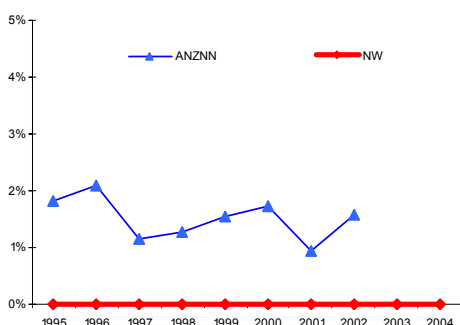


Figure 37: ROP at 28-31 weeks

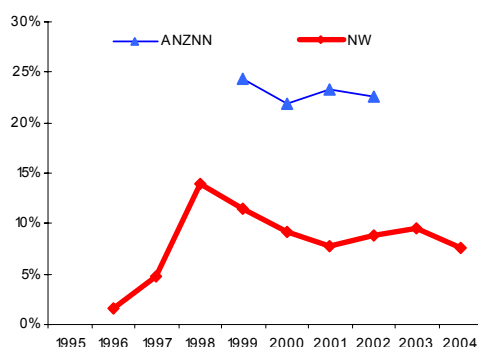


Figure 38: HFOV at 24-7 weeks

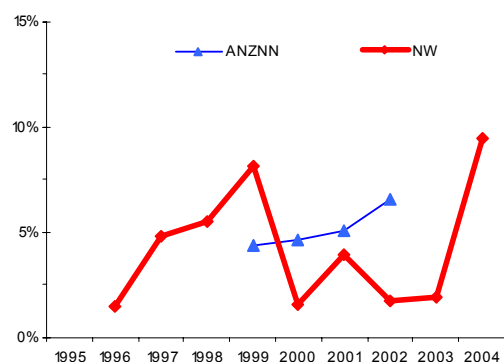


Figure 39: Inhaled nitric oxide at 24-7 weeks

Retinopathy of prematurity is largely confined to very immature infants. Severe stages remain very uncommon at NW. While the policy of not indenting the eye to look for minor degrees of ROP may result in some babies with Stage 1 disease not being diagnosed, we are confident that major ROP is not being missed as over 90% of very low birth weight infants are followed long term, and New Zealand has a single body responsible for registering and following blind children. 1995-2002 ANZNN 12%. NW 3.8% (95%CI 2.3%-6.2%)

Over nine years, no baby with a gestational age of 28 weeks or more has been diagnosed with severe ROP at NW. In ANZNN and these NW data, from 1995 to 1997, the denominator for the ROP data is the number of infants alive at 42 days of age. From 1998 onwards, it is those alive at 36 weeks post-menstrual age. This definition change makes very little difference to the results 1995-2002 ANZNN 1.4%. NW 0% (95%CI 0%-0.4%).

High frequency oscillatory ventilation was introduced at NW in 1996, initially with Infant Star ventilators and then with the Sensor Medics 3100A ventilator. Latterly, Drager Babylogs have been used occasionally. The Network started collecting data in 1999. The use of HFOV remains low at NW. It is used only as a 'rescue' treatment for infants who are deteriorating on conventional ventilation.

Inhaled nitric oxide was first used in NW in 1995. Most use is in term infants. It is used occasionally in very preterm infants.

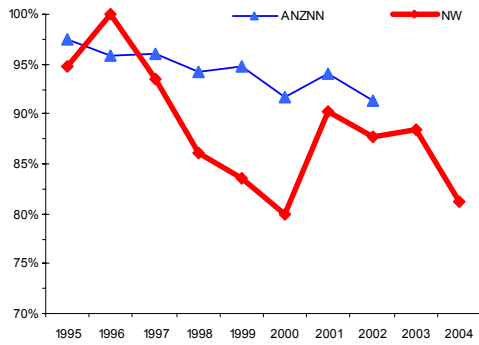


Figure 40: % on IPPV at 24-7 weeks

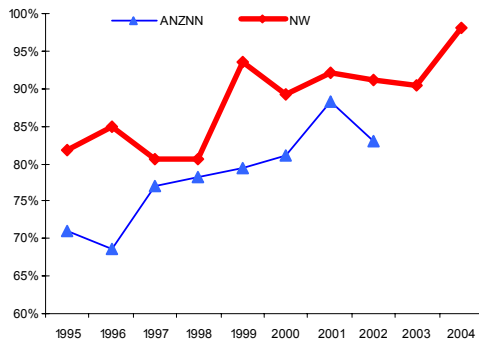


Figure 41: CPAP at 24-27 weeks

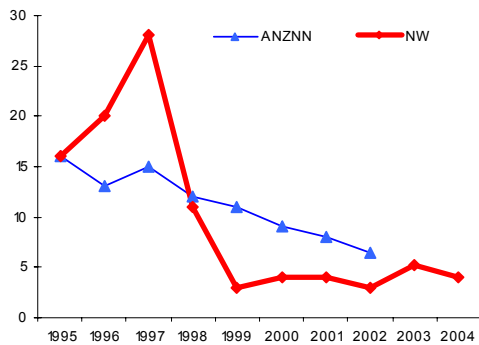


Figure 42: Median days on IPPV at 24-7wks

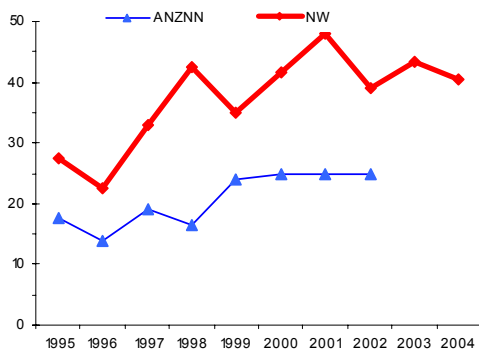


Figure 43: Median days on CPAP at 24-7wks

The change in the approach to ventilatory support of preterm infants is shown in these figures. In 1997, NW changed to adopt aspects of the 'Columbia' approach, with less ventilation, more CPAP and faster weaning off IPPV. The percentage of very immature infants treated at any time with intermittent positive pressure ventilation declined in 1997 to below that of the Network overall. However, most of these infants are still on a ventilator at some stage of their course.

