National Women's Annual Clinical Report 2006

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Disclaimer

The purpose of this publication is to promote discussion and audit outcomes. The opinions expressed in this publication do not necessarily reflect the official views of NW and Auckland District Health Board.

Acknowledgements

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Welcome to our 2006 Annual Clinical Report. Our Annual Clinical Report is our vehicle for the formal review and analysis of our performance. Making this information public provides the opportunity to share our results with colleagues and to receive valued feedback.

This year's report includes some enhanced data collection that furthers our understanding of some important issues and I have no doubt will lead to some interesting discussion. The better our understanding of the services we provide, the greater opportunity we have to improve.

NW continue to enjoy the great facilities of Auckland City Hospital and the Greenlane Clinical Centre and we know that the women who spend time with us do so in facilities that are women focussed and they are supported by staff committed to providing the best possible service.

Thank you for sharing in our Annual Clinical Report.

Kay Hyman
General Manager
NW Health

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INTRODUCTION

1 INTRODUCTION

1.1 Purpose of this Report

The purpose of the NW Annual Clinical Report is:

- To chronicle the care provided at NW during 2006
- To demonstrate trends in the population, service provision, and outcomes over time
- To stimulate further analysis and thus improvement in services provided by NW
- To encourage external commentary and critique of care provided at NW
- To provide a benchmark for obstetric and neonatal care in New Zealand against which other services might compare themselves

1.2 Report structure

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

Chapter 1: Introduction
This chapter provides background information, describes the data sources and the methodology.

Chapter 2: Summary statistics
This chapter provides, for the obstetric and neonatal population at NW, the summary data on principal outcomes.

Chapter 3: Maternal demography
This chapter provides information on domicile, age, ethnicity, parity, smoking behaviour, BMI and LMC for the women who birthed at NW. It also provides data on the characteristics of standard primipara at NW.

Chapter 4: Antenatal complications
This chapter focuses on the following antenatal complications: diabetes, preterm birth, multiple pregnancy, antepartum haemorrhage, growth restriction, hypertensive disease and cervical cerclage.

Chapter 5: Labour and birth
This chapter focuses on birth interventions including induction of labour, mode of birth, and neonatal and maternal outcomes associated with birthing. It also provides data on normal birth and on outcomes of women labouring at Birthcare Auckland.

Chapter 6: **Labour and birth outcomes**
This chapter includes the outcomes for labour and birth, including perineal trauma, postpartum haemorrhage, emergency peripartum hysterectomy, and neonatal outcomes.

Chapter 7: Postnatal care
This chapter focuses on feeding outcomes and provision of postnatal care.

Chapter 8: Newborn services
This chapter describes interventions and outcomes for the babies cared for in the newborn intensive care unit in 2006. It includes a report of activity of the Child Development Unit.

Chapter 9: Maternal and perinatal mortality
This chapter provides information and analysis about mothers and babies who died at NW.

Chapter 10: Fertility
This chapter documents the IVF and ICSI clinical outcomes from Fertility Plus in 2006 and a discussion on recent advances in the service.

Chapter 11: Gynaecology
This chapter provides limited information on inpatient and outpatient services provided at NW.

Chapter 12: Termination of pregnancy
This chapter provides information on the number and demographic characteristics of women cared for at Epsom Day Unit.

Appendices
The appendices provide additional detailed statistical tables for the chapters. The appendices are numbered consistently with the chapters to which they apply.

1.3 Description of mothers and babies included in the Annual Clinical Report

The Maternity section of this Annual Clinical Report includes data pertaining to women giving birth to their babies at and beyond 20 weeks gestation at NW during the 2006 calendar year or, if prior to arrival, due to unplanned birth at home or en route (BBA = born before arrival), and the babies of these women. Data in the Neonatal section pertain to all babies admitted to and cared for at the NW Newborn Intensive Care Unit if born during the 2006 calendar year. This includes babies transferred from other units or home.

1.4 Data sources

Data for this report have been extracted from Healthware (*ibahealth*) and from stand-alone databases for Neonatology, Perinatal Mortality, Fertility Plus, Epsom Day Unit, and from the Decision Support Unit (DSU) who collect ICD-10 coded data on all inpatient admissions and from data collected manually by the Recurrent Miscarriage Clinic and the Early Pregnancy Assessment Unit (EPAU).

Data for years prior to 2001 were collected into the AMSIS (Auckland Maternity Services Information System) database. For this report, most data for the years prior to 2001, included in tables and figures to demonstrate time trends, have been obtained from previous Annual Clinical Reports.

1.4.1 Healthware

In 2001, Healthware was introduced to NW to replace the clinical database system AMSIS. The implementation process was difficult and no systems were initially put in

place for data extraction and cleaning. As a result, not all 2001 births were recorded. Further, data on all births were captured in 2002 and 2003, but these data were cleaned only sporadically with the focus directed to claiming maternity funding via Section 88.

Since 2004, Information Services staff have modified and developed early Healthware data extraction tools allowing improved flexibility. This has greatly enhanced clinical data management.

The majority of booking data on mothers with non-NW LMCs are entered into Healthware by one Healthware administrator. Booking data for NW bookings, and all antenatal, birth, and postnatal data are entered by clerks and NW midwives.

Cleaning is undertaken daily for birth numbers. On a monthly basis, cleaning of place and mode of birth and reconciliation with Birthcare numbers is undertaken. Further to this, monthly cleaning is undertaken for Section 88 claiming. This is primarily cleaning of missing data.

For the 2004 -2006 years, the data have been cleaned for the purpose of this clinical report. Cleaning has included completing missing data and checking out of range and inconsistent data. These cleaning strategies have been focussed around priority areas for reporting and areas where cleaning could be efficiently completed within the resource available. Further details of variables cleaned are provided below and in Appendix 1.

In 2006, Ward 97, (Gynaecology), worked hard to collect inpatient visit data. However, when audited against DSU coding data, the ward data were found to be incomplete.

1.4.2 Decision Support Unit (DSU)

DSU data were used, along with Healthware data, to clean hypertension, antepartum and postpartum haemorrhage, blood transfusion and medical history data. DSU data were again the principal source of general gynaecology data in 2006.

1.4.3 Neonatology database

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

1.5 Data quality

1.5.1 Maternity data quality

Specific cleaning queries were run and identified discrepancies were checked and corrected prior to analysis of the data for the 2006 NW Annual Clinical Report. These are listed in Appendix 1.

It should be acknowledged that these cleaning efforts, whilst extremely time consuming, are not comprehensive. On occasion, it became apparent during analysis that further cleaning was required and this was performed on an ad hoc basis and may not be included in the list provided in the appendix.

Services or individuals wishing to use the 2006 data for further analysis should be aware that areas not mentioned may not have been cleaned. For further advice please contact the NW Health Intelligence Department.

1.5.2 Neonatal data quality

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

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

1.6 Derived definitions (maternity)

The definitions given here are for derived variables (as opposed to variables collected directly by the Healthware database system). Definitions of some variables within Healthware are given in Appendix 1.

1.6.1 Maternal age

Defined as mother's age at her baby's birth.

1.6.2 Gestation

The gestation used in the maternity section of this report is derived from Best Estimate of date of birth (EDD Best) calculated by Healthware at booking based on Last Menstrual Period (LMP), scan data (overriding LMP data based on scan accuracy data sourced from the Australasian Society for Ultrasound Medicine), or clinical override of these dates as deemed appropriate. Healthware does not include gestation calculated from these data into its dataset, so this gestation, in weeks, is derived by taking the integer value of 40 + (date of birth - EDD Best)/ 7.

The derived gestation was then compared with the gestation entered into Healthware on examination of the baby at birth. Where this gestation differed from that defined above by at least 2 weeks, gestation was manually checked against the clinical record and data in Healthware amended where appropriate. Further checking was undertaken against gestation recorded in the perinatal mortality database for perinatal deaths and the neonatal database for all neonatal unit admissions. The clinical record was checked where gestation varied by at least 1 week in these instances.
Because of the incomplete reconciliation of data sets, there may be a minimal number of cases where gestation varies in reporting of the neonatal and maternity data.

1.6.3 Ethnicity

Ethnicity is collected at hospital registration with the standard census 2001 question. Three options are input into the CMS (Case Management System) database. In preparing the data for this report, each mother has been allocated to a single ethnic

group. When more than one ethnic group is recorded, the prioritised ethnicity system outlined in 'Ministry of Health. 2004. *Ethnicity Data Protocols for the Health and Disability Sector*. Wellington: Ministry of Health.' (available online at *http://www.nzhis.govt.nz/documentation/ethnicity/index.html)* has been used.
The most summarised (Level 1) prioritisation is as follows: Maori, Pacific peoples, Asian, other groups except NZ European, NZ European. To this, we have added 'Other European' and split 'Indian' from Asian, either because these are a large group in our population and/or because their obstetric risk profile is significantly different from the remaining women in the 'Other' or 'Asian' category. In the majority of figures in this document, these categories are recombined. Level 2 prioritisation is given in Appendix 1.

