section 5

NEWBORN SERVICES

5.1 ADMISSIONS TO NEONATAL UNITS

Over the last 5 years the number of admissions of babies born in National Women's Hospital has been 1460, 1228, 1038, 1109 and 1154 in successive years. Out-born admissions have been 230, 192, 262, 244 and 258.

5.1.1 Admissions to the Newborn Intensive Care Unit

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Babies admitted	1663	1580	1635	1666	1464	1690	1420	1300	1352	1412

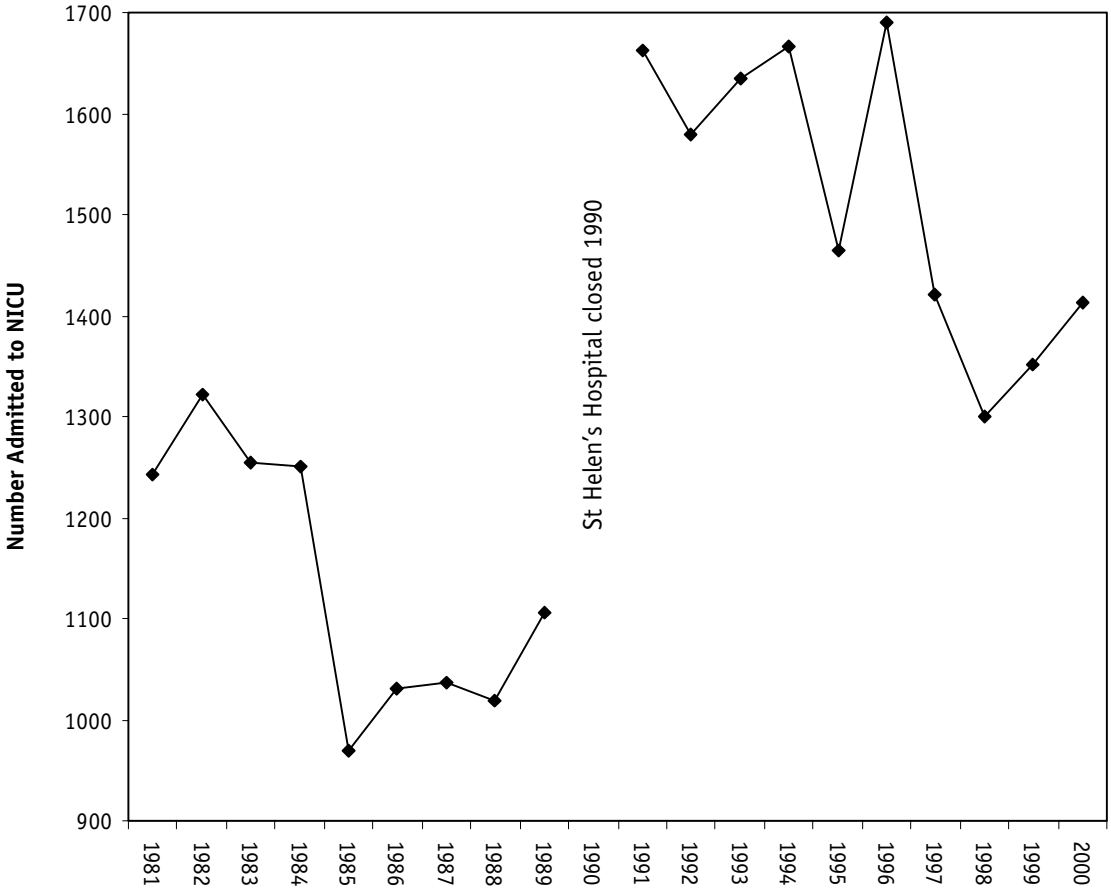

Figure 39: Admissions to NICU from 1981

Comment:

Admission numbers decreased from 1996 but there has been a small increase over the last two years. There are significantly fewer admissions than in the early 1990s. The percentage of babies born in NWH who were admitted has remained almost the same over the last four years. In 1997 14.6% of babies were admitted, in 1998 13.8% were admitted, in 1999 14.6% were admitted and in 2000 14.5% were admitted.

There are some discrepancies in numbers between the maternity and neonatal sections of this report, mainly related to the assigning of gestational age in some babies.

5.1.2 Admissions to NICU by Gestational Age of Babies born in National Women's Hospital

Gestational Age	Live Births	Admitted to NICU	Admitted %	Died Abnormal	Died Normal	Survived n	Survived %
20	4	0	0.0%	0	4	0	0.0%
21	3	0	0.0%	2	1	0	0.0%
22	11	0	0.0%	3	8	0	0.0%
23	8	5	62.5%	0	6	2	25.0%
24	5	4	80.0%	0	2	3	60.0%
25	22	21	95.5%	3	5	14	64.0%
26	23	23	100.0%	2	4	17	73.9%
27	15	15	100.0%	0	0	15	100.0%
28	18	18	100.0%	0	1	17	94.4%
29	35	34	97.1%	1	1	33	94.3%
30	32	32	100.0%	1	0	31	96.9%
31	53	53	100.0%	0	0	53	100.0%
32	77	77	100.0%	0	1	76	98.7%
33	99	99	100.0%	1	0	98	99.0%
34	138	135	97.8%	2	0	136	98.6%
35	165	107	64.8%	1	0	164	99.4%
36	277	114	41.2%	3	0	274	98.9%
37	536	88	16.4%	2	0	534	99.6%
38	1093	93	8.5%	2	0	1091	99.8%
39	1563	77	4.9%	2	2	1559	99.7%
40	2520	109	4.3%	0	0	2520	100.0%
41	1085	44	4.1%	0	0	1085	100.0%
42	178	6	3.4%	0	0	178	100.0%
43	1	0	0.0%	0	0	1	100.0%
Total	**7961**	**1154**	**14.5%**	**25**	**35**	**7901**	**99.2%**

5.1.3 Admissions to NICU by Gestational Age of Babies not born in National Women's Hospital

Gestational Age	Admitted to NWH	Admitted to NICU	Admitted %	Died	Survived n	Survived %
24	4	4	100.0%	1	3	75%
25	1	1	100.0%	0	1	100%
27	2	2	100.0%	0	2	100%
28	3	3	100.0%	1	2	67%
29	1	1	100.0%	0	1	100%
30	5	5	100.0%	1	4	80%
31	1	1	100.0%	0	1	100%
32	2	2	100.0%	0	2	100%
33	6	6	100.0%	0	6	100%
34	5	5	100.0%	0	5	100%
35	9	9	100.0%	0	9	100%
36	37	33	89.0%	0	37	100%
37	25	19	76.0%	0	25	100%
38	43	38	88.4%	3	40	93%
39	46	24	52.2%	1	45	98%
40	75	61	81.3%	1	74	99%
41	39	33	84.6%	1	38	97%
42	11	11	100.0%	0	11	100%
Total	**315**	**258**	**81.9%**	**9**	**306**	**97.1%**

5.1.4 Admissions to NICU by Birth Weight of Babies born in National Women's Hospital

Birth Weight	n	Admitted to NICU	% Admitted	Died Abnormal	Died Normal	Survived	% Survived
<500	13	0	0.0%	2	11	0	0.0%
500-749	31	22	71.0%	5	14	12	39.0%
750-999	42	41	98.0%	0	4	38	90.0%
1000-1249	46	45	98.0%	4	3	39	85.0%
1250-1499	64	64	100.0%	1	0	63	98.0%
1500-1999	193	193	100.0%	1	1	191	99.0%
2000-2499	427	291	68.0%	5	0	422	99.0%
2500-2999	1129	182	16.0%	2	1	1126	99.7%
3000-3999	4901	239	5.0%	5	1	4895	99.9%
≥4000	1114	77	7.0%	0	0	1114	100.0%
Unknown	1	0	0.0%	0	0	1	100.0%
Total	**7961**	**1154**	**14.5%**	**25**	**35**	**7901**	**99.0%**

5.1.5 Admissions by Birth Weight of Babies not born in National Women's Hospital

Birth Weight	Admitted to NWH	Admitted to NICU	Admitted %	Died	Survived n	Survived %
500-999	6	6	100.0%	1	5	83%
1000-1499	9	9	100.0%	2	7	78%
1500-1999	14	14	100.0%	0	14	100%
2000-2499	39	35	90.0%	0	39	100%
2500-2999	48	37	77.0%	0	48	100%
3000-3999	153	120	78.0%	3	150	98%
≥4000	46	37	80.0%	3	43	93%
Total	**315**	**258**	**82.0%**	**9**	**306**	**97.0%**

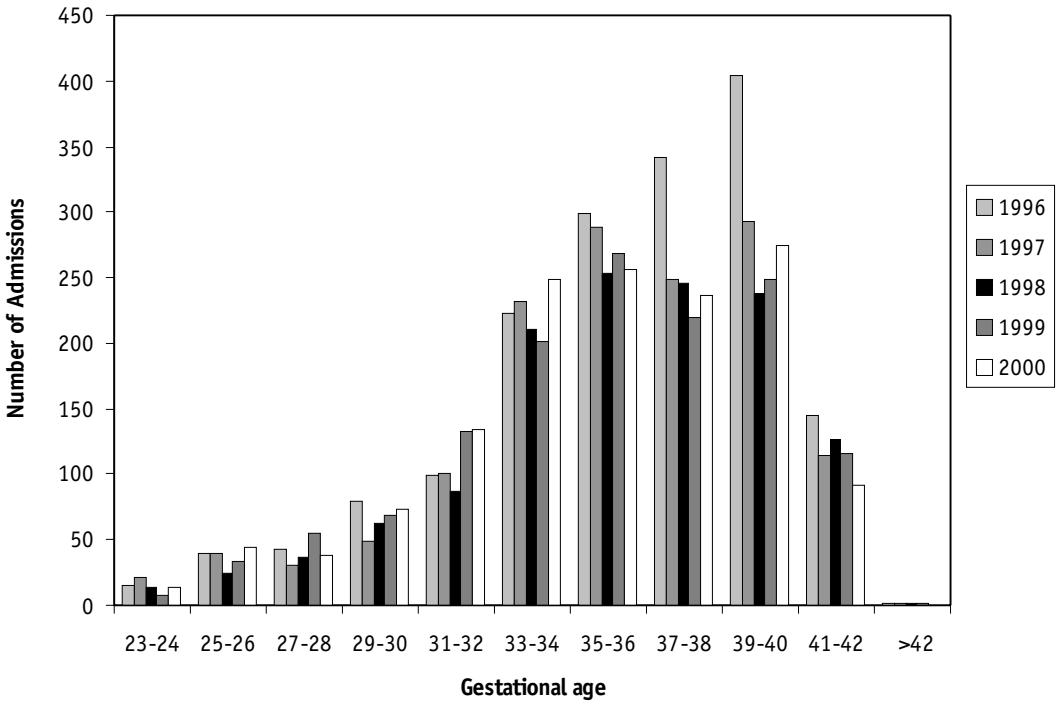

Figure 40: Admissions and Discharges from NICU

5.1.6 Domicile of Mother and Babies Admitted to NICU

Northern region		**1353**
Auckland Healthcare	523	
South Auckland Health	205	
Waitemata Health	595	
Northland	30	
Midland region		**33**
Central region		**23**
Southern region		**3**

Fifty-nine babies came from other regions. This is less than last year, when 95 babies came from out-of-region. It represents 4% of admissions. Twenty babies were <30 weeks gestation. Eighteen of these were admitted because of lack of space locally, and two because of the need of sub-specialist assessment at Starship.

Twenty-one babies were between 30 and 36 weeks gestation. Two of these had antenatally diagnosed cardiac malformations and another two serious congenital abnormalities needing sub-specialty services.

Eighteen of the babies were at term. Nine of these had cardiac abnormalities and another 4 had serious congenital malformations.