Continuous positive airways pressure use has always been high at NW. There has been a steady increase over the years. Its use in the rest of the Network was comparatively lower.

There has been a dramatic fall in the number of days on IPPV from 1998 onwards. The rest of the Network has shown a steady decrease, so that now practice at NW seems to be similar to the overall use of positive pressure ventilation in the rest of the Network.

These data are for all babies admitted at these gestations, including those who died. Many of those dying will have only been on IPPV.

CPAP use in survivors is almost universal. NW has always used CPAP for longer than the rest of the Network.

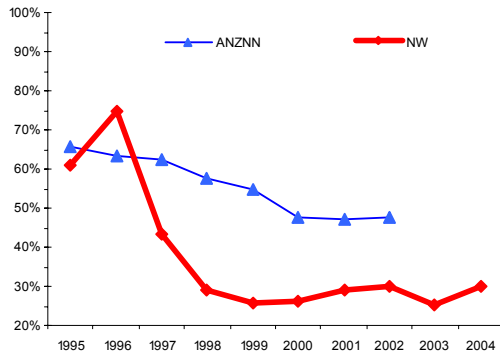


Figure 44: IPPV at 28-31 weeks

With the adoption of the 'Columbia' approach favouring CPAP, the use of IPPV fell dramatically at NW in 1997. In 1996, 74% of babies at these gestations were ventilated. In 2003, this was down to 25%. Its use in the rest of the Network overall is slowly falling, but remains considerably higher than at NW.

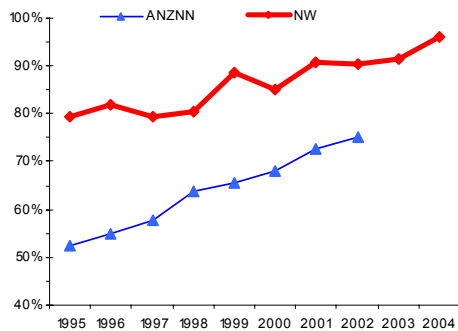


Figure 45: CPAP at 28-31 weeks

CPAP use at NW has always been high. Its use is increasing. The rest of the Network is showing a steady rise in CPAP use.

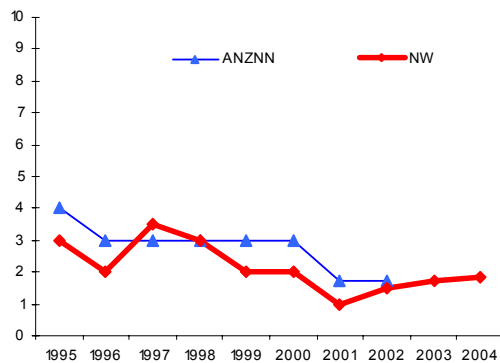


Figure 46: Median days on IPPV at 28-31wks

Babies at these gestations who need IPPV usually need it only for a short time. There is no real difference between the time on ventilation at NW and the overall time in the rest of the Network.

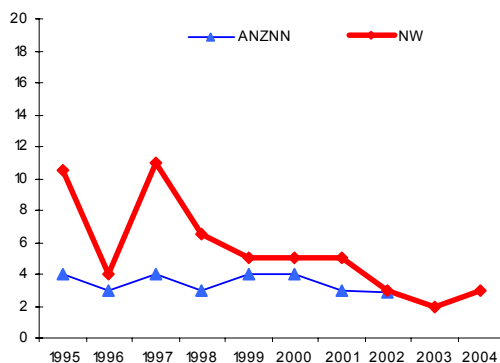


Figure 47: Median days on CPAP at 28-31wks

The time spent on CPAP in babies of 28-31 weeks gestation is falling steadily. The time used to be significantly greater than that of the Network overall, but now is comparable.

7. RESEARCH, PUBLICATIONS AND PRESENTATIONS

7.1 International Research.

The following research projects are in progress on the Newborn Service

COIN trial: A randomised trial of CPAP vs. intubation at birth for babies from 25-28 weeks gestation.

Less MASS trial: A randomised trial of surfactant washout of the trachea in babies with severe meconium aspiration syndrome.

INIS trial: A randomised trial of IV immunoglobulin treatment of babies on intensive care with suspected or proven sepsis.

ACTORDS trial: The follow-up of this trial of repeat courses of antenatal steroids to prevent neonatal lung disease is being completed.

7.2 Newborn Service Research.

Correlations of bedside EEG monitoring with detailed EEG recordings

Ultrasound scans to determine long line position

Neurological outcome following methadone use in pregnancy

Temporal changes in EEG and Prediction of White Matter Injury

EEG and long-term outcomes in preterm infants

Temporal changes in cardiac function and blood flow in very low birth weight infants.

7.3 Publications.

1. Baker PA, Aftimos S, Anderson BJ. Airway management during an EXIT procedure for a fetus with dysgnathia complex. Paediatr Anaesth. 2004 Sep;14(9):781-6.
2. Bloomfield FH, Oliver MH, Hawkins P, Holloway AC, Campbell M, Gluckman PD, Harding JE, Challis JR. Periconceptual undernutrition in sheep accelerates maturation of the fetal hypothalamic-pituitary-adrenal axis in late gestation. Endocrinology 2004;145(9):4278-89.
3. Cranefield DJ, Odd DE, Harding JE, Teele RL. High incidence of nephrocalcinosis in extremely preterm infants treated with dexamethasone. Pediatr Radiol 2004;34:138-142.