1.6.4 Standard primipara

Standard primipara is defined as a woman with

- no prior birth $\geq$ 20 weeks,
- aged 20-34 years at index birth,
- with a singleton pregnancy,
- cephalic presentation,
- gestation 37-41 weeks,
- baby not small for gestational age (customised centile $\geq 10^{th}$),
- no medical disease, defined as no history of cardiac disease, renal disease, mental health disorder, SLE, HIV infection, CVA/TIA, diabetes or hypertension,
- no gestational diabetes in index pregnancy,
- no pregnancy associated hypertensive disease in index pregnancy,
- and no antepartum haemorrhage during index pregnancy.

1.6.5 Onset of birth

Onset of birth has been defined by the 4 pathways to birth: (1) elective caesarean section, (2) emergency caesarean before the onset of labour, (3) induction of labour, and (4) spontaneous onset of labour.

1.6.6 Mode of birth for multiple pregnancies

For analyses where the denominator is mothers, mode of birth is represented as the mode of birth of the baby requiring most intervention. Mode of birth has been prioritised as emergency caesarean, elective caesarean, forceps, ventouse, vaginal breech, then spontaneous vertex birth.

1.7 Analytical and statistical methods

The data have been analysed using Access, Excel, StatView, EpiInfo, and STATA9. Tables are formatted with either column or row percentages as indicated.

1.8 Clinical indicators

Clinical indicators in maternity are largely only appropriate for use in benchmarking. Many of the data required for this exercise are provided in this report. There is inadequate evidence in many of the areas of greatest interest in obstetric care to determine what ideal rates should be for interventions and so use of clinical indicators to drive practice improvement is limited. Clinical intervention and outcome rates in obstetrics are also hugely affected by case-mix, as the data presented in this report even in relation to simple variables such as parity and age clearly demonstrate. Unless obstetric facilities can adjust for case-mix, benchmarking is of limited value.

At NW we have discussed various clinical indicator systems in current use, and for some years have contributed data to the WHA (Women's Health Australasia) benchmarking initiative. Ideally, we would establish a system to allow us to benchmark within New Zealand, and this is a goal which is increasingly achievable as obstetric clinical database systems become standardised across the country.

Chapter 2

SUMMARY STATISTICS

2 SUMMARY STATISTICS

2.1 Mother and baby numbers: NW 2006

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

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

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

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

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

		Mothers	Babies
National Women's births	Singletons	7035	7035
	Twins	157	314
	Triplets	5	15
Totals (not including BBA)		**7197**	**7364**
BBA	Singletons	15	15
	Twins	0	0
	Triplets	0	0
Totals (including BBA)		**7212**	**7379**

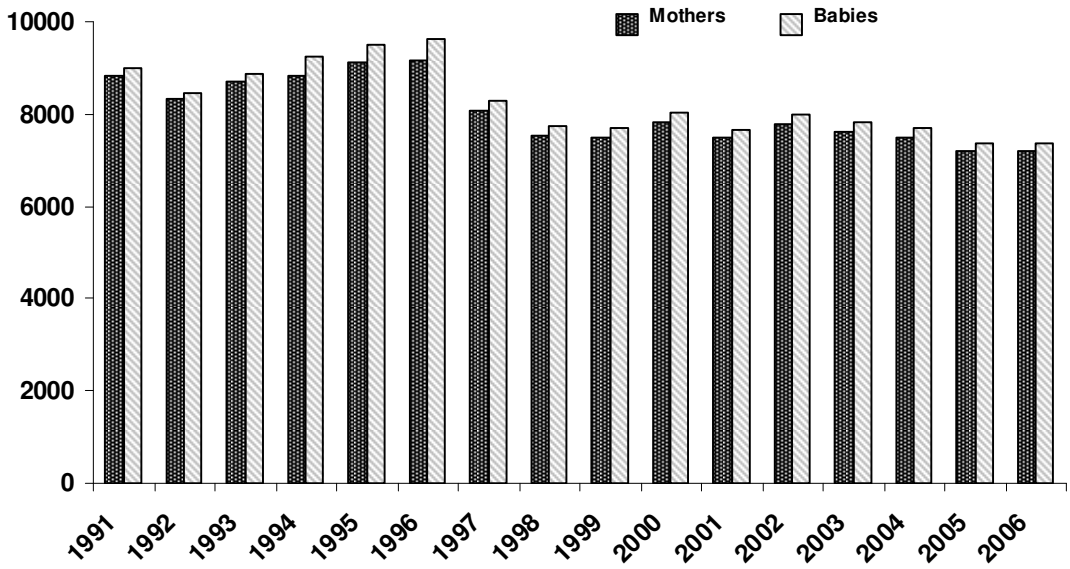

Figure 1: Numbers of women birthing and babies born at National Women's (1991-2006)

2.2 Summary of maternal outcomes 2006

Table 3: Mode of onset of birth

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

Table 4: Mode of birth

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

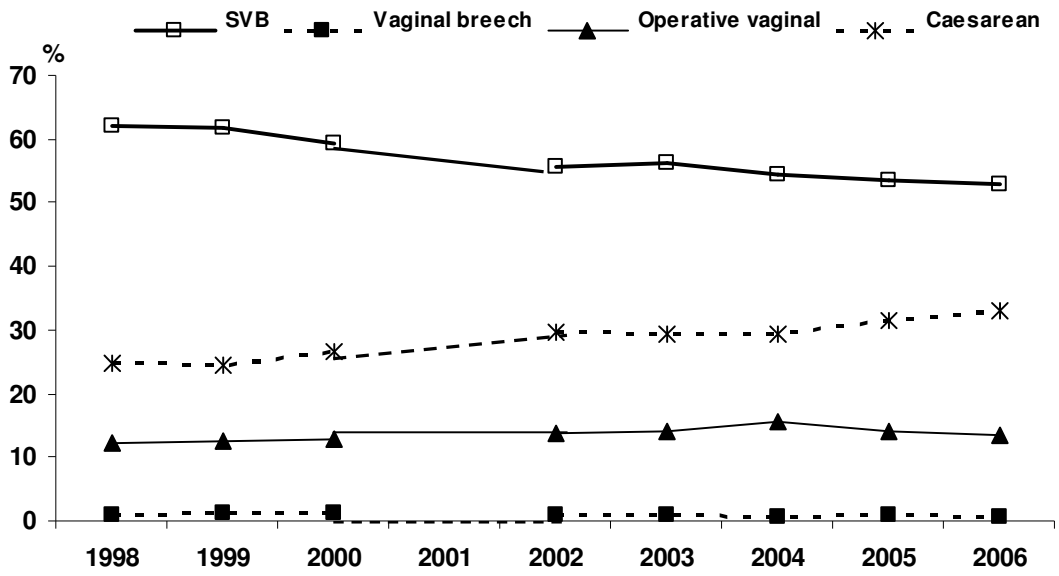

Figure 2: Mode of birth (1998-2006)

Table 5: Maternal postpartum outcomes

	Birthing mothers	n	%
PPH ≥1000mls	7212	554	7.7
SVB	3866	134	3.5
Instrumental vaginal birth	956	37	3.9
Caesarean section	2390	383	16.0
Episiotomy among vaginal births	4822	1103	22.9
Third/ fourth degree tears among vaginal births	4822	103	2.1
Postpartum blood transfusions	7212	150	2.1
Infant Feeding at discharge from NW facility (excludes babies admitted to NICU)			
Exclusive breastfeeding	6158	4546	73.8
Fully breastfeeding	6158	441	7.2
Partial breastfeeding	6158	958	15.6
Artificial feeding	6158	213	3.5