5.1.7 Place of Birth, Source of Referral and Discharge Destination of NICU Admissions

	Hospital	Born at	Admitted From	Discharged To
Auckland Healthcare	NWH	1154		
	Cornwall suite		18	39
	Delivery suite		495	
	Post natal ward		175	667
	Theatre		441	
	Birth Care	3	12	1
	Greenlane	1	7	27
	Home	2	11	516
	Starship		4	40
	Other			2
Waitemata	Waitakere	124	124	3
	Northshore	95	95	
	Helensville	2	2	6
South Auckland	Middlemore	5	4	28
	Pukekohe	1	1	2
	Botany Down			1
Northland	Whangarei	7	8	20
	Warkworth	2	2	
	Kaitaia	3	2	1
Midland	Waikato	1	1	5
	New Plymouth	2	2	3
	Rotorua	3	2	3
	Tauranga			1
	Gisborne			1
Central	Wellington	3	2	4
	Palmerston N	4	3	4
	Wanganui			1
	Nelson			2
	Hastings		1	1
Southern	Christchurch			1

5.1.8 Reason for Admission and Major Problems of NICU Admissions

	Reason Admitted	1999		2000	
		n	Total	n	Total
Preterm <35 weeks			498		546
	Preterm	486		533	
	Abnormality	12		13	
Preterm 35-36 weeks			267		263
	Preterm alone	60		69	
	Respiratory distress	114		100	
	Hypoglycaemia	52		51	
	IUGR <2000g	22		21	
	Birth asphyxia	5		10	
	Abnormality	5		8	
	Cardiac abnormality	1		2	
	Infection	6		1	
	Rhesus disease	0		1	
	GI Obstruction	2		0	
Term/Post-term			587		603
	Respiratory distress	271		240	
	IUGR 2000-2499g	20		59	
	Hypoglycaemia	67		52	
	Birth asphyxia	25		40	
	Abnormality	21		36	
	Observation	9		26	
	Cardiac abnormality	31		24	
	Meconium aspiration	25		23	
	IDM	12		17	
	Cyanotic episode	0		13	
	Haemolytic disease (mostly ABO)	19		11	
	IUGR <2000g	16		11	
	Feeding problem	10		11	
	Infection	15		10	
	Convulsion	4		10	
	Jaundice	11		6	
	Birth trauma	3		6	
	Apnoea	0		6	
	Drug withdrawal	7		2	
	Other	21			
Total			**1352**		**1412**

Comment:

These data are derived from coding data of the principal diagnoses of babies admitted. In some babies it is not easy to derive the reason for admission from these data. There is also a lot of overlap between categories: A large baby of a diabetic mother could fit into either the macrosomic, the IDM or the hypoglycaemia category. All babies <35 weeks gestation have been allocated 'preterm' as the reason for admission. At these gestations admission to NICU is almost automatic. The mildly preterm group at 35-36 weeks gestation is presented separately, as this group represents the transitional gestational age at which admission is not automatic, but at which gestational age alone can be a valid reason for admission.

5.2 ASSISTED VENTILATION

5.2.1 Number of Babies Receiving Assisted Ventilation

Gestational Age	n	Admissions	IPPV	CPAP	IPPV or CPAP	IPPV %	CPAP %	% IPPV or CPAP
23	8	5	5	2	5	63%	25%	63%
24	9	8	8	7	8	89%	78%	89%
25	23	22	19	19	21	83%	83%	91%
26	23	23	20	20	23	87%	87%	100%
27	17	17	10	17	17	59%	100%	100%
28	21	21	7	19	21	33%	90%	100%
29	36	35	15	33	33	42%	92%	92%
30	37	37	10	34	35	27%	92%	95%
31	54	54	7	39	40	13%	72%	74%
32	79	79	4	38	39	5.00%	48%	49%
33	105	105	6	46	47	5.71%	44%	45%
34	143	140	6	37	38	4.19%	26%	27%
35	174	116	2	28	28	1.20%	16%	16%
36	314	147	3	36	38	1.00%	11%	12%
37	561	107	4	20	21	0.70%	3.60%	3.70%
38	1136	131	12	26	31	1.10%	2.30%	2.70%
39	1609	101	15	19	28	0.90%	1.20%	1.70%
40	2595	170	8	29	33	0.30%	1.10%	1.30%
41	1124	77	2	9	11	0.20%	0.80%	1.00%
42	189	17	3	8	9	1.60%	4.20%	4.80%
43	1	0	0	0	0	0.00%	0.00%	0.00%
Total	**8258**	**1412**	**166**	**486**	**526**	**2.00%**	**5.90%**	**6.40%**

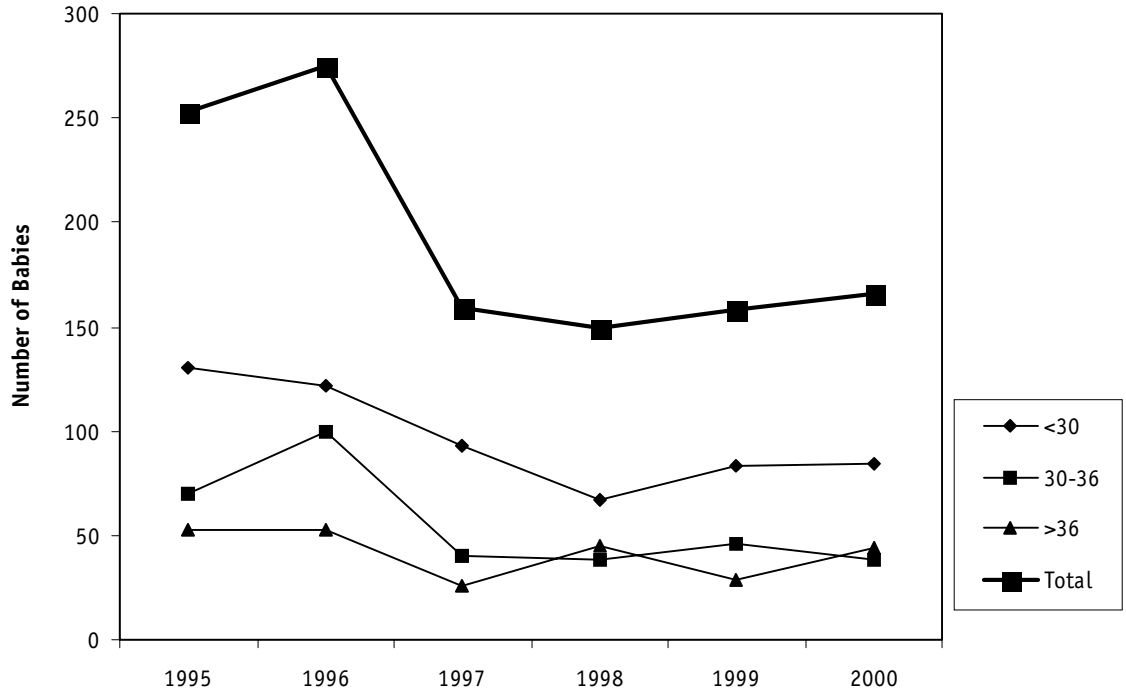

Figure 41: Number of Babies on Intermittent Positive Pressure Ventilation over the last Five Years by Gestational Age

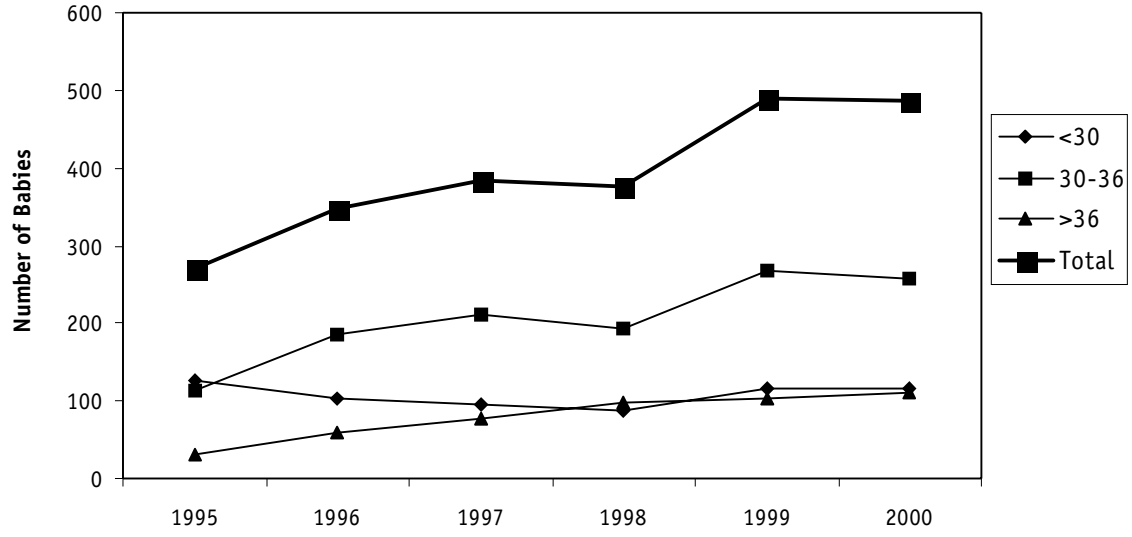

Figure 42: Number of Babies on Continuous Positive Airways Pressure over the Last Five Years by Gestational Age

Comment:

Over the last three years there has been a decrease in the number of babies requiring ventilation with an increasing emphasis on the use of CPAP. In term and moderately preterm infants, CPAP is being used as an alternative to both assisted ventilation and head-box oxygen. Very preterm infants are spending less time on positive pressure ventilation.

This changing trend in the use of respiratory support seems to have levelled off, with use of CPAP and IPPV being similar in 1999 and 2000.

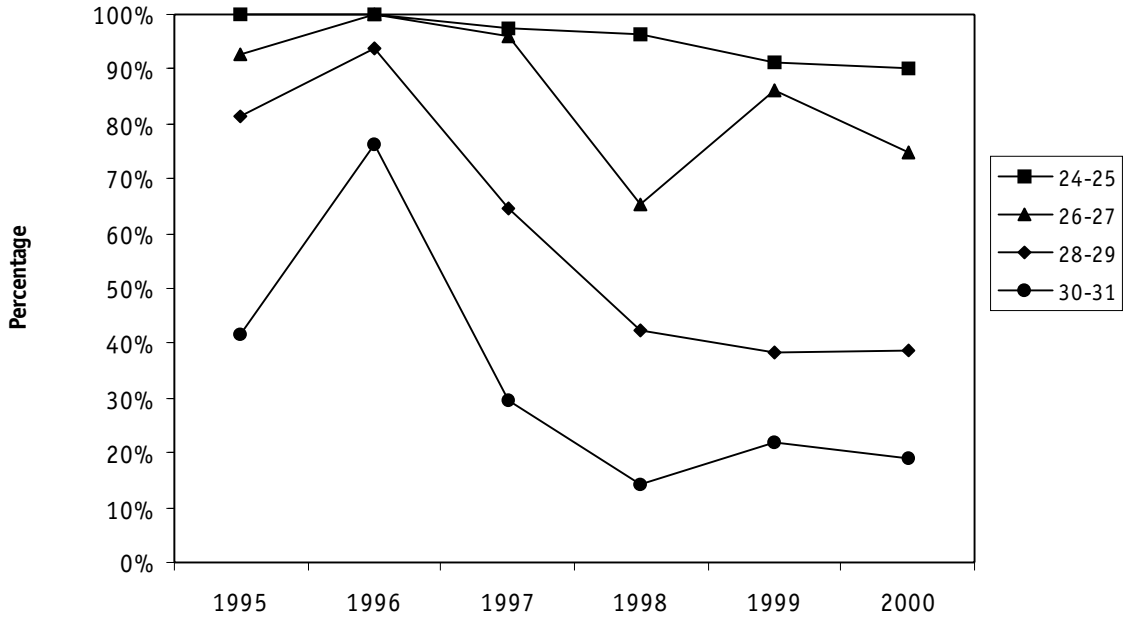

Figure 43: Percentage of Preterm Infants Treated with Positive Pressure Ventilation