4. Dalziel SR, Liang A, Parag V, Rodgers A, Harding JE. Blood pressure at 6 years of age after prenatal exposure to betamethasone: Follow-up results of a randomized ,controlled trial. *Pediatrics* 2004;114:e373-7.
5. Groves AM, Briggs KA, Kuschel CA, Harding JE. Predictors of chronic lung disease in the 'CPAP era'. *J Paediatr Child Health* 2004;40:290-4.
6. Groves AM, Kuschel CA, Knight DB, Skinner JR. Cardiorespiratory stability during echocardiography in preterm infants. *Arch Dis Child* 2005;90(1):86-7.
7. Hofman PL, Regan F, Jackson WE, Jefferies C, Knight DB, Robinson EM, Cutfield WS. Premature birth and later insulin resistance. *N Engl J Med*. 2004 Nov 18; 351(21):2179-86.
8. James PA, Aftimos S, Oei P. Partial tetrasomy 15 due to a unique inverted triplication of chromosome15q24-q26. *Am J Med Genet A*. 2004 Oct 1;130A(2):208-10.
9. Jones B, Peake K, Morris AJ, McCowan LM, Battin MR. Escherichia coli: a growing problem in early onset neonatal sepsis. *Aust N Z J Obstet Gynaecol* 2004;44:558-61
10. Kannu P, Aftimos S, Der Kaloustian VM. Unilateral radio-ulnar synostosis, generalized hypotonia, and developmental delay with a characteristic facial appearance: a further case report. *Am J Med Genet A*. 2004 Mar 15;125(3):321-4.
11. Kannu P, Aftimos S, Winship I. Autosomal dominant velopharyngeal insufficiency: father-to-son transmission confirmed. *Clin Genet*. 2003 Dec;64(6):522-3.
12. Kannu P, Kelly P, Aftimos S. Microcephalic osteodysplastic primordial dwarfism type II: a child with cafe au lait lesions, cutis marmorata, and moyamoya disease. *Am J Med Genet A*. 2004 Jul 1;128(1):98-100.
13. Krakow D, Robertson SP, King LM, Morgan T, Sebald ET, Bertolotto C, Wachsmann-Hogiu S, Acuna D, Shapiro SS, Takafuta T, Aftimos S, Kim CA, Firth H, Steiner CE, Cormier-Daire V, Superti-Furga A, Bonafe L, Graham JM Jr, Grix A, Bacino CA, Allanson J, Bialer MG, Lachman RS, Rimoin DL, Cohn DH. Mutations in the gene encoding filamin B disrupt vertebral segmentation, joint formation and skeletogenesis. *Nat Genet*. 2004 Apr;36(4):405-10.
14. Kuschel CA, Austerberry L, Cornwell M, Rowley RSH, Couch R. Can methadone levels predict the severity of withdrawal in infants at risk of neonatal abstinence syndrome? *Arch Dis Child Fetal Neonatal Ed*. 2004; 89:F390-3.
15. Odd DE, Armstrong DL, Teele RL, Kuschel CA, Harding JE. A randomized trial of two dexamethasone regimens to reduce side effects in infants treated for chronic lung disease of prematurity. *J Paediatr Child Health* 2004;40:282-9.
16. Odd DE, Battin MR, Kuschel CA. Variation in identifying neonatal percutaneous central venous line position. *J Paediatr Child Health* 2004; 40:540-3.
17. Odd DE, Page B, Battin MR, Harding JE. Does radio-opaque contrast improve radiographic localisation of percutaneous central venous lines? *Arch Dis Child Fetal Neonatal Ed* 2004;89:F41-3.

18. Sharpe C, Kuschel C. Outcomes of infants born to mothers receiving methadone for pain management in pregnancy. Arch Dis Child Fetal Neonatal Ed. 2004;89 F33-6.
19. West CR, Harding JE. Maternal water intoxication as cause of neonatal seizures. J Paediatr Child Health 2004;40:709-10.

7.4 Chapters, reviews and commentaries

1. Harding JE, Bloomfield FH, Oliver MH. Sheep nutrition, fetal growth and human health. Proceedings of the New Zealand Society of Animal Production:64, 17-18, 2004.
2. Harding JE, Bloomfield FH. Prenatal treatment of intrauterine growth restriction: Lessons from the sheep model. Pediatric Endocrinology Reviews 2: 182-192, 2004.
3. Harding JE. Nutritional basis for the fetal origins of adult disease. In: Fetal Nutrition and Adult Disease. Programming of chronic disease through fetal exposure to undernutrition. Frontiers in Nutritional Science, No 2. Langley-Evans, SC. (Ed). CABI Publishing, Wallingford, UK, p21-53, 2004.
4. Harding JE. What have we learned from animal experiments about mothers and babies? In: Lifting the veil: finding common ground. Proceedings of the ANZCCART Conference, Christchurch, August 2003. ANZCCART, Wellington, 67-70, 2004.
5. Kuschel CA, Harding JE. Multicomponent fortified human milk for promoting growth in preterm infants (Cochrane Review). In: The Cochrane Library, Issue 1, 2004. Chichester, UK: John Wiley & Sons, Ltd.