2.3 Summary of neonatal outcomes 2006

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

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

Table 7: Perinatal mortality 2006

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

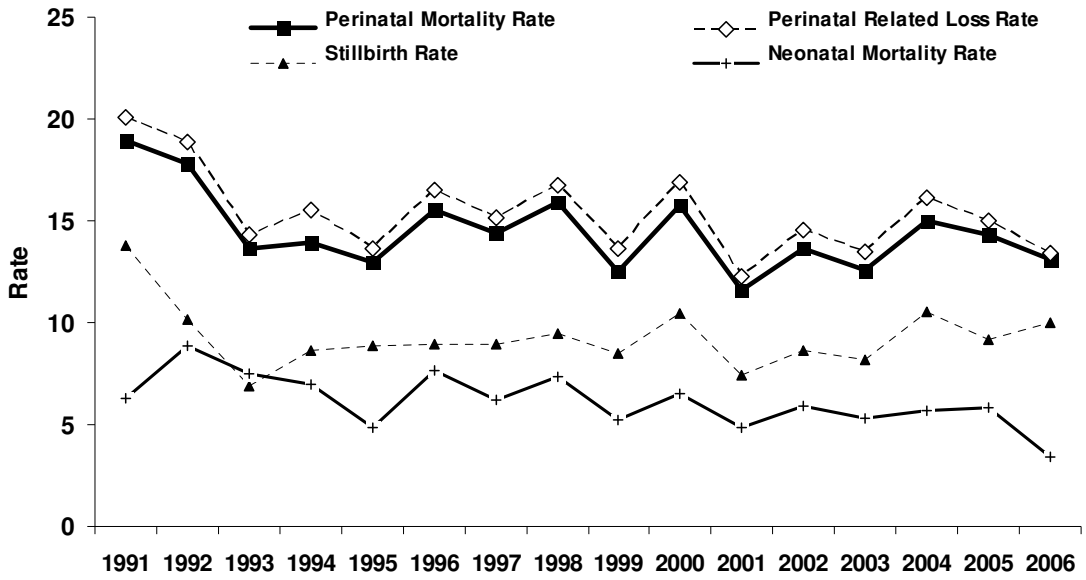

Figure 3: Perinatal mortality rate, perinatal related loss rate, stillbirth rate and neonatal mortality rate 1991-2006 (all rates expressed as deaths/1000 births)

Chapter 3

MATERNAL DEMOGRAPHY

3 MATERNAL DEMOGRAPHY

This chapter describes the demographic characteristics of the women birthing at NW. Additional data pertaining to this chapter can be found in Appendix 3.

3.1 Maternal domicile

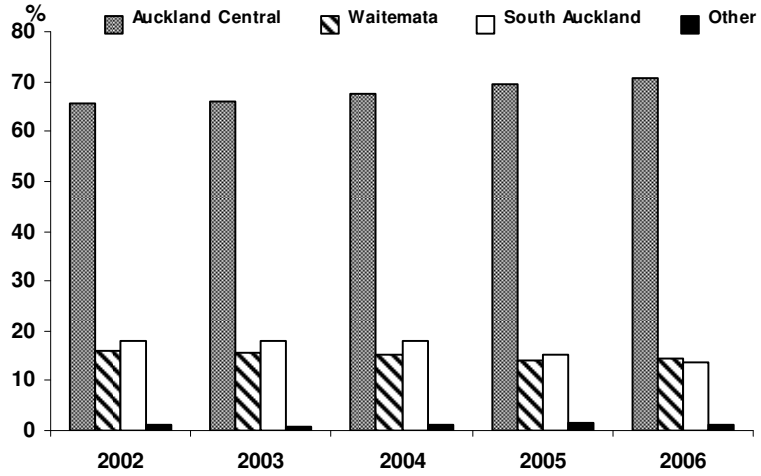

Figure 4: Domicile of women birthing at NW (2002-2006)

There has been a steady increase since 2002 in the proportion of women provided with maternity care at NW who are from our own District Health Board area. This is an associated drop in the proportions that are resident in the other Auckland board areas. Small numbers from Northland and other areas make up the 7212 birthing mothers in 2006.

3.2 Maternal age, parity, and ethnicity

The clear trends over the past years towards an aging maternal population with an almost equal proportion of multipara and nullipara are not evident in the data this calendar year. Whether this heralds a new stability in these maternal demographics remains to be seen.

Interpretation of time-trends in obstetric interventions and outcomes need to incorporate the marked demographic changes over the past 15 years. The most common age category among women having their first and later babies is now 31-35 years rather than the 26-30 years seen previously. The differing age and parity distributions by ethnicity should also be considered when comparing interventions and outcomes by ethnicity (Figures 6-8). European and Asian women are older and more likely to be nulliparous than Maori and Pacific mothers.

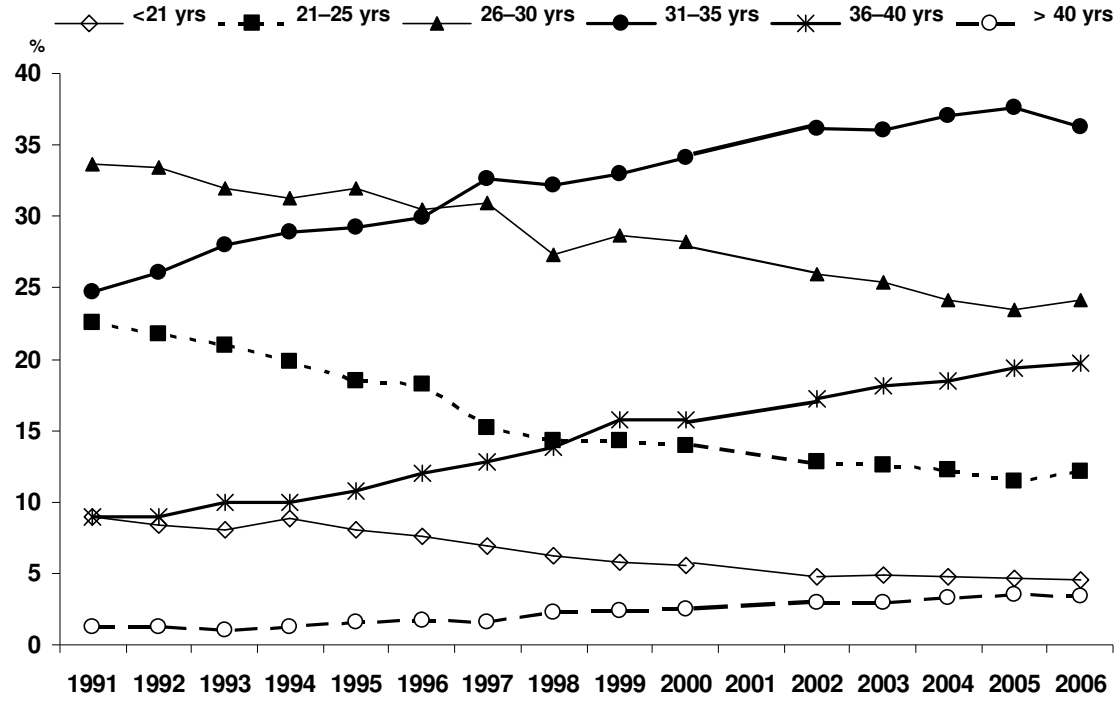

Figure 5: Maternal age distribution (1991-2006)

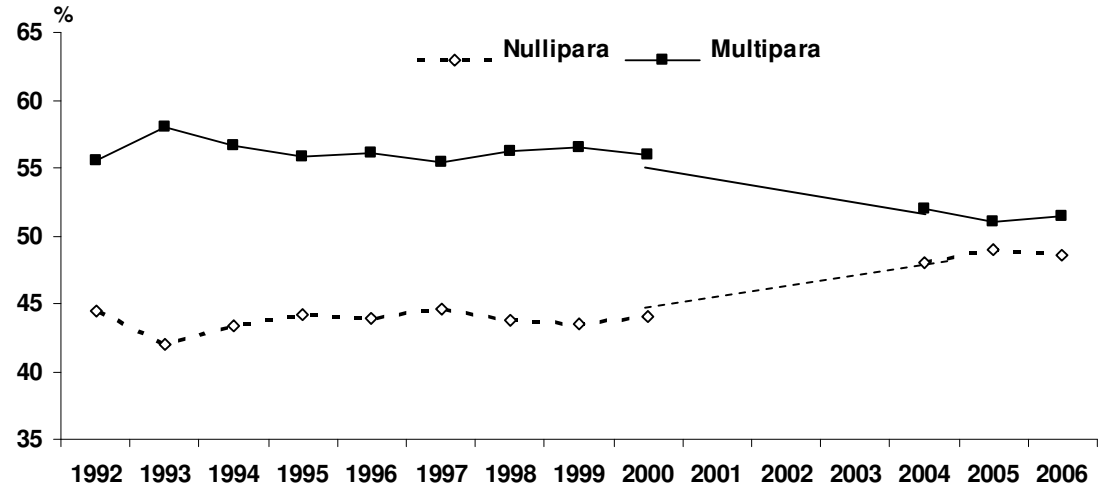

Figure 6: Parity distribution (1992-2006)