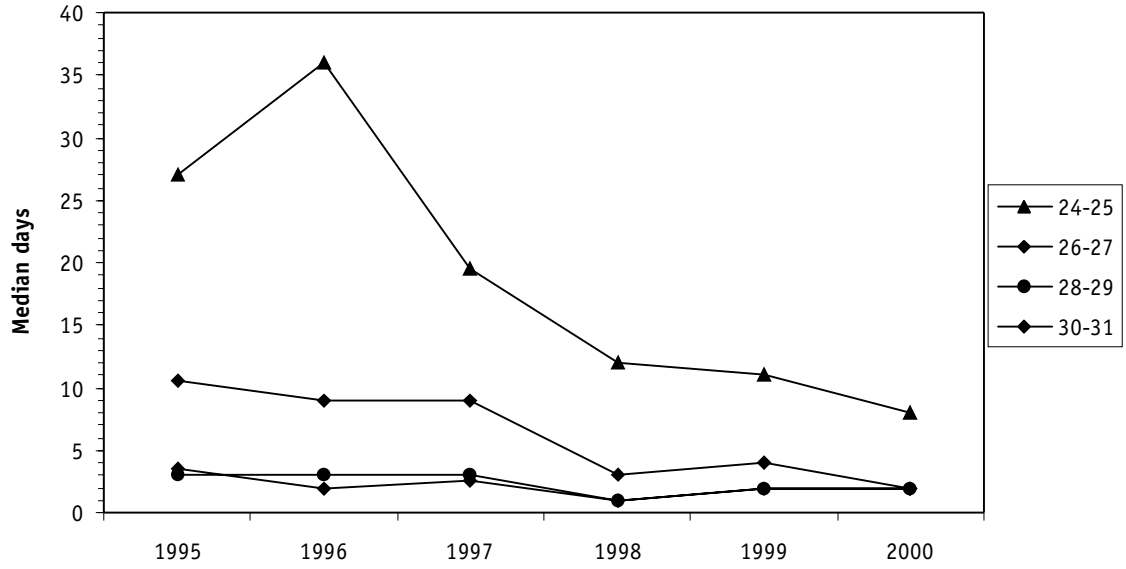

Figure 44: Median number of days on IPPV in surviving preterm infants

Comment:

The changing use of assisted ventilation is seen in these two figures. At very immature gestations most babies still require positive pressure ventilation, so that at less than 28 weeks gestation 83% of babies are still ventilated (down from 90% last year). However the time spent on a ventilator has reduced dramatically. Babies at 24-5 weeks gestation had a median of 36 days of IPPV in 1996, 12 days in 1998, 11 days in 1999 and 8 days in 2000. Babies of 26-7 weeks gestation had a median of 10 days IPPV in 1995 but 3 days in 1998, 4 days in 1999 and 2 days in 2000.

At 29-31weeks gestation, the number needing IPPV has fallen but the time each baby spent on ventilation has only changed a little (3 days to 2 days median). In 1995 82% of babies of 28-29 weeks gestation required IPPV. In 2000 38% were ventilated. At 30-31 weeks these proportions were 76% (1996) and 25% (2000).

5.3 SEIZURES AND HYPOXIC ISCHAEMIC ENCEPHALOPATHY IN THE NEWBORN

Hypoxic ischaemic encephalopathy (HIE) remains the major cause of seizures in the newborn, accounting for 62% of cases over the last 4 years. The incidence of HIE varies from year to year, with 25 babies having stage 2 or 3 HIE in 2000.

The numbers of babies with stage II or III HIE admitted from the Auckland Healthcare or Waitemata Health Areas represent all the babies so affected from each region. Babies from South Auckland or outside Auckland would normally be cared for at the local Level II or Level III neonatal unit but were referred to NWH. (The baby from Middlemore Hospital was referred for inclusion into the randomised trial of selective head cooling.) They are a selected population.

5.3.1 Causes of Seizures

	1997	1998	1999	2000
HIE	11	26	15	20
Meningitis	2	2	0	0
Associated with sick infant	1	2	0	1
Neonatal stroke	1	1	3	2
Brain abnormality	0	1	1	3
IVH	0	0	1	1
Encephalomalacia	0	0	1	1
Hyperammonaemia	0	0	0	1
Unknown	4	7	3	6
Total	**19**	**39**	**24**	**35**

5.3.2 Place of Birth of Term Babies with Hypoxic Ischaemic Encephalopathy Stage 2 or 3

	1997	1998	1999	2000
NWH	10	7	6	9
Waitakere	0	7	4	3
Northshore	1	5	2	4
Home	0	0	1	1
Birthcare	0	0	0	1
Middlemore	0	0	0	1
Rotorua	0	0	1	1
Ambulance	0	1	0	0
Auckland A&E	0	1	0	0
Whangarei	0	5	0	0
Warkworth	0	1	0	0
Kawakawa	0	0	1	0
Kaitaia	0	0	1	0
Total	**11**	**27**	**16**	**20**

5.3.3 Babies with Hypoxic Ischaemic Encephalopathy Stage 2 or 3

Born at	Gestation	Birth Weight	HIE	Apgar 1/5	Died
Birth Care	39	3700	S3	0/5	Yes
Home	42	3685	S2	4/7	No
Middlemore	38	3430	S3	0/1	Yes
Northshore	34	1560	S3	0/0	No
Northshore	38	3140	S2	1/4	No
Northshore	38	4560	S3	1/4	Yes
Northshore	39	3800	S2	4/4	No
Northshore	40	4100	S3	3/3	Yes
NWH	26	880	S3	2/4	Yes
NWH	32	1800	S3	0/1	Yes
NWH	36	1980	S2	2/5	No
NWH	38	2880	S2	1/3	No
NWH	38	3035	S2	3/8	No
NWH	38	3900	S2	3/6	No
NWH	39	2590	S2	1/4	Yes
NWH	39	3115	S3	0/4	Yes
NWH	39	3265	S2	4/4	No
NWH	39	3650	S2	4/7	No
NWH	40	4025	S2	2/4	No
NWH	40	4350	S2	0/0	No
Rotorua	40	3910	S2	6/5	No
Waitakere	38	4500	S3	0/0	Yes
Waitakere	40	3295	S2	2/5	No
Waitakere	41	3080	S3	2/3	Yes
Whangarei	30	1400	S2	8/8	Yes

The events leading to the HIE are as follows:

7 Normal labour and delivery, no known fetal distress
4 Placental abruption, not in labour
4 Fetal distress (abnormal CTG) in labour
3 Meconium staining with no known fetal heart abnormality
2 Cardiac arrest in NICU
1 Shoulder dystocia
1 Failure to progress, Caesarean section
1 Fetal distress, not in labour
1 Unable to assess fetus because of lack of maternal co-operation
1 Prolapsed cord

A feature seen in the cases of severe HIE this year, and not seen in previous years is the proportion of normal labours and deliveries without known fetal distress.

5.4 VERY LOW BIRTH WEIGHT INFANTS (VLBW, <1500 gram) NUMBERS AND SURVIVAL

5.4.1 All National Women's Hospital Live Births and Babies Admitted to NICU who were born Elsewhere

Inborn	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
<500	2	6	7	14	10	13	11	14	13	13
500 - 749	25	31	32	42	34	36	47	28	22	31
750 - 999	52	38	51	46	44	50	33	35	45	42
1000 -1249	58	47	39	45	46	47	39	37	49	46
1250 -1499	63	53	51	49	79	43	36	55	57	64
Total	**178**	**164**	**164**	**176**	**200**	**173**	**166**	**169**	**186**	**196**
Born elsewhere	22	11	16	20	13	16	12	12	18	15
Total number	**200**	**175**	**180**	**196**	**213**	**189**	**178**	**181**	**204**	**211**

These numbers include babies who were born alive but died in the delivery room. Details of these babies in 2000 are in the section on neonatal deaths. Continuing good regionalisation of care is demonstrated by the high proportion of these vulnerable babies who are born in NWH.

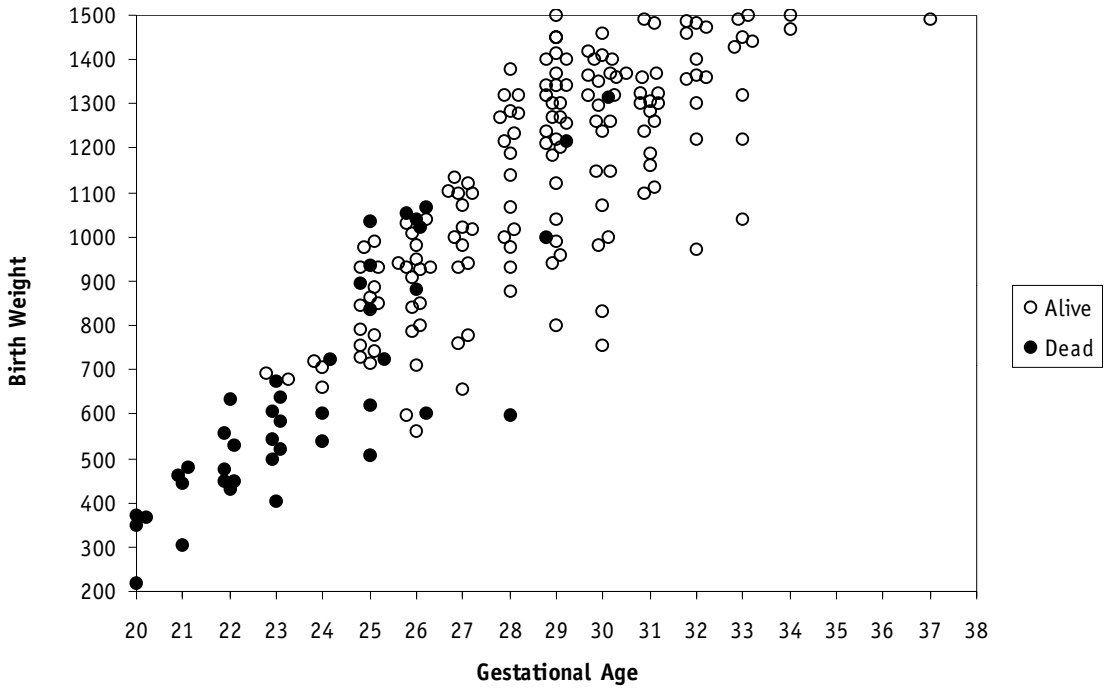

Figure 45: Scatter plot of very low birth weight babies with survival. Data on all babies born alive in NWH, including those with abnormalities and delivery room deaths.

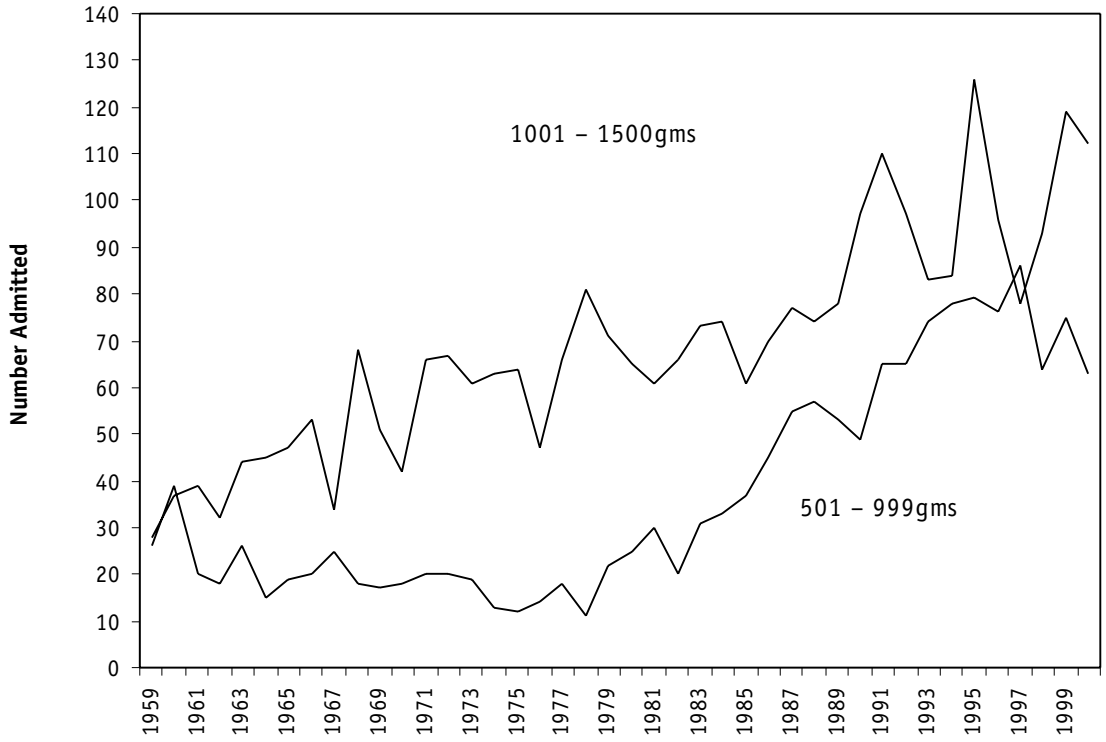

Figure 46: Number of deliveries of inborn live-births 501-1500g birth weight from 1959 to present.