7.5 Abstracts

1. Anderson P, Aftimos S, Misur P, Teele R, Battin M. Small Adrenal Glands On Ultrasound And Low Basal Cortisol Levels In Neonates with Prader Willi Syndrome. Proceedings of the Paediatric Society of New Zealand Annual Scientific Meeting, Rotorua, 2004.
2. Battin MR, Bevan C, Morton SM, Harding JE. Repeat courses of antenatal corticosteroids do not alter hypothalamic-pituitary-adrenal axis function after birth; Results of a randomised controlled trial. Pediatric Research 2004;55:A2541, 447A.
3. Battin MR, Mildenhall LFJ, Morton SMB, Kuschel CA, Bevan C, Harding JE. Repeat doses of antenatal steroids alter cardiovascular status after birth. Proceedings of the 8th Annual Congress of the Perinatal Society of Australia and New Zealand, Sydney, 2004;P88.
4. Bevan C, Battin MR, Morton SMB, Harding JE. Repeated courses of antenatal steroids alter growth. Proceedings of the 8th Annual Congress of the Perinatal Society of Australia and New Zealand, Sydney, 2004;P89.

5. Bloomfield FH, Oliver MH, Harding JE. The importance of being a twin: within twin pair analysis of glucose tolerance and hypothalamic-pituitary-adrenal axis responsiveness. Medical Sciences Congress of New Zealand, Queenstown, 2004;C8.
6. Bloomfield FH, Sheikh S, Phua HH, Bauer MK, Gilmour RS, Harding JE. Intra-amniotic insulin-like growth factor (IGF)-1 supplementation of the growth restricted fetal sheep alters IGF-1 and IGF receptor type 1 mRNA and protein expression in placental and fetal tissues. J Soc Gynecol Invest 2004;11(2 Suppl):305A.
7. Cormack B, Bloomfield FH. An audit of feeding practices in babies <1200 g or 30 weeks gestation during the first month of life. Medical Sciences Congress of New Zealand, Queenstown, 2004;C17.
8. Crowther CA, McLaughlin K, Willson K, Battin M, Harding JE. Repeat doses of prenatal corticosteroids for women at risk of preterm birth: A non-randomised preference cohort study. 8th Annual Congress of the Perinatal Society of Australia and New Zealand, Sydney, 2004;A87.
9. Dalziel SR, Walker NK, Parag V, Mantell C, Rea HH, Rodgers A, Harding JE. Long-term effects of antenatal exposure to betamethasone: Thirty-year follow-up of a randomised controlled trial. 8th Annual Congress of the Perinatal Society of Australia and New Zealand, Sydney, 2004.
10. Dalziel SR, Walker NK, Parag V, Mantell C, Rea HH, Rodgers A, Harding JE. Long-term effects of antenatal exposure to betamethasone: Thirty year follow-up of a randomised controlled Trial. Pediatric Res 2004;55:A2119, 372A.
11. Dalziel SR, Walker NK, Parag V, Mantell C, Rea HH, Rodgers A, Harding JE. Long-term effects of antenatal exposure to betamethasone: thirty-year follow-up of a randomised controlled trial. Proceedings of the Royal Australasian College of Physicians Joint Annual Scientific Meeting, Christchurch, 2004;P31.
12. Dalziel SR, Walker NK, Parag V, Mantell C, Rea HH, Rodgers A, Harding JE. Long-term effects of antenatal exposure to betamethasone: Thirty year follow-up of a randomised controlled trial. Proceedings of the Paediatric Society of New Zealand Annual Scientific Meeting, Rotorua, 2004;p67.
13. Darlow BA, Hutchinson JL, Simpson JM, Donoghue DA, Henderson-Smart DJ, Evans N, Cust A, Harding J, Broadbent R, Gibberd R, Knight D, Dickson N, Williams S, Tarnow-Mordi W on behalf of the Australian and New Zealand Neonatal Network (ANZNN). Who is at risk for significant retinopathy of prematurity? Proceedings of the 8th Annual Congress of the Perinatal Society of Australia and New Zealand, Sydney, 2004;P92
14. De Boo HA, Van Zijl PL, Smith D, Lafeber HN, Harding JE. Arginine and mixed amino acids increase protein accretion in the growth restricted and normal ovine fetus using different mechanisms. Proceedings of the 8th Annual Congress of the Perinatal Society of Australia and New Zealand, Sydney, 2004; A7.
15. deBoo HA, Cracendonk A, Kulik W, Harding JE, Lafeber HN. Protein kinetics and urea production in preterm small for gestational age infants fed fortified human milk or preterm formula. Medical Sciences Congress, Queenstown, 2004; C11.