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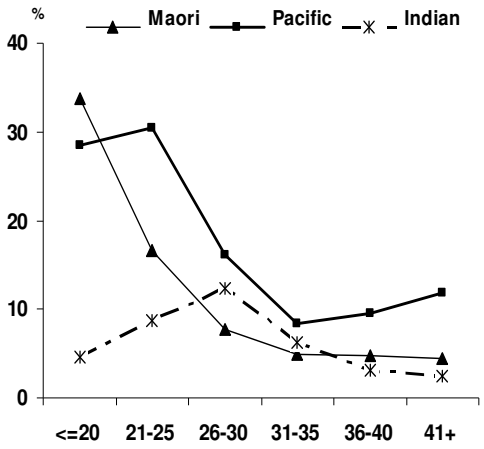

Figure 7: Maternal age among Maori, Pacific and Indian ethnicities (2006)

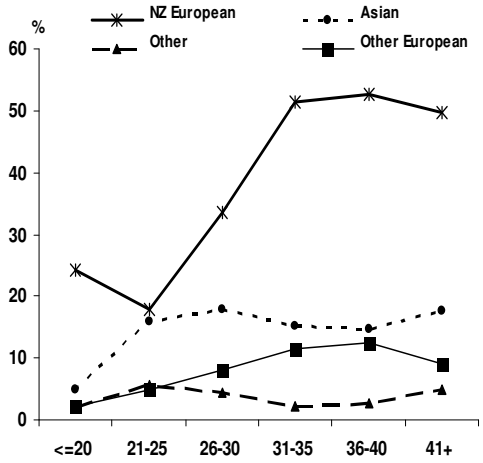

Figure 8: Maternal age among NZ European, Asian, Other European and Other ethnicities (2006)

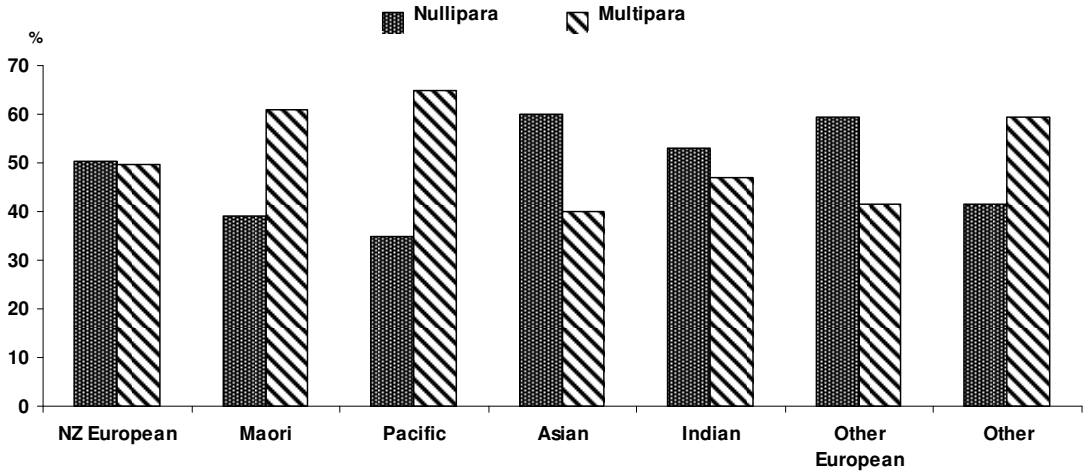

Figure 9: Parity distribution by maternal ethnicity (2006)

3.3 Lead Maternity Carer (LMC) and maternal demographic characteristics

In 2006, 40% of mothers were booked with independent midwives (IMW) at birth, 24% with private obstetricians, 19% with NW community clinics, 6% with NW Domino midwives, and 8% with NW diabetic and medical clinic midwives. Small numbers were under GP care, unbooked or transferred from other DHB areas. Overall, 65% of mothers were booked with private LMC, consistent with numbers in 2004 and 2005.

There is a marked variation in maternal demography by LMC. Older women are most likely to be seen by private LMCs (private obstetricians, GPs and independent midwives) and the hospital high-risk services (medical and diabetes clinics) while younger women are more likely to be seen by the hospital low-risk services. This might suggest that older and/or European women are more likely and/or able to exercise their right to choice of LMC.

The ratio of multipara to nullipara by LMC is fairly similar other than among women cared for by high-risk services who are more often multiparous.

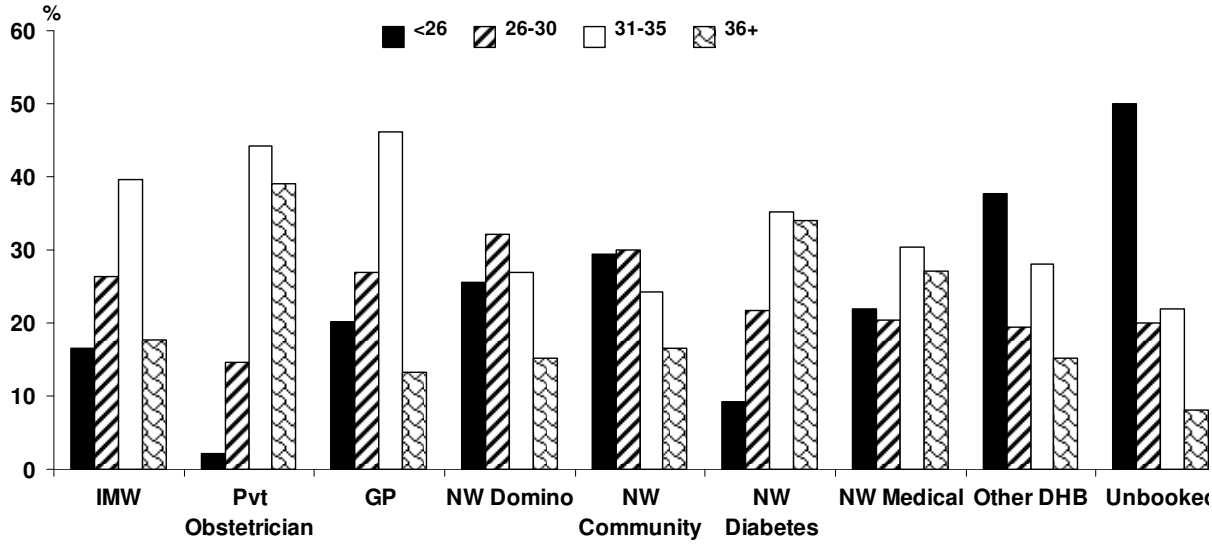

Figure 10: LMC at birth and maternal age

NW Community includes 39 women who are cared for by the alcohol, drug and psychiatric team (ADAPT)