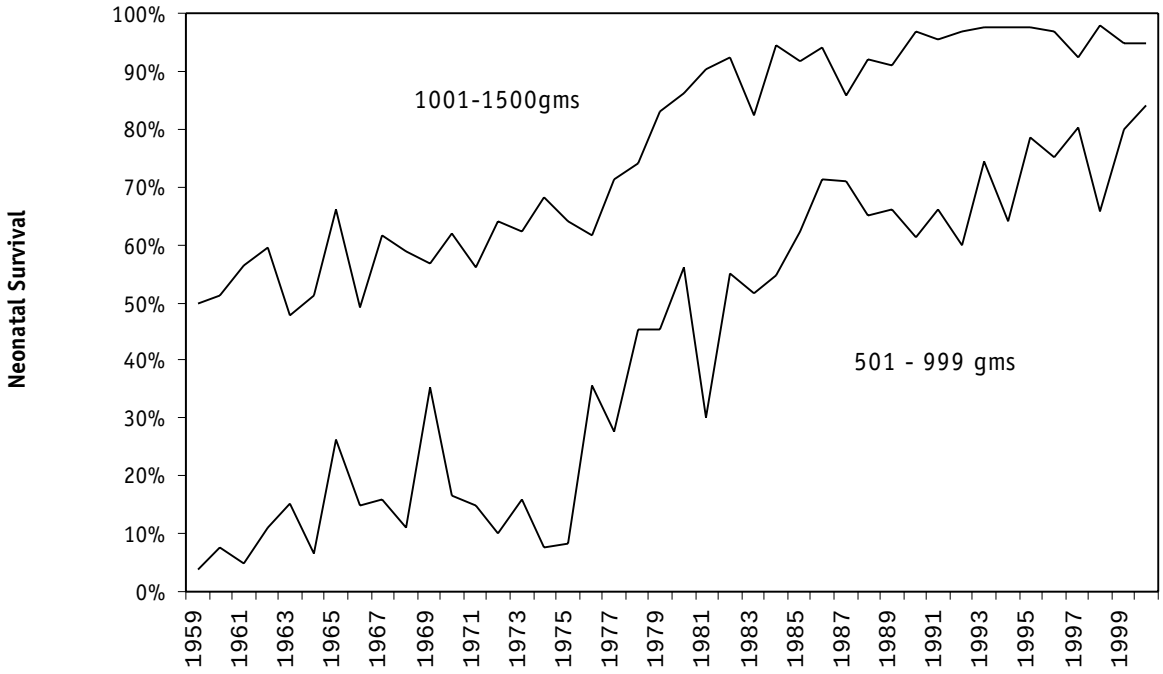

Figure 47: Neonatal survival (to 28 days) of inborn live births 501-1500g birth weight from 1959 to present.

Comment:

The previous graphs are of neonatal survival of babies born in NWH over the last 41 years. A neonatal death is one at <28 days of age. The data were collected initially by Prof. Ross Howie. Over the years the definitions used have been the same, with all delivery room deaths included if they were live births. The definition of a live birth as 'any signs of life' (WHO) 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.

In 2000, there were 22 neonatal deaths of babies between 501-1000 birth weight. Of these, 3 had serious abnormalities that contributed to or caused the death. Nine were under 24 weeks gestation and 8 died in the delivery room. Seven babies of 1001-1500 grams birth weight died, five of who had abnormalities.

The number with abnormalities 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.

5.5 IN-HOSPITAL MORBIDITY OF VERY LOW BIRTH WEIGHT BABIES

These data are on all babies admitted to NICU and born at NWH in 2000

5.5.1 Intraventricular Haemorrhage in all Babies

Birth weight	Number	Unknown	None	Grade 1	Grade 2	Grade 3	Grade 4
500-749	22	1	12	3	1	1	4
750-999	41	1	34	1	2	0	3
1000-1249	45	3	36	2	1	1	2
1250-1499	64	7	53	4	0	0	0
Total	**172**	**12**	**135**	**10**	**4**	**2**	**9**

5.5.2 Intraventricular Haemorrhage in Surviving Infants

Birth weight	Number	Unknown	None	Grade 1	Grade 2	Grade 3	Grade 4
500-749	12	0	7	1	1	1	2
750-999	38	0	33	1	2	0	2
1000-1249	39	1	35	2	1	0	0
1250-1499	63	7	52	4	0	0	0
Total	**152**	**8**	**127**	**8**	**4**	**1**	**4**

Comment:

The rate of IVH in very low birth weight infants has fallen over the years but the rate of grade 4 IVH (haemorrhagic infarction in the brain parenchyma) has remained steady.

Periventricular leukomalacia continues to be uncommon, occurring in three infants. The smallest was 620 gm birth weight and 25 weeks gestation. She died of necrotising enterocolitis. The next was 850 gm and 26 weeks and the largest was 1100 gm and 27 weeks.

5.5.3 Retinopathy of Prematurity in Surviving Infants

Birth weight	Number	Unknown	None	Stage 1	Stage 2	Stage 3
500-749	12	0	9	1	2	0
750-999	38	0	30	4	2	2
1000-1249	39	1	34	4	0	0
1250-1499	63	11	52	0	0	0
Total	**152**	**12**	**125**	**9**	**4**	**2**

Severe ROP remained uncommon. No baby required laser therapy.

5.5.4 Chronic Lung Disease: An Oxygen Requirement at 28 days

Birth weight	Number	Dead by d28	Alive on d28	In O2	In O2 if alive	In O2 or dead
500-749	22	8	14	12	86%	91%
750-999	41	2	39	19	49%	51%
1000-1249	45	6	39	3	8%	20%
1250-1499	64	0	64	3	5%	5%
Total	**172**	**16**	**156**	**37**	**24%**	**31%**

5.5.5 Chronic Lung Disease: An Oxygen Requirement at 36 Weeks Post Menstrual Age

Birth weight	Number	Dead by 36 weeks	Alive at 36 weeks	In O2	In O2 if alive	In O2 or dead
500-749	22	10	12	6	50%	73%
750-999	41	2	39	14	36%	39%
1000-1249	45	6	39	3	8%	20%
1250-1499	64	0	64	4	6%	6%
Total	**172**	**18**	**154**	**27**	**18%**	**26%**

There are different definitions of chronic lung disease. The most widely used is an oxygen requirement persisting to 36 weeks gestation (or 4 weeks of age in babies born at 32 weeks gestation or more). Overall, 18% of very low birth weight infants who survived met this definition of chronic lung disease in 2000.

5.5.6 Necrotising Enterocolitis, Patent Ductus Arteriosus and Pneumothorax

Birth weight	Number	Necrotising Enterocolitis		PDA Treated	Pneumothorax
		Proven	Suspect		
500-749	22	2	2	15	0
750-999	41	1	1	15	2
1000-1249	45	1	1	7	3
1250-1499	64	0	0	1	1
Total	**172**	**4**	**4**	**38**	**6**

Proven NEC is defined as either radiological intramural gas or a surgical or pathological diagnosis. Suspect NEC is a baby treated with at least 5 days nil by mouth and antibiotics because of a clinical presentation compatible with NEC, but without any diagnostic features. Thirty-six of the babies treated for a patent ductus arteriosus received indomethacin. Five babies had surgical ligation.

5.5.7 Treatment Used

Birth weight	Number	Antenatal Steroids		Surfactant	HFOV	Nitric Oxide
		Optimal	Any			
500-749	22	16	21	21	5	1
750-999	41	30	38	28	2	0
1000-1249	45	29	40	17	0	2
1250-1499	64	33	57	11	0	0
Total	**172**	**108**	**156**	**77**	**7**	**3**

Comment:

Optimal antenatal steroids is defined as a course being given between 24 hours and 7 days before delivery. There was a reduction in surfactant use between 1997 and 1998. The use of both was similar from 1998 to 2000 (74, 76 and 77 babies treated). Surfactant use reflects the decreasing use of positive pressure ventilation in the first day. Seven babies were treated with high frequency oscillation compared to 11 in 1999, 8 in 1998 and 4 in 1997. HFOV is reserved for rescue use. The majority of nitric oxide use was in larger term babies with persistent pulmonary hypertension.

5.5.8 Postnatal Dexamethasone for the Treatment of Chronic Lung Disease

	1995	1996	1997	1998	1999	2000
500-749	64%	82%	76%	75%	54%	56%
750-999	44%	60%	53%	31%	25%	18%
1000-1249	17%	5%	11%	5%	6%	0
1250-1499	1%	2%	3%	2%	0	0
Overall	22%	29%	35%	18%	13%	11%

Comment:

This table giving post-natal steroid use over the last 6 years is included because of the increasing controversy over the role of post-natal dexamethasone. Dexamethasone had become an accepted and proven treatment to lessen the severity of chronic lung disease. Recently, questions have been raised as to whether it may increase the rate of cerebral palsy in survivors. This is now being tested in randomised controlled trials. Dexamethasone use at NWH has decreased, and parents are involved in decisions. The decrease 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.

5.6 IN HOSPITAL MORBIDITY OF BABIES <32 WEEKS GESTATION

These data are on all babies admitted to NICU who were born at NWH in 2000

5.6.1 Intraventricular Haemorrhage in all Babies

Gestation	Number	Unknown	None	Grade 1	Grade 2	Grade 3	Grade 4
<24	5	0	2	2	0	0	1
24 - 5	25	3	13	2	2	1	4
26 - 7	38	1	30	2	2	0	3
28 - 9	52	0	46	4	0	1	1
30 - 1	85	10	72	2	0	0	1
Total	**205**	**13**	**163**	**12**	**4**	**2**	**10**

5.6.2 Intraventricular Haemorrhage in Surviving Infants

Gestation	Number	Unknown	None	Grade 1	Grade 2	Grade 3	Grade 4
<24	2	0	0	1	0	0	1
24-5	17	0	11	1	2	1	2
26-7	32	0	27	2	2	0	1
28-9	50	0	46	4	0	0	0
30-1	84	10	71	2	0	0	1
Total	**185**	**10**	**155**	**10**	**4**	**1**	**5**

5.6.3 Retinopathy of Prematurity in Surviving Infants

Gestation	Number	Unknown	None	Stage 1	Stage 2	Stage 3
<24	2	0	1	0	1	0
24-5	17	0	12	3	2	0
26-7	32	0	26	3	1	2
28-9	50	1	47	2	0	0
30-1	84	17	66	1	0	0
Total	**185**	**18**	**152**	**9**	**4**	**2**

5.6.4 Chronic Lung Disease: An Oxygen Requirement at 28 Days

Gestation	Number	Died by d28	Alive on d28	In O2	Survivors in O2	In O2 or dead
<24	5	2	3	3	100%	100%
24-5	25	7	18	16	89%	92%
26-7	38	5	33	13	39%	47%
28-9	52	2	50	3	6%	10%
30-1	85	1	84	2	2%	4%
Total	**205**	**17**	**188**	**37**	**20%**	**26%**

5.6.5 Chronic Lung Disease: An Oxygen Requirement at 36 Weeks Post Menstrual Age

Gestation	Number	Died by 36 weeks	Alive at 36 weeks	In O2	Survivors in O2	In O2 or dead
<24	5	3	2	2	100%	100%
24-5	25	8	17	8	47%	64%
26-7	38	5	33	10	30%	39%
28-9	52	2	50	4	8%	12%
30-1	85	1	84	4	5%	6%
Total	**205**	**19**	**186**	**28**	**15%**	**23%**

5.6.6 Necrotising Enterocolitis, Patent Ductus Arteriosus and Pneumothorax

Gestation	Number	NEC		PDA Treated	Pneumothorax
		Proven	Suspect		
<24	5	0	1	5	0
24-5	25	2	1	13	0
26-7	38	2	1	16	3
28-9	50	0	1	3	2
30-1	85	0	0	1	3
Total	**203**	**4**	**4**	**38**	**8**

5.6.7 Treatments Used

Gestation	Number	Antenatal Steroids		Surfactant	HFOV	Nitric oxide
		Optimal	Any			
<24	5	5	5	5	1	1
24-5	25	20	24	23	4	0
26-7	38	26	36	27	2	1
28-9	52	27	48	19	0	1
30-1	85	43	71	14	0	0
Overall	**205**	**121**	**184**	**88**	**7**	**3**

5.6.8 Postnatal Dexamethasone for the Treatment of Chronic Lung Disease

Gestation	1995	1996	1997	1998	1999	2000
24-5	68%	96%	84%	74%	67%	43%
26-7	46%	44%	60%	30%	20%	12%
28-9	5%	7%	15%	5%	0	0
30-1	0	0	5%	1%	1%	0
Total	**20%**	**24%**	**30%**	**16%**	**11%**	**7%**

5.7 COMPARISON OF OUTCOMES FOR BABIES <32 WEEKS GESTATION FROM 1995 TO 2000.

Data on all in-born babies.