16. Eremia SC, Bloomfield FH, Oliver MH, Harding JE. Maternal growth hormone and fetal intravenous and amniotic IGF-I supplements improve fetal growth in growth-restricted fetal sheep. Medical Sciences Congress of New Zealand, Queenstown, 2004;C7.
17. Eremia SC, Bloomfield FH, Oliver MH, Harding JE. Amniotic and intravenous IGF-1 supplements promote growth in different ways in growth-restricted fetal sheep. Proceedings of the 8th Annual Congress of the Perinatal Society of Australia and New Zealand, Sydney, 2004; A11.
18. Gerrits LC, Battin MR, Bennet L, Gonzalez H, Gunn AJ. Epileptiform activity during rewarming from moderate cerebral hypothermia In near-term fetal sheep. Society for Pediatric Research, San Francisco, 2004
19. Groves AM, Kuschel CA, Knight DB, Skinner JR. Stability and repeatability of neonatal echo. Eric Burnard Neonatal Update, Wellington, 2004.
20. Groves AM, Kuschel CA, Knight DB, Skinner JR. The role of the ductus in the first 24 hours. Eric Burnard Neonatal Update, Wellington, 2004.
21. Groves AM, Kuschel CA, Knight DB, Skinner J. Cardiorespiratory stability during echocardiography in the preterm infant. Proceedings of the 8th Annual Congress of the Perinatal Society of Australia and New Zealand, Sydney, 2004; P112.
22. Groves AM, Kuschel CA, Knight DB, Skinner JR. Early prediction of the requirement for treatment of the patent ductus arteriosus in the preterm infant. Proceedings of the 8th Annual Congress of the Perinatal Society of Australia and New Zealand, Sydney, 2004; P188.
23. Groves AM, Kuschel CA, Knight DB, Skinner JR. Maternal pre-eclampsia is associated with improved haemodynamic status in the first postnatal day in preterm infants. Proceedings of the 8th Annual Congress of the Perinatal Society of Australia and New Zealand, Sydney, 2004; A20.
24. Groves AM, Kuschel CA, Knight DB, Skinner JR. Patent ductus arteriosus in preterm infants is associated with low systemic blood flow in the first 24 hours of postnatal life. Proceedings of the 8th Annual Congress of the Perinatal Society of Australia and New Zealand, Sydney, 2004; P113.
25. Harding JE, Dalziel SR, Walker NK, Parag, V, Mantell C, Rea HH, Rodgers A. Long term effects of antenatal exposure to betamethasone: Thirty year follow-up of a randomised controlled trial. J Soc Gynecol Invest 2004;11(2 Suppl): 210A.
26. Harding JE. Manipulating fetal growth for health. Medical Sciences Congress of New Zealand, Queenstown, 2004;p25.
27. Harris DL, Bloomfield FH, Harding JE, Teele RL. The quality and completeness of cerebral ultrasound scanning may contribute to the variability in reported incidence of germinal matrix/intraventricular haemorrhage in New Zealand. 5th International Neonatal Nursing Conference, Toronto, 2004.
28. Harris DL, Bloomfield FH, Teele RL, Harding JE. Reported variation in the incidence of cerebral white matter changes may be due to differences in interpretation of scans. Medical Sciences Congress of New Zealand, Queenstown, 2004;C14.

29. Harris DL, Teele RL, Bloomfield FH, Harding JE. Variations in the Incidence of Intraventricular Haemorrhage in New Zealand. Paediatric Society of New Zealand 57th Annual Meeting, Rotorua, 2004.
30. Harris DL, Bloomfield FH, Teele RL, Harding JE. Is there variation in the incidence of germinal matrix-intraventricular haemorrhage between newborn intensive care units in New Zealand? Proceedings of the 8th Annual Congress of the Perinatal Society of Australia and New Zealand, Sydney, 2004; A161.
31. Hatton-Wills ML, Kuschel CA, Mildenhall LFJ. Amikacin as a first-line treatment for late-onset neonatal sepsis. Proceedings of the 8th Annual Congress of the Perinatal Society of Australia and New Zealand, Sydney, 2004; P76.
32. Henderson-Smart DJ, Hutchinson J, Simpson J, Donoghue D, Evans N, Broadbent R, Cust A, Darlow BA, Gibberd R, Harding J, Knight D, Dickson N, Williams S, Tarnow-Mordi W on behalf of the Australian and New Zealand Neonatal Network (ANZNN). Size matters – Prenatal risk factors for chronic lung disease. Proceedings of the 8th Annual Congress of the Perinatal Society of Australia and New Zealand, Sydney, 2004;A75.
33. Hughes B. The extent, in a paediatric and neonatal population, of un-licensed (un-approved) and off-label medicine use. Proceedings of the Paediatric Society of New Zealand Annual Scientific Meeting, Rotorua, 2004.
34. Hutchinson J, Donoghue D, Henderson-Smart D, Simpson J, Evans N, Broadbent R, Cust A, Darlow B, Gibberd R, Harding J, Knight D, Dickson N, Williams S, Tarnow-Mordi W on behalf of the Australian and New Zealand Neonatal Network (ANZNN). Risk factors for death in very preterm babies of the Australian and New Zealand Neonatal Network. Proceedings of the 8th Annual Congress of the Perinatal Society of Australia and New Zealand, Sydney, 2004; P164.
35. Jaquier AL, Oliver MH, Bloomfield FH, Harding JE. Effects of periconceptual undernutrition on glucose and insulin metabolism in sheep. The Eighteenth National Workshop on Fetal and Neonatal Physiology, Sydney, 2004; A16.
36. Jaquier AL, Oliver MH, Bloomfield FH, Harding JE. Effects of periconceptual undernutrition on pregnancy outcome and feto-placental growth in sheep. The Eighteenth National Workshop on Fetal and Neonatal Physiology, Sydney, 2004; A19.
37. Jaquier AL, Oliver MH, Harding JE. Effect of periconceptual undernutrition on maternal HPA axis in sheep. Medical Sciences Congress of New Zealand, Queenstown 2004;C9.
38. Knight DB, Beca JS. Effect of changes in preoperative conventional ventilation settings on blood gases in relatively stable babies with congenital diaphragmatic hernia. Proceedings of the 8th Annual Congress of the Perinatal Society of Australia and New Zealand, Sydney, 2004. P146.
39. Krahn DC, Groves AM, Kuschel CA, Knight DB. Efficacy and adverse effects of repeated long courses of indomethacin in the preterm infant. Proceedings of the 8th Annual Congress of the Perinatal Society of Australia and New Zealand, Sydney, 2004; A76.
40. Kumarasamy V, Mitchell MD, Bloomfield FH, Oliver MH, Harding JE. Effects of periconceptual undernutrition on the prepartum rise in circulating prostaglandin

and cortisol concentrations in sheep. Proceedings of the 8th Annual Congress of the Perinatal Society of Australia and New Zealand, Sydney, 2004; A100.