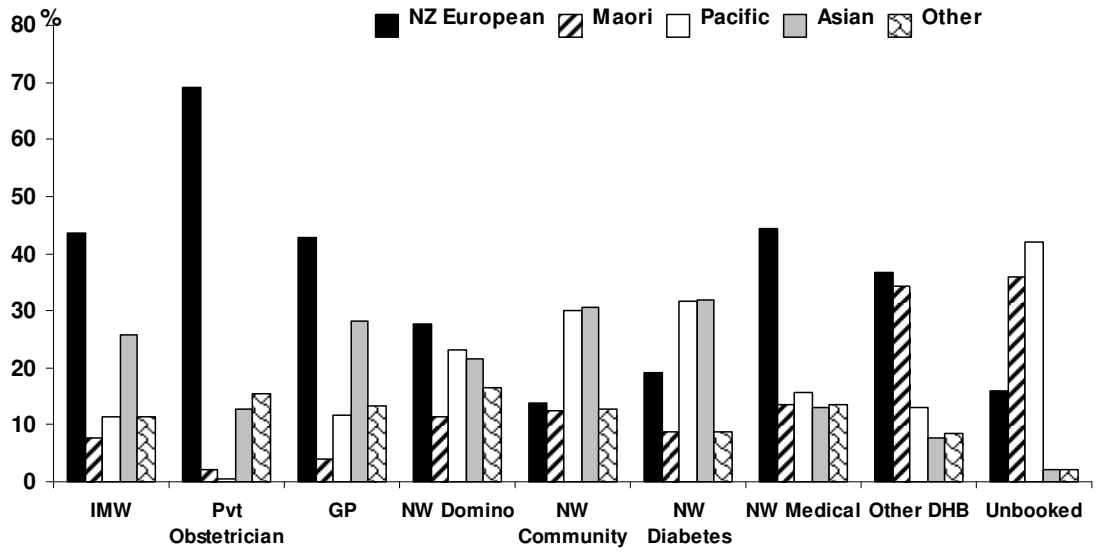

Figure 11: LMC at birth and maternal ethnicity

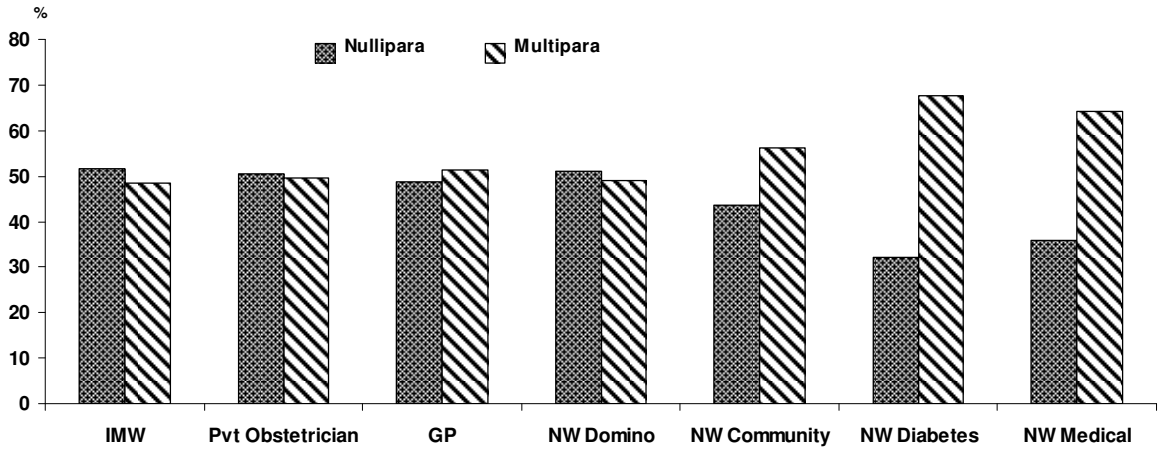

Figure 12: LMC at birth and parity

3.4 Smoking

As noted in the 2005 Annual Clinical Report, it is difficult to reconcile smoking data entered in early pregnancy with data entered at birth. However, we try to do this to improve completeness of the data and to ascertain how effective smoking reduction interventions are in our service.

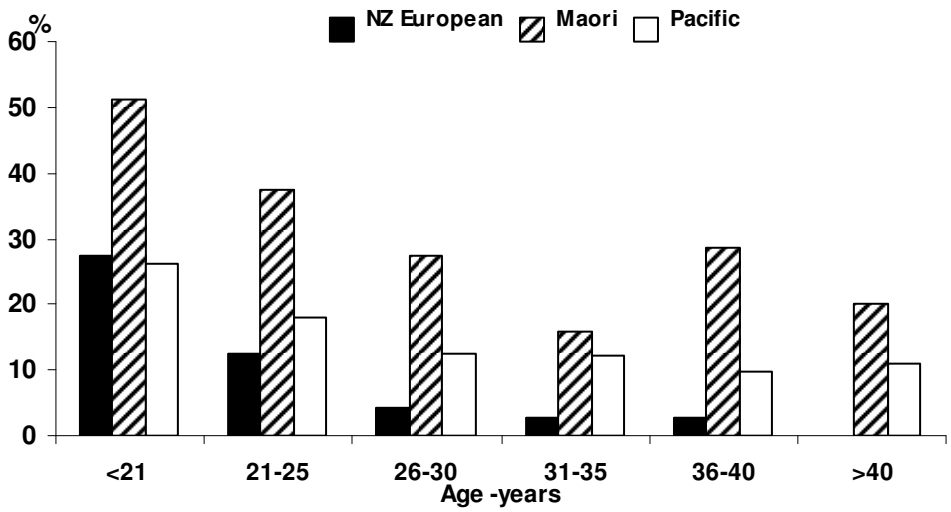

Figure 13: Smoking status by age and ethnicity

In 2006, smoking data were unavailable at booking for 22% of women. At birth, smoking data were missing for 24%. The women with missing data at booking are not the same as those with missing data at the end of pregnancy.

In recent years we have constructed a “summary” variable to try and eliminate missing data. This summary variable prioritised smoking (in either early or late pregnancy) over non-smoking. Using this technique, the smoking rate among women with known smoking status was 568/6717 (8.5%) in 2006, consistent with 8.1% and 8.2% in 2004 and 2005.

It is possible, however, that this constructed variable overestimates the smoking rate in the population. The smoking rate of women giving birth at NW obtained from data collected at booking is 458/5639 (8.1%). At the end of pregnancy, 358/5480 (6.5%) of mothers were recorded as smokers and 111 (2.0%) as having stopped smoking in pregnancy. Of these 111

women, the vast majority were recorded as past smokers at booking or smokers of less than 10 per day.

In summary, it is difficult to know how best to use these data. For the purposes of the chapters which follow in this report, the data collected at birth have been used to represent smoking status. This is different from the prioritised summary variable used in 2005.

Smoking is approximately 8-times more common among Maori mothers (32%) and 4-times more common among Pacific Island mothers (15%) than among NZ European (4%). Some of this difference is related to younger maternal age. Smoking is significantly more common among NZ European women up to age 25 but drops to low rates after this age. Among Maori and Pacific mothers smoking rates are significantly higher among younger mothers than mothers over 25 but remain high through all age groups.

We hope in 2007 to audit data alongside the Smoke Change programme in order to evaluate this programme in our service.

3.5 Body mass index

Table 8: Maternal BMI

	Mothers	
	n=7212	**%**
<19	304	4.2
19-25	3329	46.2
26-35	1625	22.5
>35	402	5.6
Missing data	1552	21.5

Body mass index (BMI) was able to be calculated for 78% of mothers in 2006 compared to only 52% in 2005. Although data are still missing for 22%, BMI data have been analysed to quantify the role of BMI as an obstetric risk factor in the NW population.