Survival

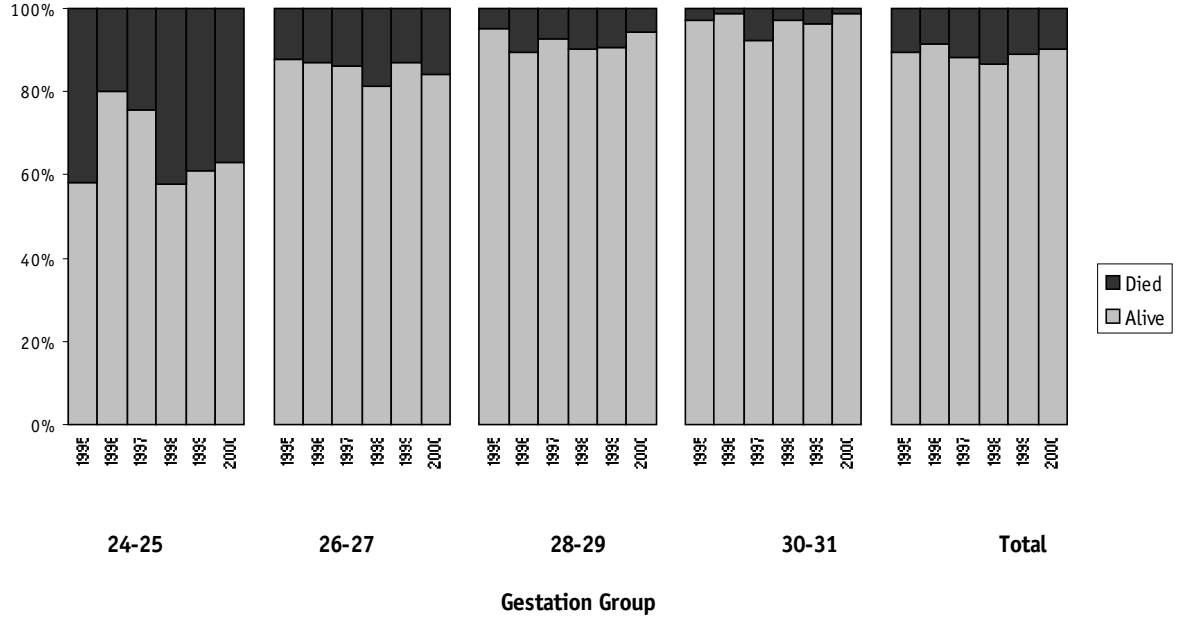

Figure 48: Survival by Gestational Age over the last five years (all in-born babies)

Comment:

This figure is from data on all inborn babies, including delivery room deaths and deaths of babies with abnormalities. At the lower gestations, numbers in any one year are small. However, these results show a lower survival at <28 weeks gestation in 1998 to 2000 than in 1996-97.

Over the last three and a half years there has been a change in emphasis in ventilation away from positive pressure ventilation towards CPAP and earlier extubation. A detailed audit of outcome at <27 weeks gestation for the years 1995-1999 has been completed and presented at national and international meetings. This shows that there is no change in outcome that can be attributed to treatment used.

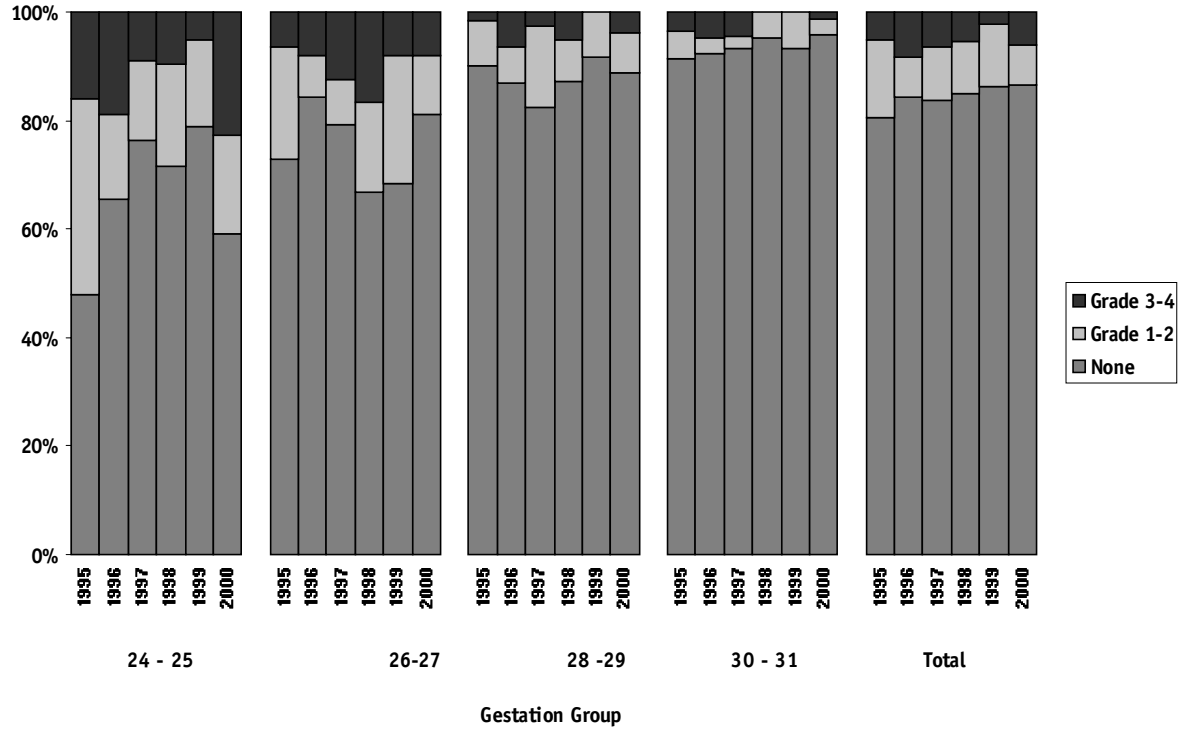

Figure 49: Intraventricular haemorrhage by gestational age over the last five years. (Born in NWH and admitted to NICU)

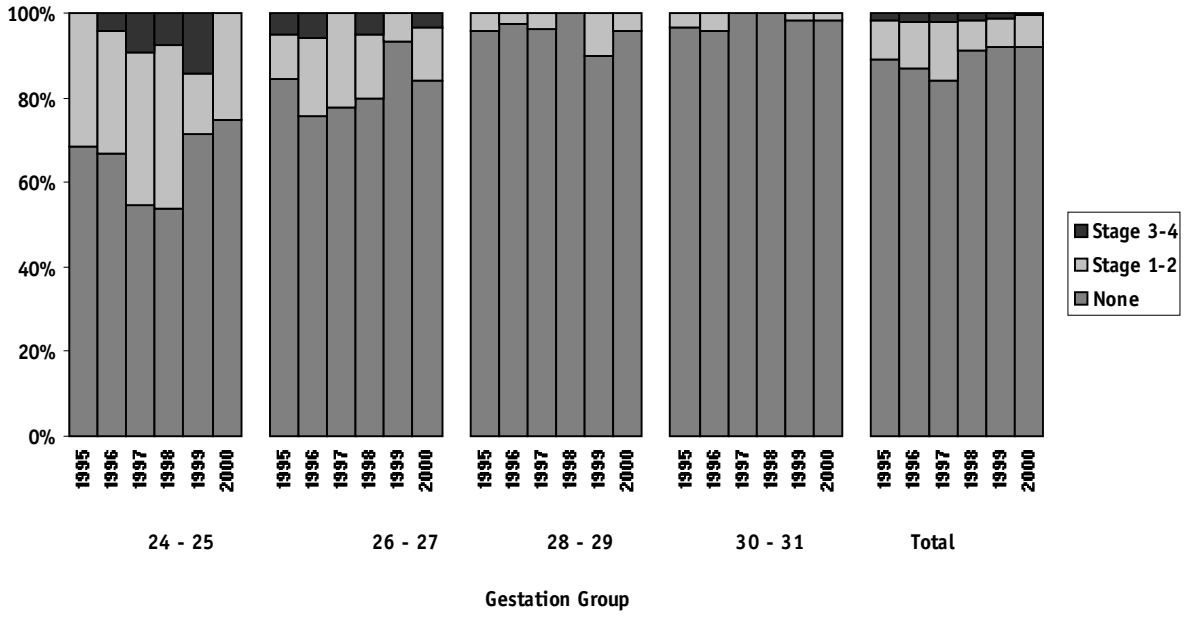

Figure 50: Retinopathy of prematurity by gestational age over the last five years. (Born in NWH and survived)

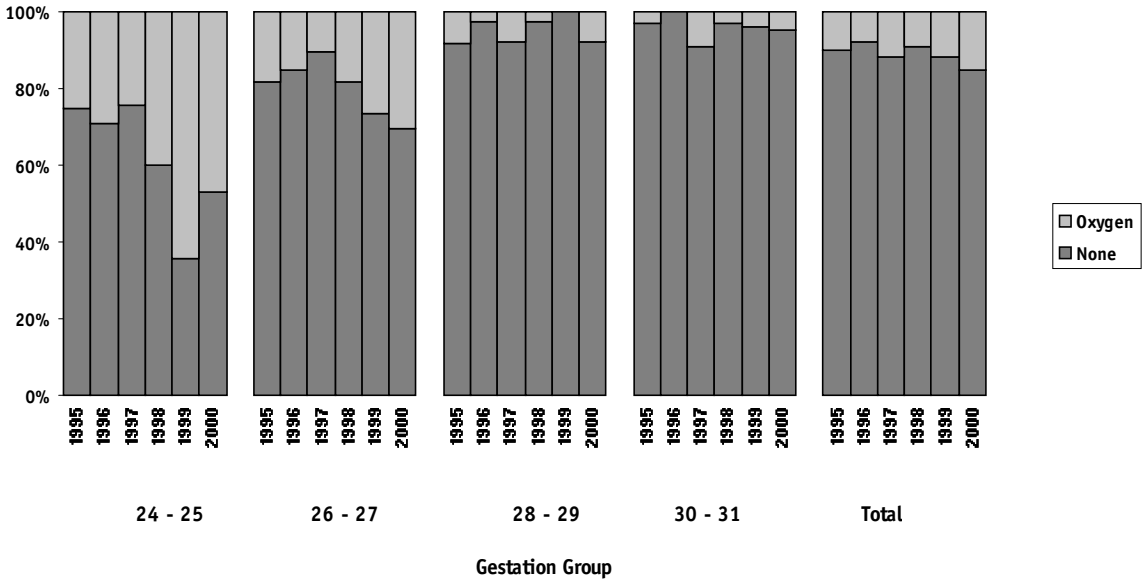

Figure 51: Chronic lung disease (an oxygen requirement at 36 weeks gestation) by gestational age over the last five years. Number of babies in oxygen and total number alive at 36 weeks gestation.