41. Kuschel CA, Morley CJ. Pressure support ventilation: changes in gas flow determine inflation time in ventilated infants. Proceedings of the 8th Annual Congress of the Perinatal Society of Australia and New Zealand, Sydney, 2004; P147.
42. Kuschel CA, Oswald L, Groves AM, Knight DB, Finucane K. Surgical ligation of the persistent patent ductus arteriosus is possible within the NICU. Proceedings of the 8th Annual Congress of the Perinatal Society of Australia and New Zealand, Sydney, 2004; A49.
43. Kuschel CA, Roy N. What's in a NICU? Benchmarking exercise for Neonatal Intensive Care Units in Australia and New Zealand. Proceedings of the 8th Annual Congress of the Perinatal Society of Australia and New Zealand, Sydney, 2004; P115.
44. Kuschel CA, Roy RN. Who's got what? NICU Design and Family Centred Care. Royal Women's Hospital, Melbourne, 2004.
45. Kuschel CA. Environmental implications in the NICU: incorporating the physical with the developmental environment. Occupational Therapy Conference, Auckland, 2004.
46. Kuschel CA. Medically managing neonatal opiate withdrawal in New Zealand. Perinatal Substance Use Special Interest Group, Perinatal Society of Australia and New Zealand. Sydney, 2004.
47. Kuschel CA. Planning, building, moving and adapting. NICU Design and Family Centred Care. Royal Women's Hospital, Melbourne, 2004.
48. Kuschel CA. The internet for dummies: a demonstration of internet use in child health practice. Paediatric Society of New Zealand 57th Annual Scientific Meeting, Rotorua, 2004.
49. McCowan LME, Harding JE, Stewart AW. Customised birthweight centiles predict SGA pregnancies with perinatal morbidity. Medical Medical Sciences Congress of New Zealand, Queenstown, 2004;C6.
50. Oliver MH, Street JA, Hawkins P, Harding JE. Infusion of cortisol for 11 days to either mother or fetus suppresses fetal adrenal response to ACTH in late gestation sheep. 8th Annual Congress of the Perinatal Society of Australia and New Zealand, Sydney, 2004; A8.
51. Phua HH, Bloomfield FH, Bauer MK, Harding JE. Effects of chronic pulsatile growth hormone (GH) infusion to the growth-restricted fetal sheep on mRNA levels of IGF-I and of the GH and IGF type 1 receptors. Medical Sciences Congress of New Zealand, Queenstown, 2004;B30.
52. Van Zijl P, Oliver MH, Harding JE. Urea cycle amino acids are elevated in ewes with low fertility independent of nutritional status. 8th Annual Congress of the Perinatal Society of Australia and New Zealand, Sydney, 2004;A99.
53. Webster NJ, Kuschel CA, Harding JE. Evaluation and treatment of suspected sepsis in term infants. Proceedings of the 8th Annual Congress of the Perinatal Society of Australia and New Zealand, Sydney, 2004; A93.

54. Webster NJ, Page B, Kuschel CA, Battin MR. Digital radiology does not help in the localisation of percutaneous central venous lines. Proceedings of the 8th Annual Congress of the Perinatal Society of Australia and New Zealand, Sydney, 2004; P119.
55. West C, Curr L, Belgrave S, McCowan L, Westgate J, Knight D, Harding J, Battin M. Antenatal antecedents of moderate or severe hypoxic-ischaemic encephalopathy in term infants. Proceedings of the 8th Annual Congress of the Perinatal Society of Australia and New Zealand, Sydney, 2004; P176.
56. West CR, Harding JE, Williams CE, Dezoete JA, Battin MR. Nine month psychomotor development index in extremely preterm infants with early electroencephalograph recordings. Medical Sciences Congress of New Zealand, Queenstown, 2004; p64.
57. West CR, Harding JE, Williams CE, Gunning MI, Nolan MA, Battin MR. Comparison of cotside and conventional electroencephalograms in term infants with neonatal encephalopathy. Medical Sciences Congress of New Zealand, Queenstown, 2004;C15.
58. West CR, Williams CE, Harding JE, Battin MR. Changes in novel electroencephalography measurements in premature infants between birth and discharge from neonatal intensive care. Proceedings of the 8th Annual Congress of the Perinatal Society of Australia and New Zealand, Sydney, 2004; A115.
59. West CR, Williams CE, Harding JE, Battin MR. Changes in novel electroencephalography measurements over the first week after birth in premature infants. Pediatric Research 2004; 55: A2461, 433A.
60. West CR, Williams CE, Harding JE, Battin MR. Effects of drug administration on novel electroencephalographic measurements in premature infants. Proceedings of the 8th Annual Congress of the Perinatal Society of Australia and New Zealand, Sydney, 2004; P22.
61. West CR, Williams CE, Harding JE, Battin MR. Spectral edge frequency measurements in the first week predict Hammersmith neonatal neurology score near term in a cohort of premature infants. Pediatric Research 2004; 55: A2376, 418A.
62. West CR, Williams CE, Harding JE, Battin MR. Spectral edge frequency measurements in the first week predict Hammersmith neonatal neurology score near term in a cohort of premature infants. Proceedings of the Paediatric Society of New Zealand Annual Scientific Meeting, Rotorua, 2004; p71.