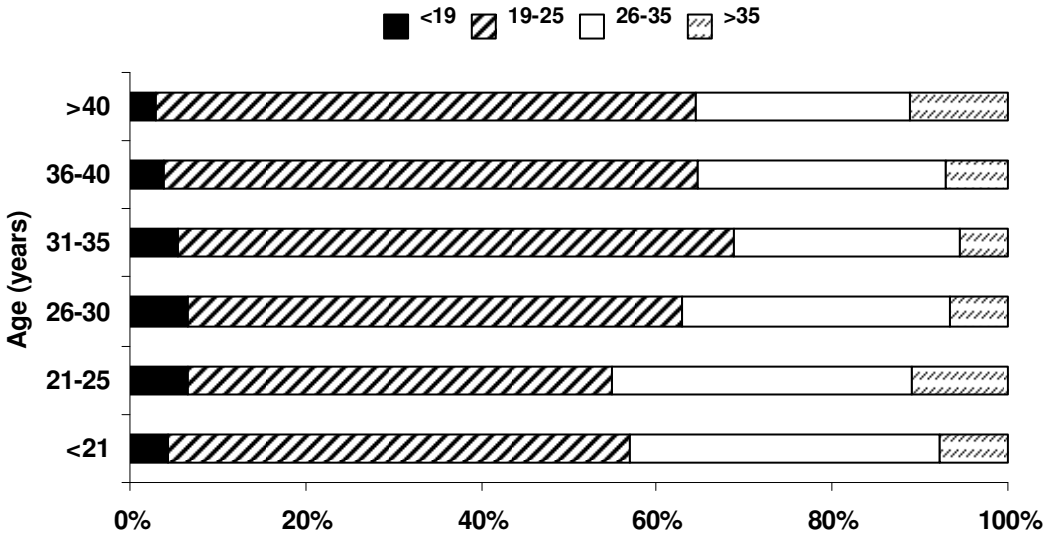

Figure 14: Distribution of BMI categories by age

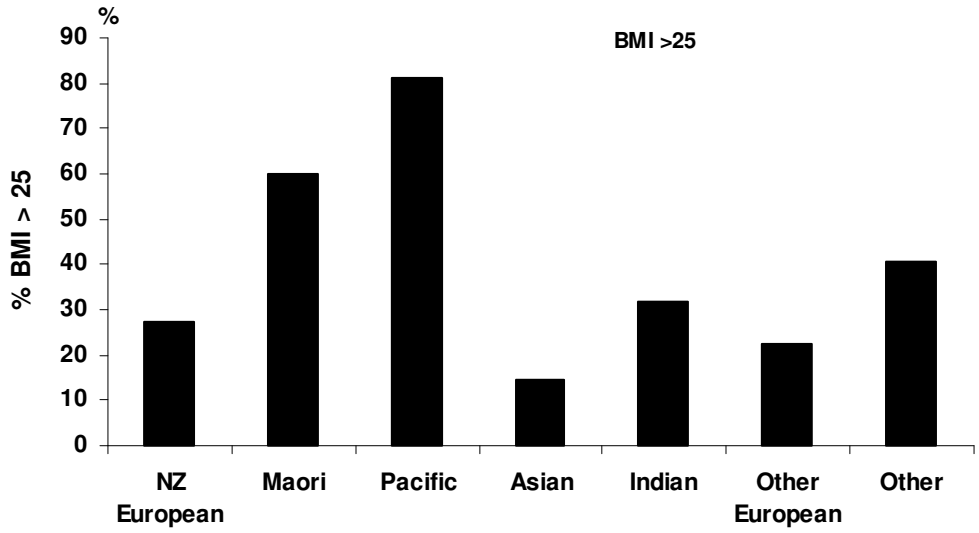

Figure 15: Rates of high BMI (>25) by ethnicity

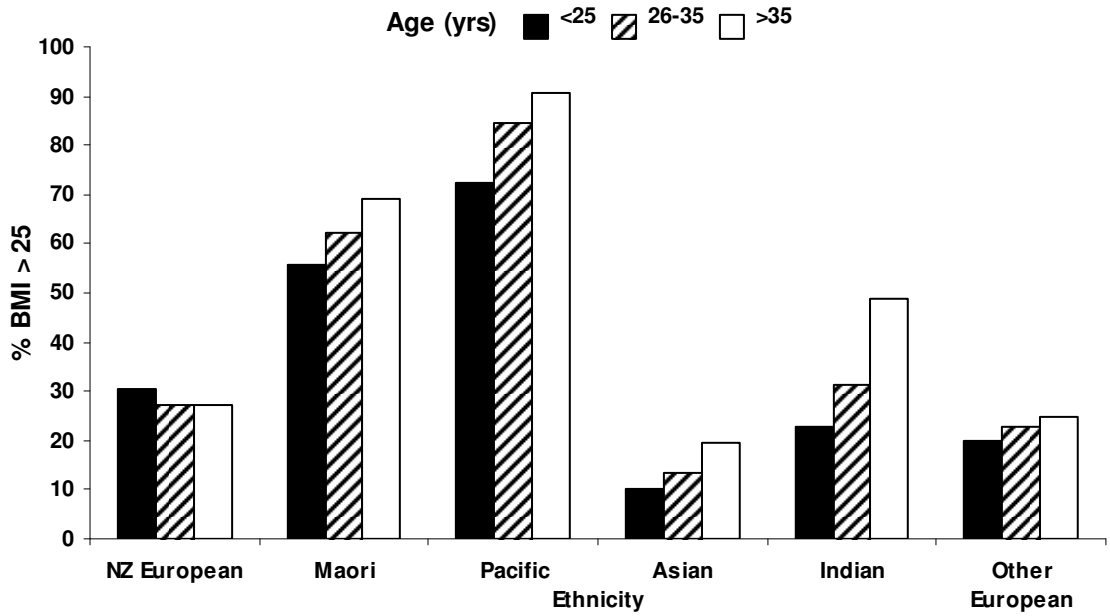

Figure 16: Rates of high BMI (>25) by ethnicity and age

Of the women for whom BMI data were available, 36% have a BMI over 25 and 7% have a BMI over 35. Overall, women under the age of 25 have significantly higher BMI than older women. However, this is a result of the differing age distribution by ethnicity (see Figures 7 and 8). There is a trend of increasing BMI with age within all ethnic groups except NZ European. However, Maori and Pacific women have significantly greater rates of high BMI (60% Maori and 80% Pacific above 25) compared to NZ European (27% over 25). As Maori and Pacific mothers are significantly younger than all other ethnicities the overall data show that women under the age of 25 have significantly higher BMI than older women. For this reason, and because Maori and Pacific ethnicity are associated with poorer obstetric outcomes, the univariate associations between BMI and obstetric outcomes should be interpreted with caution.

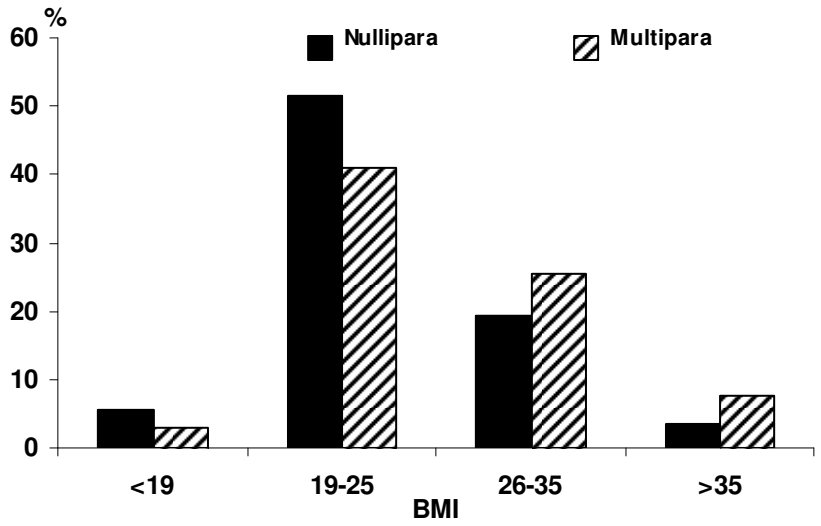

Figure 17: Parity and BMI

Across ethnicities, multiparous mothers are significantly more likely to have a BMI greater then 25. It is also in part explained by the higher rates of multiparity among Maori and Pacific mothers.

3.6 Standard primipara

The definition for standard primipara is given in the introductory chapter. The objective in defining the standard primipara is to analyse intervention rates and outcomes in a selected low-risk group. This facilitates informative benchmarking between institutions and caregivers by controlling for case-mix.

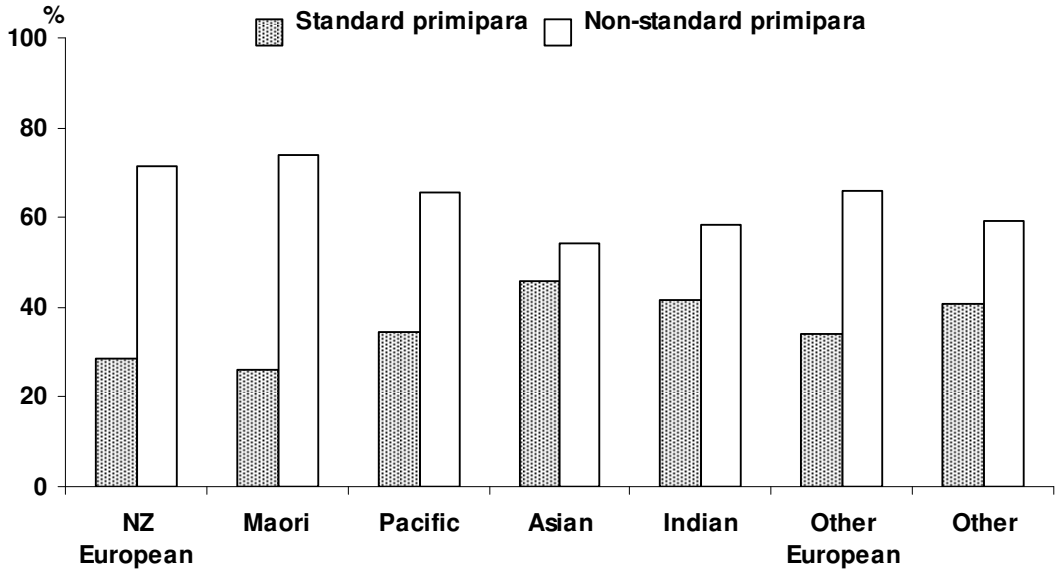

Figure 18: Ethnicity by primiparous risk status

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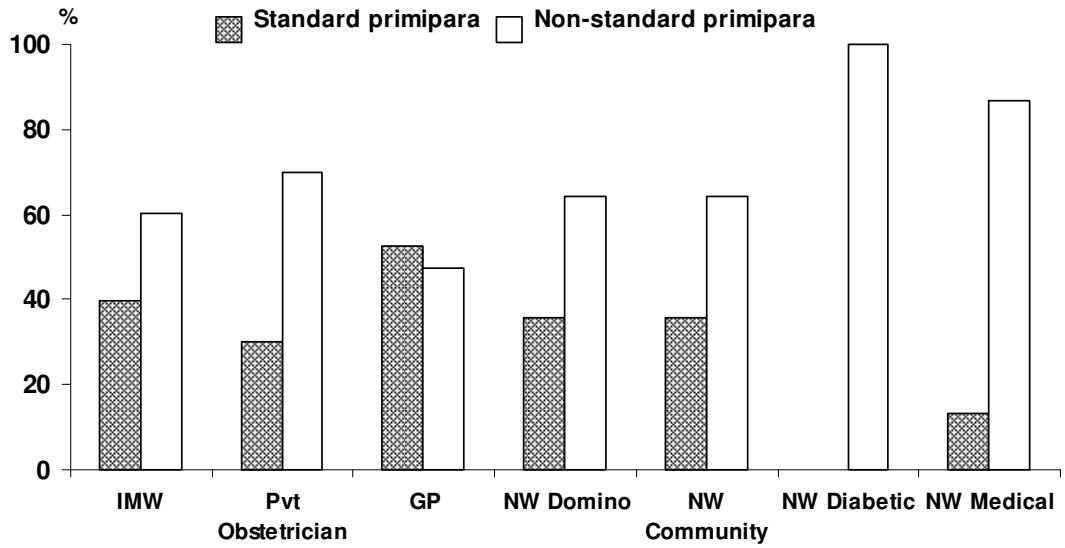

Figure 19: LMC at birth by primiparous risk status.