Comment:

Our changing emphasis away from IPPV towards CPAP has not resulted in any reduction in chronic lung disease over the last three years.

One difficulty in interpreting these data is that the criteria for using oxygen in ex-premature babies have changed over the years. NWH follows the recommendations of the Respiratory Paediatricians at Starship and now has a lower threshold to use oxygen in these babies. Overnight pulse oximetry needs to show that the oxygen saturation is >95% for >80% of the time to stop oxygen therapy. This has resulted in babies who would not have been in oxygen in the past, continuing to be treated with it now.

INTRAVENTRICULAR HAEMORRHAGE IN ALL BABIES ADMITTED TO NICU, 1985-2000

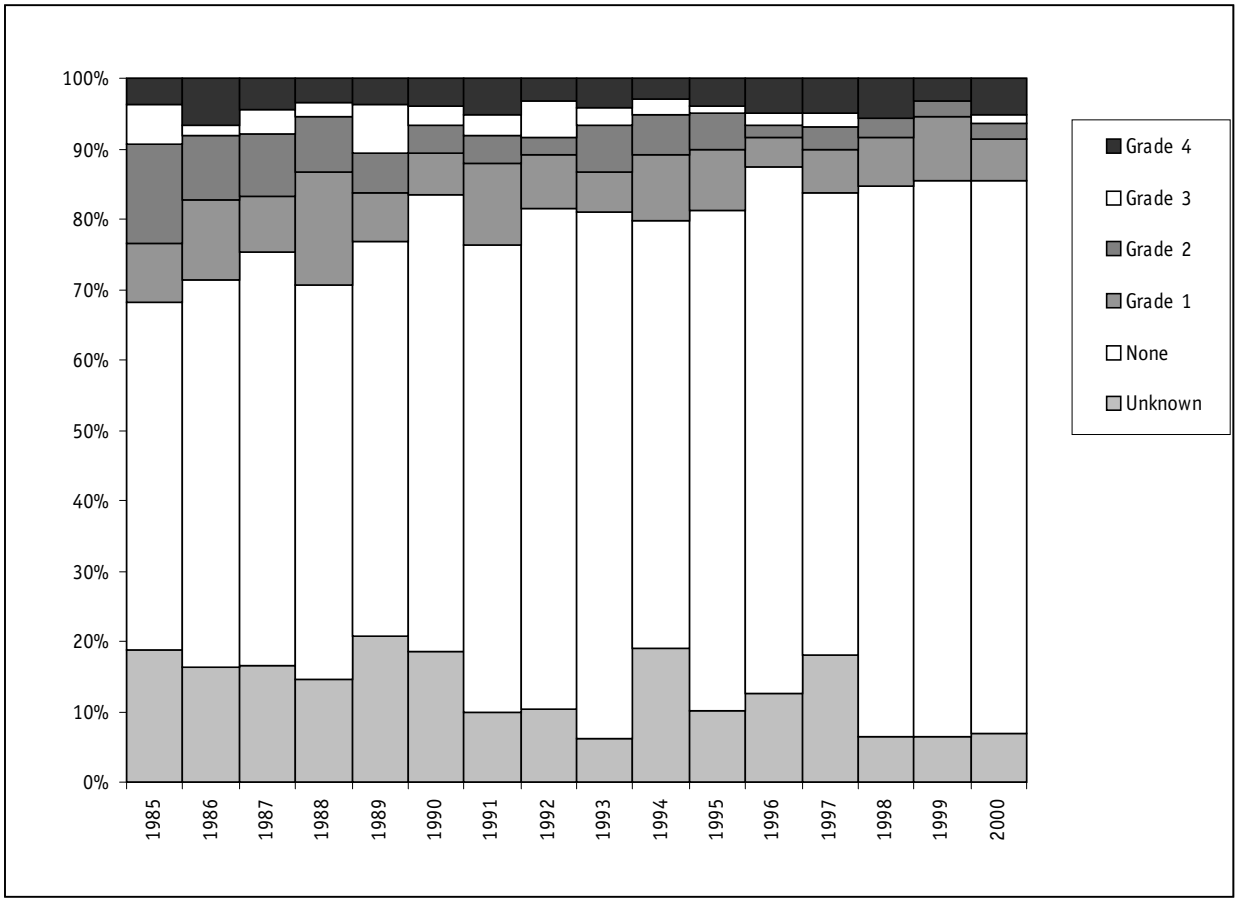

Figure 52: Grade of intraventricular haemorrhage from 1985 to 2000

Comment:

The incidence of IVH has fallen from 39% to 15%, 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 6%. 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. However, a few are the sickest who die soon after birth before an ultrasound scan is done, and in whom no post mortem examination is done.

SURVIVAL BY GESTATIONAL AGE OF ALL <1500 GRAM BABIES ADMITTED TO NICU FROM 1985 TO 2000

Gestation	<24	24 - 5	26 - 7	28 - 9	30 - 1
Survived	10	230	454	627	574
Died	29	116	110	59	27
Survival	26%	66%	80%	91%	96%

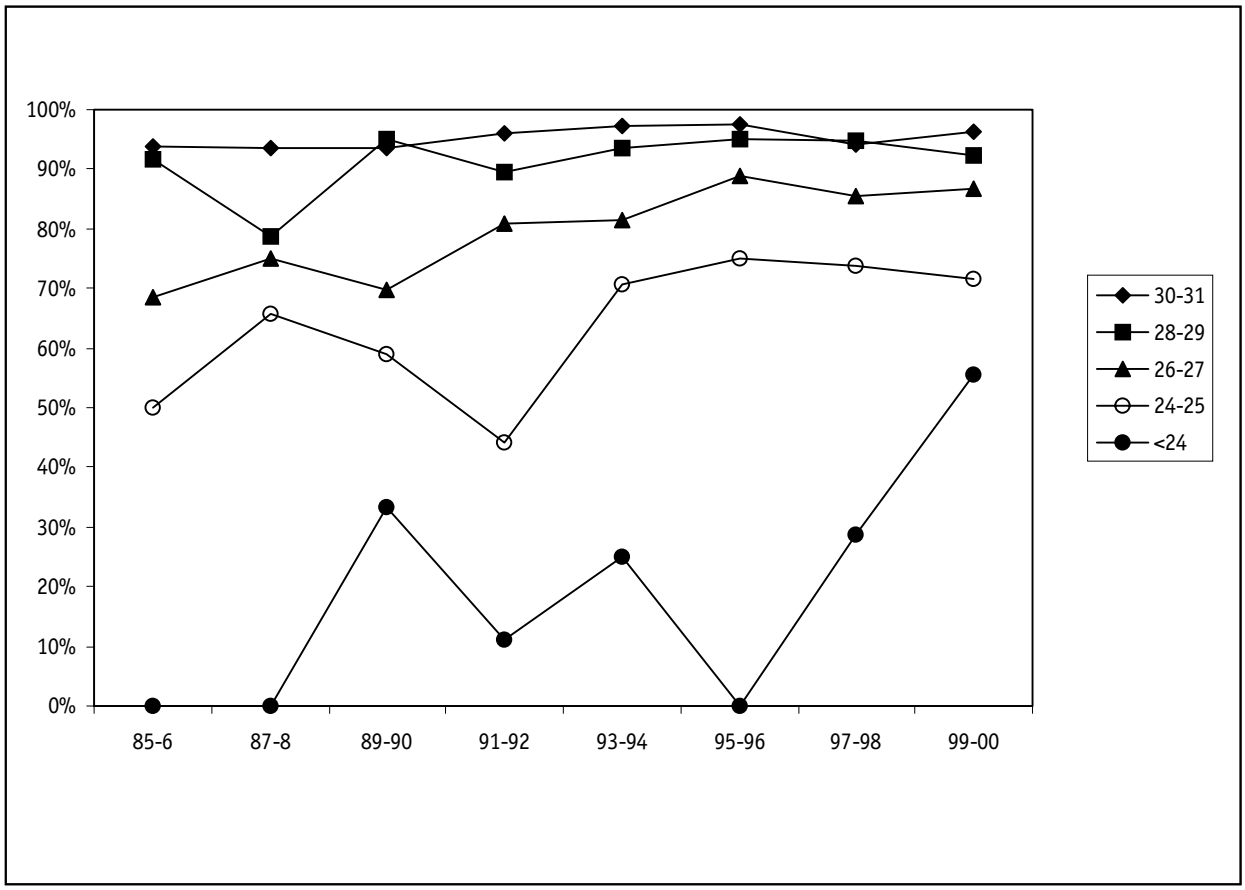

Figure 53: Survival by gestational age of all <1500 gram infants admitted to NICU from 1985-1999

Comment:

Survival of babies of 24 and 25 weeks gestation has risen from 50% in 1985-6 to the best of 75% in 1995-2000.

At 26-27 weeks gestation, survival has risen from under 67% to over 85% over the last 6 years. At 28 weeks and over survival has been over 90% for most years over the whole 15 years. At these gestations with few deaths, babies with lethal abnormalities have a considerable influence on the survival figures.

5.8 NEONATAL AND INFANT DEATHS

5.8.1 Total Number of Neonatal and Infant Deaths

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Inborn	61	73	62	75	47	62	51	56	42	60
Outborn	10	11	5	7	3	9	4	11	6	9
Total	**71**	**84**	**67**	**82**	**50**	**71**	**55**	**67**	**48**	**69**

5.8.2 Classification of Deaths

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Early neonatal	54	65	51	64	40	58	43	51	33	49
Late neonatal	8	11	9	13	8	9	9	7	9	11
Total neonatal	62	76	60	77	48	67	52	58	42	60
Post neonatal	8	8	7	5	2	4	3	9	6	9

5.8.3 Causes of Death

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Extreme prematurity	25	34	17	40	26	30	24	33	16	31
Premature	6	4	9	7	3	4	6	2	4	4
Term/post term	10	10	5	4	2	3	3	5	1	8
Associated abnormality	14	18	18	10	8	15	8	11	9	12
Lethal malformation	16	18	18	21	11	19	14	16	18	14

Note: Seven babies died after discharge from NWH and are included in the paediatric section of this report. Five of these were late neonatal deaths and two were infant deaths. One was from birth asphyxia, three from associated abnormalities and three had lethal malformations. One died in hospice care, three at home and three in other hospitals.

CAUSES OF DEATH

1	Extreme Prematurity	Deaths in infants <28 weeks gestation
2	Premature	Deaths in infants 28 - 36 weeks gestation
3	Term/post term	Deaths of infants over 36 weeks gestation
4	Associated Abnormality	Deaths of infants in whom a congenital abnormality had a major influence on outcome, but in whom treatment was attempted
5	Lethal malformations	Deaths in infants with abnormalities severe enough to preclude treatment

5.8.4 Deaths from Extreme Prematurity (n=31)

Babies under 28 weeks gestation remain a large group of baby deaths. The majority of these babies died in the delivery room; in 15 no attempt was made to resuscitate because of the gestational age and size, and in 3 resuscitation failed.