7.6 Letters.

1. Battin M, Bennett L, Gunn A. Rebound seizures during rewarming. Pediatrics 2004;114:1369
2. Webster NJ, Odd D, Harding J, Battin MR. Digital imaging and long lines. Arch Dis Child 2004; <http://fn.bmjournals.com/cgi/eletters/89/1/F44>

8. CHILD DEVELOPMENT UNIT

8.1 Follow up at 18 months of children under 1500 grams born 1 January – 31 December 2002

One hundred and fifty-two infants who weighed <1500 grams, survived to discharge from the Newborn Service. Forty-five (29.6%) weighed <1000 grams at birth.

Eleven infants had congenital abnormalities that were considered to warrant exclusion and, although most children were assessed, they were excluded from the following tables. Two infants died (SIDS) after discharge from hospital, at 6 weeks and 5 months respectively.

Nine children were lost to follow up, none weighed under 1000 grams. Five were from other centres in New Zealand, two lived in Australia, and two were in Auckland but unable to attend appointments. Data were obtained for 130 (93.5%) children.

Children received individual assessment at the Child Development Unit, and when this was not possible (mainly because of distance from home to National Women's), 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 chronological 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 Table 38.

Table 42: 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 deviations below mean
	(ii) Mild-moderate cerebral palsy without developmental (cognitive) delay
	(iii) Impaired vision requiring spectacles
	(iv) Conductive hearing loss requiring hearing 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.

Outcome Categories at 18 Months for Children Under 1500g Born 2002
(For description of Categories see Table 42)

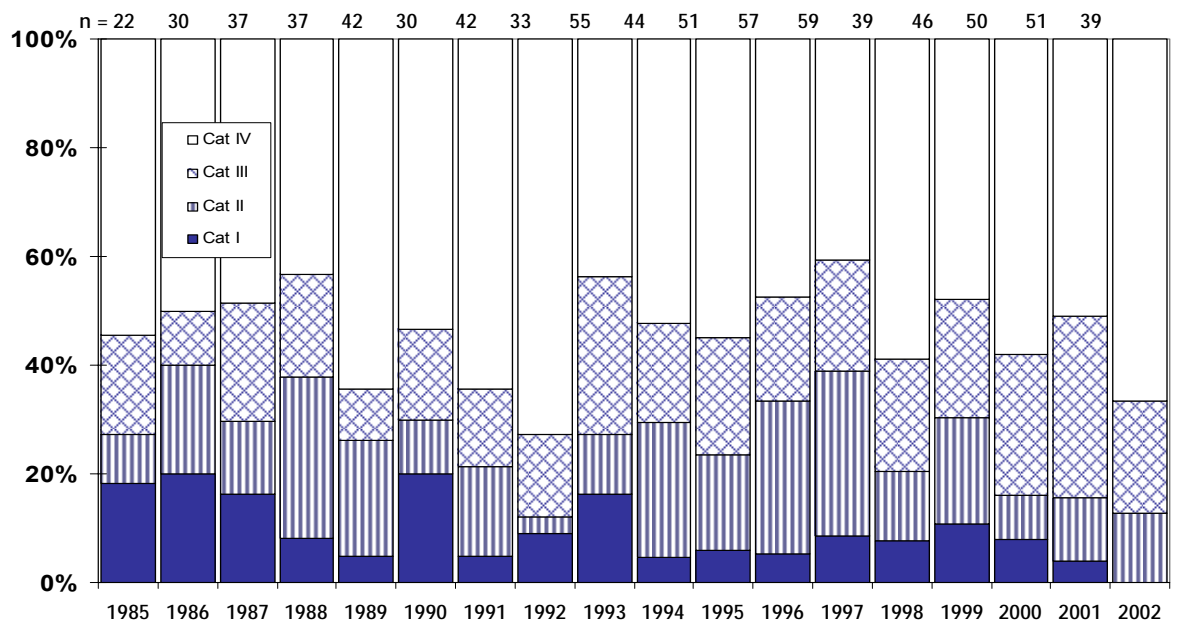
Category I: 0 infants

Category II: 13 (10%) children: 1 with cognitive and motor impairment, spastic diplegia/hemiplegia, and spectacles; 1 with cognitive and motor delays and general hypotonia; 1 with developmental delay, hypotonia and visual impairment; 1 with cognitive, motor and visual impairment; 3 with low cognitive and motor scores; 3 with low cognitive scores; 2 children* with bilateral hearing aids for mild-moderate conductive hearing loss; 1 with left hemiparesis and spectacles.

Category III: 23 (17.7%) children: 3 with low motor scores and tonal abnormalities; 18 with motor delay; and 2 with tonal abnormalities.

Category IV: 94 (72.3%) children.

Note: These children were discussed with the paediatricians in the Newborn Service and the decision was made to place them in Category II because their hearing loss was conductive, not sensorineural.



N = 764

Figure 48: Outcomes of children <1000g born 1985-2002 at 18 months.

Table 43: Children under 1500g born in 2002. Outcome at 18 months by gestational age groups (n = 130)

Outcome Category	Gestational Age (Weeks)				
	24-27		28 – 33		Total
	n=42	%	n=88	%	n=130 %
I	0		0		0
II	6	14.3	7	8.0	13 10.0
III	11	26.2	12	13.6	23 17.7
IV	25	59.5	69	78.4	94 72.3

Table 44: Children under 1500g born in 2002. Outcome at 18 months by birth weight Groups (n = 130)

Outcome Category	Birth weight				
	<1000		1000 – 1499		Total
	n=39	%	n=91	%	n=130 %
I	0		0		0
II	5	12.8	8	8.8	13 10.0
III	8	20.5	15	16.5	23 17.7
IV	26	66.7	68	74.7	94 72.3

8.2 Development at 4 years of children under 1500g born 1 January – 31 December 2000

One hundred and fifty-nine children born in 2000, who weighed less than 1500 grams and were cared for in the Newborn Service, survived to hospital discharge. One child died at 8 months of age. Eight children had congenital abnormalities and were not included in the analyses of data. After 18 months of age a further child was diagnosed with a congenital abnormality, and was excluded from the outcome data at 4 years.