As in 2005, standard primipara accounted for 34% of the primiparous population.

Chapter 4

ANTENATAL COMPLICATIONS

4 ANTENATAL COMPLICATIONS

This chapter provides data and analysis on the complications and diseases that affect some women in the antenatal period, namely preterm birth, growth restriction, multiple pregnancy, antepartum haemorrhage and hypertensive disease. Additional data on these complications can be found in Appendix 4.

4.1 Preterm birth

Methods

Preterm birth is defined as birth prior to 37 completed weeks. Since 2004, iatrogenic preterm birth has been defined as induction of labour, elective caesarean section and emergency caesarean before the onset of labour. Prior to 2001, elective caesareans were not defined at data entry but derived based on a definition of caesarean section before the onset of contractions.

Comments

Preterm birth has many causes and therefore one must be careful when drawing conclusions about obstetric care and risks for women and obstetric care.

At NW the rate of preterm birth has remained around 10% over the last 8 years. This is reassuring as in many units in the developed world rates are rising. This puts extra pressure on resources. The main resource issues are for preterm births at lower gestations. When looking at the NW data for preterm births less than 32 completed weeks, the rates have also remained static at around 3%.

Typically one-third of preterm birth is iatrogenic and the remaining two-thirds are spontaneous. The most common reasons for iatrogenic preterm delivery are fetal growth restriction, pre-eclampsia, bleeding and induction following premature prelabour rupture of membranes. We now have three years of consistent data on spontaneous and iatrogenic preterm birth. The number of spontaneous preterm births is similar to the number of iatrogenic preterm births, suggesting that we have more iatrogenic deliveries at NW than are seen in other populations.

Table 9: Rates of preterm birth <37 completed weeks (1994 – 2006)

	1994	1995	1996	1997	1998	1999	2000	2004	2005	2006
Total number of women	8812	9125	9157	8055	7492	7501	7827	7491	7194	7212
Women birthing preterm	852	913	911	906	852	850	912	756	685	716
Incidence %	†	†	†	†	11.4	11.3	11.7	10.1	9.5	9.9
Spontaneous <37 weeks						350	385	372	323	335
Incidence %						4.7	4.9	5.0*	4.5	4.6
Iatrogenic <37 weeks						500	527	384	362	381
Incidence %						6.7	6.7	5.1*	5.0	5.3
Total babies <37 weeks	1010	1052	1085	1047	991	984	1062	886	806	836

† Note denominators pre-1998 include postnatal transfers and therefore incidence has not been calculated

* Changes in rates of spontaneous and iatrogenic preterm births from the 1999-2000 data are likely to be related to definition and data collection changes rather than real differences. See methods above.

The incidence of spontaneous preterm birth has remained static over the last 3 years across all gestations. A number of changes have taken place which we would hope would reduce

the rate, but these do not appear to be having a major effect at the moment. These include introduction of the Smokechange programme, a change in the policy of embryo transfer in IVF cycles, the use of cervical scanning and the identification and treatment of bacterial vaginosis for women at high risk of preterm labour.

Looking at the maternal demographics, one can see that spontaneous preterm birth is more common in mothers who are young, have a multiple pregnancy and smoke. As in previous years there is an increased risk of spontaneous preterm labour amongst our Maori population (doubled). These data, however, are not controlled for any of the other risk factors already mentioned and may represent different maternal demographics amongst Maori mothers.

Table 10: Rates of preterm birth <32 completed weeks (1994–2006)

	1994	1995	1996	1997	1998	1999	2000	2004	2005	2006
Total number of women	8812	9125	9157	8055	7492	7501	7827	7491	7194	7212
Women birthing <32 weeks	208	245	241	207	212	229	244	220	211	212
Incidence %	†	†	†	†	2.8	3.1	3.1	2.9	2.9	2.9
Spontaneous <32 weeks						86	107	106	93	96
Incidence %						1.1	1.4	1.4	1.3	1.3
Iatrogenic <32 weeks						143	137	114	118	116
Incidence %						1.9	1.8	1.5	1.6	1.6
Total babies <32 weeks						271	287	250	247	245

† Note denominators pre-1998 include postnatal transfers and therefore incidence has not been calculated

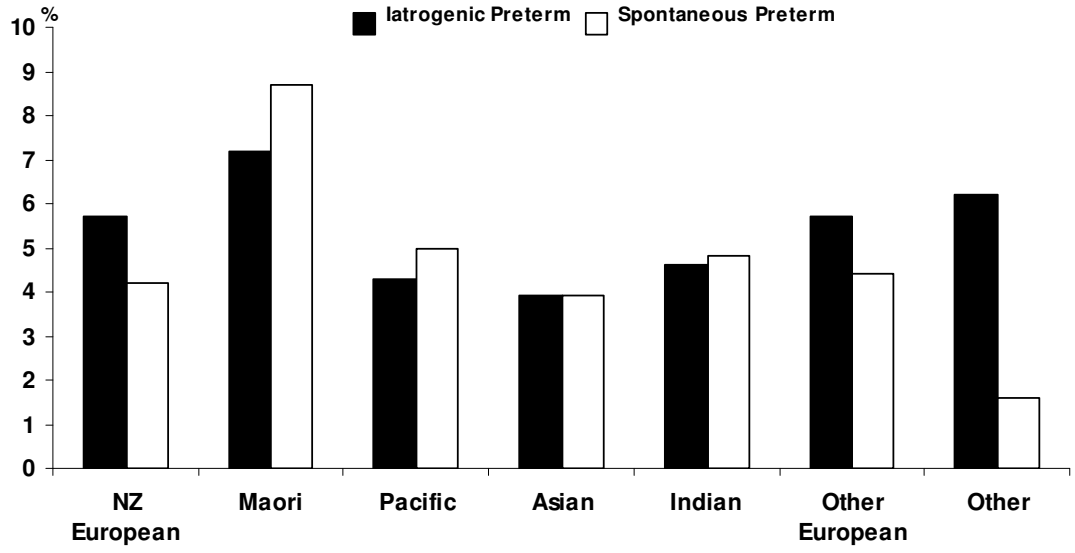

Figure 20: Spontaneous and iatrogenic preterm birth rates (<37 weeks) by ethnicity

The rate of iatrogenic preterm birth has also remained static. Looking at the maternal demographics, iatrogenic preterm birth is more common in older women. This most likely reflects a higher risk of developing placental pathology such as pre-eclampsia and fetal growth restriction. Smokers have a higher risk of iatrogenic preterm birth, which is probably related to placental reasons, including the association seen with antepartum haemorrhage.

Multiple pregnancy is a significant risk for iatrogenic preterm birth which may reflect complications such as discordant growth and twin to twin transfusion syndrome, but also clinician attitude to the definition of term in a multiple pregnancy. There is also an increase in iatrogenic preterm birth with increasing BMI.

Table 11: Perinatal outcome of preterm births by gestation (n=716)

Gestation	Births	Fetal deaths	Live births	% Live born	Neonatal death	% of Live births surviving >28 days
20	10	9	1	10	1	0
21	13	8	5	38	5	0
22	13	7	6	46	6	0
23	9	5	4	44	3	25
24	19	7	12	63	3	75
25	11	1	10	91	0	100
26	20	5	15	75	1	93
27	14	0	14	100	2	86
28	16	3	13	81	0	100
29	32	3	29	91	1	97
30	33	3	30	91	0	100
31	55	1	54	98	0	100
32	60	0	60	100	1	98
33	58	2	56	97	0	100
34	84	0	84	100	1	99
35	147	1	146	99	0	100
36	242	7	235	97	0	100
Totals	836	62	774	93	24	97

Summary / Implications

It is not surprising that the iatrogenic rate of preterm birth is not falling when one looks at the raw outcome data by gestation (see Table 11). At 28 weeks and above, with only 3 exceptions, all babies live born in 2006 at a preterm gestation survived to 28 days of life. What this data does not tell us is the rate of long-term disability of these babies. At 23 and 24 weeks survival is low. Certainly, for iatrogenic preterm delivery, obstetricians should strive to reach 28 weeks where it is safe for the mother, as neonatal survival is so good after this gestation.