Gestational Age	Birth Weight	Age Died	Sex	Hospital of Birth	Apgar 1/5	Cause of Death
20	220	0	M	NWH		Not resuscitated
20	350	0	M	NWH	1/1	Not resuscitated
20	365	0	M	NWH	1/1	Not resuscitated
20	370	0	F	NWH	2/2	Not resuscitated
21	305	0	F	NWH	2/2	Not resuscitated
21	445	0	M	NWH	3/1	Not resuscitated
21	480	0	M	NWH	3/1	Not resuscitated
22	450	0	F	NWH	1/1	Not resuscitated
22	450	0	M	NWH	1/0	Not resuscitated
22	475	0	M	NWH	1/1	Not resuscitated
22	530	0	M	NWH	1/0	Not resuscitated
22	635	0	M	NWH	3/0	Not resuscitated
23	405	0	F	NWH	0/0	Not resuscitated
23	520	0	F	NWH	1/1	Failed resuscitation, twin-twin Tx
23	545	0	F	NWH	1/0	Not resuscitated
23	585	0	F	NWH	0/0	Not resuscitated
23	605	5	F	NWH	2/5	RDS
23	640	19	F	NWH	6/10	PIE, with Pneumatocele
23	675	57	M	NWH	4/4	BPD
24	540	27	M	NWH	2/6	Candida sepsis, BPD
24	600	0	F	NWH	2/1	Failed resuscitation
24	630	34	M	Palm. Nth	9/9	BPD
25	620	72	F	NWH	6/8	Necrotising Enterocolitis
25	725	16	F	NWH	4/9	Grade 4 IVH
25	835	4	M	NWH	7/9	Grade 4 IVH
25	895	0	M	NWH	5/7	Septicaemia, RDS
25	935	0	M	NWH	1/1	Failed resuscitation
26	600	4	F	NWH	3/9	RDS Twin-twin Tx
26	880	94	M	NWH	2/4	HIE, BPD
26	1020	12	F	NWH	5/9	Grade 4 IVH
26	1040	7	F	NWH	5/10	Pericardial tamponade, Grade 4 IVH

5.8.5 Deaths in Premature (n=4)

Gestational Age	Birth Weight	Age Died	Sex	Hospital of Birth	Apgar 1/5	Cause of Death 1
28	595	0	M	NWH	5/9	Grade 4 IVH
29	1000	3	F	NWH	3/5	Gram negative septicaemia
30	1400	56	M	Whangarei	8/8	HIE postnatal
32	1800	0	M	NWH	0/1	Perinatal asphyxia

5.8.6 Deaths in Term/Post Term

There were 8 deaths in term and post-term infants in 2000, all related to perinatal asphyxia.

Gestational Age	Birth Weight	Age Died	Sex	Hospital of Birth	Apgar 1/5	Cause of Death
38	3430	3	F	MMH	0/1	Perinatal asphyxia
38	4500	0	M	Waitakere	0/0	Perinatal asphyxia
38	4560	1	M	Northshore	1/4	Perinatal asphyxia
39	2590	3	M	NWH	1/4	PPHN, perinatal asphyxia
39	3115	1	M	NWH	0/4	Perinatal asphyxia
39	3700	41	M	Birthcare	0/5	Perinatal asphyxia
40	4100	0	F	Northshore	3/3	Pulmonary haemorrhage, HIE
41	3080	4	F	Waitakere	2/3	Perinatal asphyxia

5.8.7 Deaths Associated with Abnormalities (n=12)

This category of 'Associated Abnormalities' has been used in the Paediatric Department for many years to distinguish those babies in whom malformations contributed to death from those without malformations who die from perinatal problems. This gives a clearer picture of survival changes for normally formed babies. The distinction can be debatable, for instance with premature babies with oligohydramnios from prolonged rupture of the membranes and accompanying pulmonary hypoplasia who are classified as having an associated abnormality rather than dying from complications of prematurity.

Gestational Age	Birth Weight	Age Died	Sex	Hospital of Birth	Apgar 1/5	Cause of Death
25	505	11	M	NWH	7/10	Trisomy 21, systemic candidiasis
25	725	0	F	NWH	2/5	Pulmonary hypoplasia, PPROM
25	1035	1	M	NWH	5/6	Non-immune hydrops
26	1055	1	F	NWH	2/7	Non-immune hydrops, twin-twin Tx
26	1065	0	F	NWH	1/5	Pulmonary hypoplasia, PPROM
28	1480	1	M	Kaitaia	5/6	Trisomy 21
33	2320	15	M	NWH		Polycystic kidneys, renal failure
34	2200	47	M	NWH	1/3	Ruptured omphalocele
36	2020	0	M	NWH	2/2	Cervical teratoma
36	2480	7	F	NWH	7/7	Diaphragmatic hernia
39	3255	13	M	NWH	5/8	Diaphragmatic hernia
39	3700	1	M	NWH	8/7	Diaphragmatic hernia, Tetralogy of Fallot

5.8.8 Deaths with Lethal Malformations (n=13)

The term lethal malformation is used for those babies whose abnormalities were such that treatment was not attempted or was withdrawn when the diagnosis became clear. Hypoplastic left heart syndrome is now treatable, but some parents opt for no surgical treatment.

Gestational Age	Birth Weight	Age Died	Sex	Hospital of Birth	Apgar 1/5	Cause of Death
21	460	0	F	NWH	1/1	Multicystic dysplastic kidneys, pulmonary hypoplasia
21	680	0	M	NWH	1/0	Potters syndrome
22	430	0	F	NWH	1/1	Cloacal bladder extrophy
22	500	0	M	NWH	1/1	Diaphragmatic hernia
22	555	0	F	NWH	1/0	Potters syndrome
29	1215	0	M	NWH	2/1	Fetal akinesia, pulmonary hypoplasia
30	1315	50	F	NWH	6/8	Brain stem abnormality
34	2210	38	M	NWH	7/9	Complex cardiac abnormalities
35	2690	0	M	NWH	2/4	Potters syndrome
36	3305	0	M	NWH	1/1	Multicystic dysplastic kidneys, pulmonary hypoplasia
37	1750	24	F	NWH	6/8	Trisomy 18, tetralogy of Fallot
37	2525	13	M	NWH		Hypoplastic L heart (not treated)
38	3880	3	F	NWH	6/8	Conjoined twin
38	3880	3	F	NWH	6/8	Conjoined twin

5.9.1 Follow Up at 18 Months

Findings are presented for follow up at 18 month of age of VLBW children born during 1997. (Refer CDU Reports for children born 1985 to 1997).

The majority of children were examined by specialist paediatricians and developmental psychologists but where families could not attend NWH, reports of developmental progress were obtained from professionals in other centres. After exclusion of infants with congenital abnormalities (n=9), data were obtained for 120 (92.2%) of the 129 infants. Children were categorised according to the scheme shown in the following table.

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
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.

5.9.2 Children Under 1500 Grams Birth Weight Born in 1997

Outcome at 18 Months in Gestational Age Groups

Outcome Category	Gestational Age (weeks)					
	Under 28		28 - 35		Total	
	n = 50	(%)	n = 70	(%)	n = 120	(%)
I	4	(8.0)	1	(1.4)	5	(4.2)
II	19	(38)	5	(7.2)	24	(20)
III	9	(18)	10	(14)	19	(16)
IV	18	(36)	54	(77)	72	(60)

5.9.3 Children Under 1500 Grams Birth Weight Born in 1997. At 18 Months in Birth Weight Groups

Outcome Category	Birth Weight (grams)					
	<1000 gms		1000 - 1499 gms		Total	
	n = 59	(%)	n = 61	(%)	n = 120	(%)
I	5	(8.5)	0	(0)	5	(4.2)
II	18	(31)	6	(9.8)	24	(20)
III	24	(20)	7	(12)	19	(16)
IV	18	(41)	48	(79)	72	(60)

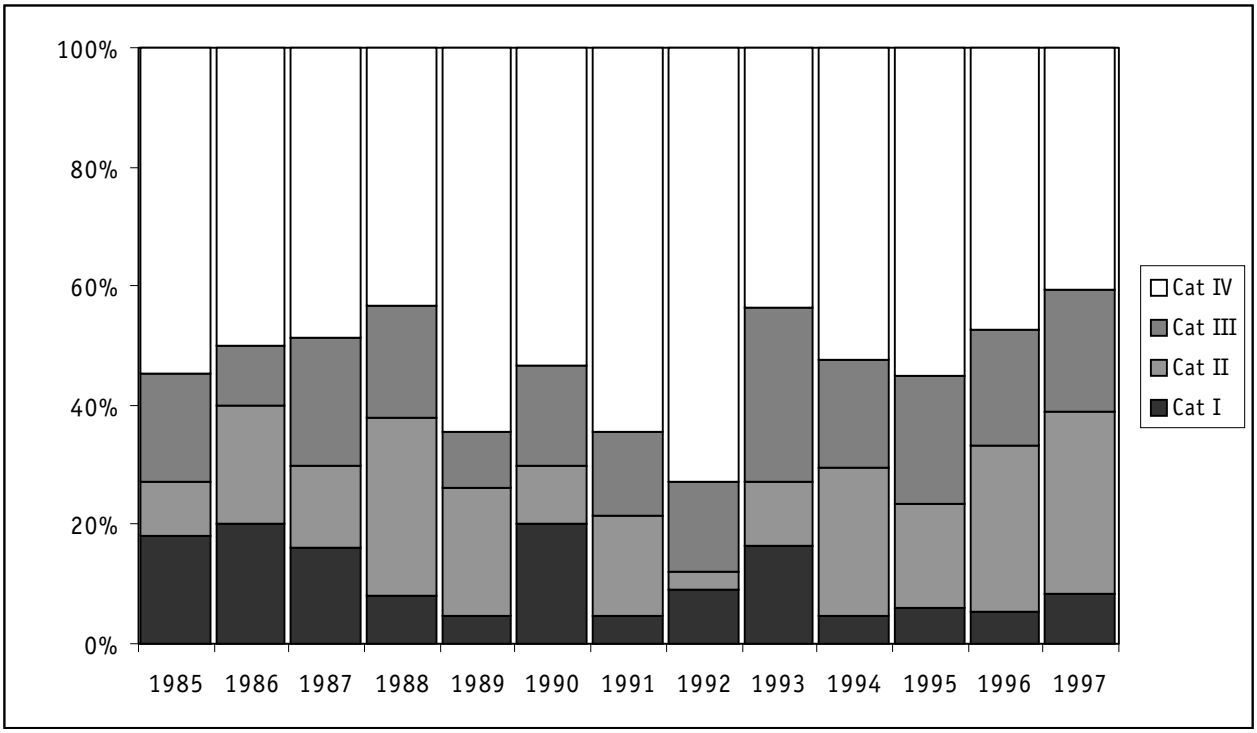

Figure 54: Neurodevelopmental outcome of babies with birth weight <1000 grams born from 1985-1997

EVALUATION AT 4 YEARS

Eighty nine of 110 VLBW children born in 1995, who did not have abnormalities and lived in the Auckland region were assessed at the Child Development Unit. Twenty-nine were <1000 grams birth weight and 60 were between 1000 and 1499 gms.

	<1000 gm	1000 - 1499 gm	
Cognitive development[1]	96 $\pm$ 15	101 $\pm$ 12	Not significant[2]
Motor co-ordination[3] (in average range)	52%	62%	Not significant
Quality of language[4] (in average range)	76%	72%	Not significant
Intelligibility of speech[4] (in average range)	72%	78%	Not significant
Attention span[4] (in average range)	52%	70%	Not significant
Activity level[4] (higher than expected)	41%	25%	Not significant
Oppositional behaviour[5] (significant problem)	24%	3%	p<0.1
Cognitive problems/in-attention[5]	31%	8%	p<0.5

1 Stanford-Binet Intelligence Scale, 4th edition, 1996
2 The larger group were significantly better at abstract/visual reasoning.
3 Vineland Adaptive Behavior Scales, 1984: Motor Skills Domain.
4 Likert Scale 1 - 5.
5 Connors' Parent Rating Scale - Revised (S), 1997

Many very low birth weight infants develop normally and cannot be distinguished from their full term peers. In the 1995 cohort, the results for the Stanford-Binet Composite Scores are positive, however abstract/visual reasoning continues to present difficulties for a number of these children, particularly those <1000 gms birth weight. Likewise, a higher proportion of these children are below average for fine and gross motor co-ordination. Behaviour reported by parents is of concern, especially for the lighter birth weight infants.

PUBLICATIONS AND PRESENTATIONS AT NATIONAL AND INTERNATIONAL CONFERENCES

PAPERS

Battin MR, Yan J, Aftimos S, Roberts A. Congenital chylothorax in siblings. British Journal of Obstetrics & Gynaecology 2000; 107: 1516-18.