Between the collating of information at 18 months, and assessment at 4 years, two children with severe disabilities including cerebral palsy, died at 2 and 3 years respectively.

At 4 years, 92 children were assessed at the Child Development Unit. Of the 55 not seen, 42 (76%) were known to be overseas or in other centres in New Zealand. (Ten children born in 2000 were lost to followup at 18 months, but the remaining 45 who were not assessed at 4 had outcome data recorded at 18 months. One child was in Category I, 6 in Category II, 7 in Category III and 31 in Category IV).

When the children turned 4 years, two registered psychologists 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 Table 41.

Table 45: Outcome categories for assessments 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 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 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.

Outcome Categories At 4 Years For Children Under 1500g Born 2000 (n = 92)

Category I: 4 (4.4%) children: One child with spastic quadriplegia and cognitive impairment; 3 children with cognitive impairment and low motor scores.

Category II: 9 (9.8%) children: Six with low cognitive and motor scores; 2 with low cognitive scores and motor skills within the average range; and one child with spastic diplegia and a low motor score.

Category III: 13 (14.1%): When tested, these children were within the average range for cognitive performance but below average for motor ability.

Category IV: 66 (71.7%) children.

9. APPENDIX: GLOSSARY OF ABBREVIATIONS

ABA	American Board of Anaesthetists	IUD	Intrauterine death
ACL	Anticardiolipin antibody	IUGR	Intrauterine growth retardation
ADAPT	Alcohol, Drugs and Pregnancy Team	ICSI	Intracytoplasmic sperm injection
AMSIS	Auckland Maternity Services Information System	IVF	In vitro fertilisation
ANA	Antinuclear antibody	IVH	Intraventricular haemorrhage
ANZNN	Australia and New Zealand Neonatal Network	LB	Live birth
APH	Antepartum haemorrhage	Ligate	Surgical ligation of PDA
ARM	Artificial rupture of membranes	LMP	Last menstrual period
AUT	Auckland University of Technology	LNND	Late neonatal death
BBA	(Baby) Born Before Arrival (not a planned home birth)	LSCS	Lower segment Caesarean section
BP	Blood Pressure	LV	Left ventricle
BPD	Bronchopulmonary dysplasia	MAS	Meconium aspiration syndrome
CDU	Child Development Unit	MAU	Maternity Assessment Unit
CHD	Congenital Heart Disease	MCDA	Monochorionic diamniotic twin
CI	Confidence Interval	MCMA	Monochorionic monoamniotic
CLD	Chronic lung disease	N/R	Not resuscitated
CPAP	Continuous positive airways pressure	NAS	Neonatal alcohol syndrome
CRIS	Clinical Records Information System	NEC	Necrotising enterocolitis
CS	Caesarean section	NFD	Not further defined
CVA	Cerebro Vascular Accident	NICU	Neonatal Intensive Care Unit
CVS	Chorionic villus sampling	NIDDM	Non-insulin dependent diabetes mellitus
DCCM	Department of Critical Care Medicine	NVB	Normal vaginal birth
DCDA	Dichorionic diamniotic twin	NWH	National Women's Hospital
DHB	District Health Board	OP	Occiput posterior
DIC	Disseminated intravascular coagulopathy	OPU	Oocyte pick up
DORV	Double outlet right ventricle	PDA	Patent ductus arteriosus
DRG	Diagnosis related groups	PE/PET	Pre-eclampsia
ECMO	Extra Corporeal Membrane Oxygenation	PG	Prostaglandin
EDU	Epsom Day Unit	PIN	Parent Infant Nursery
ENND	Early neonatal death	PM	Postmortem
FH	Fetal heart	PMR	Perinatal mortality rate
FTE	Fulltime equivalent	PPHN	Persistent pulmonary hypertension of the newborn
GA	General anaesthetic	PRLR	Perinatal related loss rate
GDM	Gestational diabetes mellitus	PROM	Prolonged rupture of membranes
GH	Gestational hypertension	PVL	Periventricular leukomalacia
GLH	Green Lane Hospital	RDS	Respiratory distress syndrome
GP	General Practitioner	ROP	Retinopathy of prematurity
GPH	Gestational proteinuric hypertension	SCBU	Special Care Baby Unit
GTT	Glucose tolerance test	SGA	Small for gestational age
Hb	Haemoglobin	SLE	Systemic Lupus Erythematosus
HDU	High Dependency Unit	SRM	Spontaneous rupture of membranes
HELLP	Hemolysis, Elevated Liver, Low Platelet (syndrome)	SVB	Spontaneous vaginal birth
HFOV	High frequency oscillatory ventilation	TCM	Transcutaneous oxygen monitor
HDU	High Dependency Unit	TGA	Transposition of the great arteries
HIE	Hypoxic ischaemic encephalopathy	TIA	Transient Ischaemic Attack
HIV	Human Immuno Deficiency Virus	TOP	Termination of pregnancy
HMD	Hyaline Membrane Disease	UAC	Umbilical artery catheter
ICH	Intracerebral haemorrhage	US/USS	Ultrasound/ultrasound scan
IDDM	Insulin dependent diabetes mellitus	VLBW	Very low birth weight
Indo	Treated with indomethacin	VSD	Ventricular septal defect
iNO	Inhaled nitrous oxide	WAU	Women's Assessment Unit
IPPV	Intermittent positive pressure ventilation	wks	weeks
IOL	Induction of labour	WHO	World Health Organisation