Bauer MK, Harding JE, Breier BH, Gluckman PD. Exogenous GH infusion to late-gestation fetal sheep does not alter fetal growth and metabolism. Journal of Endocrinology 2000; 166: 591-7.

Darlow BA, Winderbourn CC, Inder TE, Graham PJ, Harding JE, Weston PJ, Austin NC, Elder DE, Mogridge N,Buss IH, Sluis KB. The effect of selenium supplementation on outcome in very low birthweight infants: A randomized controlled trial. Journal of Pediatrics 2000; 136: 473-80.

Dezoete JA, MacArthur BA. Some influences on cognitive development in a group of very low birthweight infants at 4 years. New Zealand Medical Journal 2000; 13: 207-210.

Fryns JP, Aftimos S. New MR/MCA syndrome with distinct facial appearance and general habitus, broad and webbed neck, hypoplastic inverted nipples, epilepsy, and pachygyria of the frontal lobes. Journal of Medical Genetics 2000; 37: 460-2.

Gunn AJ, Gunn TR, Mitchell EA. Is changing the sleep environment enough? Current recommendations for SIDS. Sleep Medicine Reviews 2000; 4(5): 453-69.

Gunn AJ, Maxwell L, de Haan HH, Bennet L, Williams GE, Gluckman PD, Gunn TR. Delayed hypotension and subendocardial injury after repeated umbilical cord occlusion in near-term fetal lambs. American Journal of Obstetrics & Gynecology 2000; 183(6): 1564-72.

Gunn TR, Tonkin SL, Hadden W, Davis SL, Gunn AJ. Neonatal micrognathia is associated with small upper airways on radiographic measurement. Acta Paediatrica 2000; 89: 82-7.

Gunn TR, Thompson JM, Jackson H, McKnight S, Buckthought G, Gunn AJ. Does early hospital discharge with home support of families with preterm infants affect breastfeeding success? A randomized trial. Acta Paediatrica 2000; 89(11): 1358-63.

Jensen EC, Van Zijl P, Evans PC, Harding JE. The effect of IGF-1 on serine metabolism in fetal sheep. Journal of Endocrinology 2000; 113: 361-2.

Kuschel CA, Evans N, Askie L, Bredemeyer S, Nash J, Polverina J. A randomised trial of enteral feeding volumes in infants born before 30 week's gestation. Journal of Paediatrics and Child Health 2000; 36(6): 581-6.

McCowan LME, Harding JE, Roberts A, Barker S, Ford C, Stewart A. A pilot randomized controlled trial of two regimens of fetal surveillance in small-for-gestational-age fetuses with normal umbilical artery Doppler velocimetry. American Journal of Obstetrics and Gynecology 2000; 182: 81-6.

McCowan LME, Harding JE, Stewart AW. Umbilical Doppler studies in small for gestational age babies reflect disease severity. British Journal of Obstetrics and Gynaecology 2000; 107: 916-25.

McGaughran J, Aftimos S, Oei P Trisomy of 3pter in a patient with apparent C (trigonocephaly) syndrome. American Journal of Medical Genetics 2000; 94: 311-5.

North RA, Taylor S, Gunn TR. Infants of women with reflux nephropathy are at risk of vesico-ureteric reflux. Australian & New Zealand Journal of Obstetrics & Gynaecology 2000; 40(3): 280-5.

Robertson SP, Shears DJ, Oei P, Winter RM, Scambler PJ, Aftimos S, Savarirayan R. Homozygous deletion of SHOX in a mentally retarded male with Langer Mesomelic dysplasia. Journal of Medical Genetics 2000; 37: 959-64.

CHAPTERS, REVIEWS AND COMMENTARY

Gunn AJ, Battin MR. Hypothermic Centralization: New use for old knowledge? Pediatrics 2000; 106: 133-4.

Battin M, Rutherford M. MRI of the preterm brain from 24 weeks to term. In: Imaging the Neonatal Brain. WB Saunders, London 2000.

Fetus and Newborn Committee of the Paediatric Society of New Zealand. Routine examination of the newborn. New Zealand Medical Journal 2000; 113: 361-2.

Thomas C. Adding human milk fortifier to breast milk. New Zealand Association of Neonatal Nurses Newsletter 2000; 6(3): 10-11.

Thomas C. Maternal feelings of expressing milk at the baby's bedside. New Zealand Association of Neonatal Nurses Newsletter 2000; 2(6): 11.

ABSTRACTS

Anderson-Hawke K. Introducing the neonatal nurse practitioner role and the post graduate master of nursing with a neonatal endorsement. Women's Hospitals of Australia Conference, 2000; Melbourne.

Armstrong D, Battin M. Invasive staphylococcus aureus infection in neonatal intensive care. Proceedings of the 4th Annual Congress of the Perinatal Society of Australia and New Zealand, 2000; Brisbane: P68, p198.

Armstrong D, Bloomfield F, Penrice J, Dezoete A, Knight D, Harding J. A randomised trial of two courses of dexamethasone for preterm infants at risk of chronic lung disease; Follow-up at 18 months. Proceedings of the Joint Summer Meeting of The Neonatal Society and the Section on Neonatal Medicine of The Dutch Paediatric Association, 2000; The Netherlands: p22.

Armstrong D, Bloomfield F, Penrice J, Dezoete A, Knight D, Harding J. Follow-up of a randomised trial of two different courses of dexamethasone for perterm babies at risk of chronic lung disease. Proceedings of the 4th Annual Congress of the Perinatal Society of Australia and New Zealand, 2000; Brisbane: A105, p105.

Armstrong DL, Harding JE, Teele RL. Diagnosis of significant patent ductus arteriosus in preterm infants using renal arterial Doppler resistive index. The Australasian Society of Ultrasound in Medicine Annual Scientific Meeting, 2000; Auckland.

Armstrong D, Harding JE, Teele RL. Resistive index from renal arterial Doppler in the diagnosis of significant patent ductus arteriosus in preterm infants. Proceedings of the 4th Annual Congress of the Perinatal Society of Australia and New Zealand, 2000; Brisbane: P152, p283.

Battin M, Dezoete A, Gunn AJ. Neurodevelopmental outcome of infants treated with selective head cooling following perinatal asphyxia. Pediatric Research, 2000: 47: 1783A.

Bennet L, Westgate JW, Gunn TR, Gunn AJ. The role of the parasympathetic nervous system in the control of fetal blood flow during asphyxia. Fetal and Neonatal Physiological Society, 2000; Southampton.

Bloomfield FH, Bauer MK, Gluckman PD, Harding JE. Amniotic supplementation with IGF-1 reverses the gastrointestinal effects of placental embolisation in the ovine fetus. 82nd Annual Meeting of the Endocrine Society, 2000; Toronto: A947.

Bloomfield FH, Breier BH, Harding JE. Gastrointestinal uptake of intra-amniotic 1251-IGF-1 in ovine fetuses. 82nd Annual Meeting of the Endocrine Society, 2000; Toronto: A950.

Garton D. MRSA in the NICU. New Zealand Association of Neonatal Nurses' Conference, 2000; Wellington.

Gluckman PD, Bloomfield FH, Van Zijl PL, Harding JE. Growth factors in amniotic fluid: Role in fetal growth and gastrointestinal development. European Congress of Perinatal Medicine, 2000; Portugal.

Gluckman PD, Gunn TR, Battin M, Gunn AJ. Hypothermia - a multicentre trial. XV11th European Congress of Perinatal Medicine, 2000; Portugal.

Gunn AJ, Battin M, Bennet L, Gunn TR. Why cool the head after perinatal asphyxia? Teratology 2000; 62(2): 138.

Harding JE. Pathophysiology of intrauterine growth restriction. 11th Congress of the Federation of the Asia and Oceania Perinatal Societies, 2000; Manila.

Hawkins P, Oliver MH, Gluckman PD, Harding JE. Periconceptual maternal undernutrition alters fetal-placental metabolism in late gestation fetal sheep. Proceedings of the 14th National Workshiop on Fetal and Neonatal Physiology, 2000; Brisbane: A14.

Hawkins P, Oliver HM, Gluckman PD, Harding JE. Periconceptual maternal undernutrition alters fetal growth and length of gestation in sheep. Proceedings of the 4th Annual Congress of the Perinatal Society of Australia and New Zealand, 2000; Brisbane: A43, p 43.

Knight DB. Audit of a change in practice to an emphasis to CPAP rather than IPPV. Perinatal Society of New Zealand, 2000; Hamilton.

Kuschel CA, McGaughran J, Souter DJ. Antenatal findings suggesting aneuploidy in alveolar capillary dysplasia. Proceedings of the 4th Annual Congress of the Perinatal Society of Australia and New Zealand, 2000; Brisbane: P5, p135.

Lawry D. NICU Design Meeting Infant's Developmental Needs. New Zealand Association of Neonatal Nurses' Conference, 2000; Wellington.

McCowan L, Harding J, Pryor J. Neurodevelopmental outcome in small for gestational age children at 18 months is better with pregnancy induced hypertension. International Society for the Study of Hypertension in Pregnancy, 2000; Paris.

McCowan L, Harding J, Pryor J. Neurodevelopmental outcome in small for gestational age children at 18 months is better with pregnancy induced hypertension. Perinatal Society of New Zealand, 2000; Hamilton: A2, p4.

McCowan LME, North RA, Harding JE. Uterine artery Doppler abnormalities in small for gestational age pregnancies are associated with subsequent hypertensive complications and the severity of growth restriction. Proceedings of the 4th Annual Congress of the Perinatal Society of Australia and New Zealand, 2000; Brisbane: A126, p 26.

Ng E, Kuschel CA, Perlman M. Dexamethasone for term infants with persistent severe respiratory distress to facilitate weaning from mechanical ventilation and oxygen. Pediatric Academic Societies Annual Meeting, 2000; Boston: 2487.

Oliver MH, Hawkins P, Gluckman PD, Harding JE. Periconceptual undernutrition influences organ size in the late gestation sheep fetus. Proceedings of the 14th National Workshop on Fetal & Neonatal Physiology, 2000; Brisbane: A 11.

Oliver MH, Hawkins P, Gluckman PD, Harding JE. Undernutrition in the periconceptual period influences metabolic responses of fetal sheep to maternal fasting in late gestation. Proceedings of the 4th Annual Congress of the Perinatal Society of Australia and New Zealand, 2000; Brisbane: A92, p92.

Page B, Battin M. "Who is fastest, who is slowest and who is dirtiest?" An audit of Neonatal Long Line use. Perinatal Society of New Zealand, 2000; Hamilton.

Parsons A, Clarkson PM, Hoffman P, Wilson N. Cardiac failure in infancy due to hypocalcaemia. What is the catch? Paediatric Society of New Zealand, 2000; Napier.

Rowe D, Peachey S. Education and services available for flight transports at National Women's Hospital. Neonatal Flight Nurses' Conference, 2000; Wellington.

Rowe D, Peachey S. Effects of Neonatal Physiology in Flight. Neonatal Flight Nurses' Conference, 2000; Wellington.

Rush W, McNeil E, Battin M. Audiology outcome following intensive care in the high risk neonate. Perinatal Society of New Zealand, 2000; Hamilton.

Van Zijl PL, Bloomfield FH, Harding JE. Amino acid concentrations in amniotic fluid of normal and growth-restricted ovine fetuses determined by a novel HPLC method. Proceedings of the 14th National Workshop on Fetal and Neonatal Physiology, 2000;
Brisbane: A32.

Vogel AM, Lennon D, Harding J. The management of bronchiolitis in New Zealand. Annual Scientific Meeting of the Paediatric Society of New Zealand, 2000; Hastings.

Vogel AM, Lennon D, Harding J. Trends in bronchiolitis admissions in New Zealand. Annual Scientific Meeting of the Paediatric Society of New Zealand, 2000; Hastings.

Vogel AM, McKinlay M, Harding J, Lennon D. A New Zealand cost benefit analysis of palivizumab. Annual Scientific Meeting of the Paediatric Society of New Zealand, 2000; Hastings.