4.2 Small for Gestational Age Babies

Methods

Until 2004, the NW Annual Clinical Reports defined small for gestational age (SGA) according to a nomogram published by Beeby et al (Journal of Paediatrics & Child Health. 1996:32:512-8), which is largely derived from Caucasian births. A customised birth weight centile calculator has been developed for New Zealand women (McCowan et al, Aust N Z J Obstet Gynaecol 2004:44:428-31). This adjusts size at birth for gestation, gender, maternal ethnicity, height, booking weight, and parity. The resulting definition of SGA reclassifies as normal many babies with low rates of morbidity who are born to small mothers and reclassifies as small a group of babies with high morbidity and mortality who are born to overweight women, and is thought to more reliably identify babies with growth restriction.

SGA is defined as birthweight <10th customised centile.

This year there has been a marked increase in the number of women for whom we have height data (80%) and weight data (84%) available compared with 54% and 62% in 2005. This is likely to result in improved accuracy of the data relating SGA to pregnancy outcome in this current annual report. For the women without height and/or weight data, mean height and/or weight for women of the same ethnicity has been used to generate a customised centile.

Findings

889 (12%) babies born at NW in 2006 were SGA at birth.

Nearly one-third of SGA babies were born preterm compared with 9% of babies with birthweight $\geq$10th percentile, RR 2.9(2.5-3.3). The risk of SGA was more pronounced for iatrogenic preterm birth where 23% of babies were SGA compared with 12% in the overall population but was still present in spontaneous preterm birth where 16.9% of babies were SGA.

SGA babies were also 4 times more likely to be born at <32 weeks. These data are consistent with published reports, which have demonstrated an association between SGA and both spontaneous and iatrogenic preterm birth especially at very preterm gestations. Not surprisingly, given the high rate of preterm birth, SGA babies were also more likely to be admitted to the neonatal unit and to have prolonged stays compared with babies with birthweights $\geq$10th percentile. In future reports it would be interesting to look at rates of neonatal unit admission adjusted for gestational age at birth.

More than 50% of stillborn babies were SGA at birth by customised centiles. A substantial proportion (48%) of neonatal deaths were also SGA at birth.

In next year's annual report we plan to compare outcomes in three birthweight categories, namely <10th, 10th – 90th and >90th percentile as babies with birthweights >90th are also likely to have higher rates of morbidity.

Demographic factors associated with birth of SGA babies are detailed in appendix 4. This is the first year where BMI data are available in the majority of women. The relative risks for SGA after univariate analysis are shown in the table. As many of these demographic factors are not independent of each other (e.g. age, smoking, BMI and ethnicity) multivariate analysis was also undertaken to determine which of these factors have an independent effect on size at birth.

After multivariate analysis Maori [OR 1.42(1.01-2.01)], other Asian [OR 1.93(1.39-2.67)] and Chinese ethnicities [OR 1.50(1.11-2.03)] were associated with an increased risk of SGA whereas Pacific ethnicity was no longer significant. The effect of maternal age and BMI were also no longer significant after adjustment for other factors.

Nulliparity was associated with a small increased risk [OR 1.30(1.08-1.57)] and, as expected, smoking had a significant independent effect [OR 1.94(1.53-2.46)] on the risk of SGA.

The increased risk of SGA seen in univariate analysis in Maori was only of borderline significance after adjustment, likely due to the important effects of smoking

Table 12: Interventions and outcomes among SGA babies

	Customised birthweight <10th%(SGA) n=889	**Customised birthweight ≥10th% n=6490**	**RR(95%CI)***
	n %	**n %**	
Onset of birth - preterm	n=238	n=598	
Spontaneous Labour	64 26.9	314 52.5	0.51 (0.41-0.64)
Iatrogenic onset of birth	174 73.1	284 47.5	1.54 (1.37-1.73)
Onset of birth - term	n=651	n=5892	
Spontaneous Labour	336 51.6	3592 61.0	0.85 (0.78-0.91)
Iatrogenic onset of birth	315 48.4	2300 39.0	1.24 (1.14-1.35)
Mean birth weight (sd),grams	2429 (719)	3430 (596)	
Gestation at birth			
Mean gestation (sd),weeks	37.1 (4.3)	38.7 (2.5)	
Term	651 73.2	5892 90.8	
Preterm	238 26.8	598 9.2	2.91 (2.54-3.32)
Preterm <32 wks	88 9.9	157 2.4	4.09 (3.18-5.26)
NICU admission			
Any stay	223 25.1	548 8.4	2.97 (2.59-3.41)
≥2 days	211 23.7	496 7.6	3.11 (2.69-3.59)
Apgar at 5 mins <7	23 2.6	64 1.0	2.62 (1.64-4.20)
Stillbirth	42 47.2†	32 4.9†	9.58 (6.08-15.10)
Neonatal death	12 14.2‡	13 2.0‡	6.74 (3.08-14.72)

*Relative risk of outcome (e.g. spontaneous labour, induction, preterm birth etc) for babies with SGA compared to babies with birthweight ≥ 10th %.
† Rate/1000 births
‡ Rate/1000 livebirths

Babies born from multiple pregnancies had a three fold increased risk of SGA. It is known that multiple pregnancy is an important risk factor for SGA. However, there is considerable discussion about whether singleton birthweight reference ranges are appropriate when classifying babies from multiple pregnancies. The same limitation applies to use of customised centiles in this setting as multiple pregnancies were excluded when formulae were developed for customised centiles.

4.3 Multiple pregnancy

This section describes the characteristics and outcomes of mothers who gave birth to twins and triplets at NW during 2006 and the outcomes of their babies.

Findings

Multiple pregnancy rates have remained around 2.5% over the last 8 years. Over this time the maternal population has aged slightly which would be expected to increase the risk of multiple pregnancy, but fertility practices have also changed with less emphasis on multiple embryo replacement and thus fewer multiple pregnancies.

Table 13: Multiple pregnancy rates (per 100 mothers birthing)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Total number of multiple pregnancies	172	194	210	182	172	218	179	208	191	188	187	162
Incidence %				2.4	2.2	2.7	2.3	2.6	2.4	2.4	2.5	2.2
Number of twin pregnancies	169	187	204	176	166	207	175	201	184	188	184	157
Number of triplet pregnancies	2	7	6	5	6	11	4	7	7	0	3	5
Number of quadruplet pregnancies	1	0	0	1	0	0	0	0	0	0	0	0

Table 14: Fetal/neonatal outcomes of multiple pregnancies (per 100 mothers birthing)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Total number of babies born in a multiple pregnancy	348	395	426	371	350	447	362	423	389	376	377	329
Incidence %				4.8	4.6	5.3	4.7	5.3	4.9	4.9	5.1	4.5
Number of multiple pregnancies where one or more babies died	10	23	20	12	12	14		26	11	15	13	8
Incidence % (no. of multiple pregnancies where a baby died/number of multiple pregnancies)	5.8	11.9	9.5	6.6	7.0	6.4		12.5	5.8	8.0	7.0	4.9
Number of babies who died in a multiple pregnancy	12	36	30	25	22	23				23	17	12
Twin perinatal mortality rate*	34.5	91.1	61.3	51.1	63.3	48.3				61.2	43.5	36.5

*Perinatal twin deaths/1000 twin babies born

Multiple pregnancy represents an area of high risk, and should be managed in conjunction with or by an obstetrician for this reason. This is confirmed when examining the perinatal outcomes of multiple pregnancy. The perinatal mortality rate has fluctuated over the last 12 years from 34.5 to 91.1 per 1000 babies born. This is approximately 3-9 fold more than expected for a singleton pregnancy.

Table 15: Mode of onset of birth among twin pregnancies

	Preterm births n=73		Term births n=47	
	n	%	n	%
Mode of onset of birth				
CS elective	27	24.6	19	40.4
CS emergency before labour	23	20.9	4	8.5
Induction of labour	19	17.3	17	36.2
Spontaneous labour	41	37.3	7	14.9

Preterm birth is "usual" for twin pregnancies with two thirds being born preterm in 2006. Around one-third of the preterm births are secondary to spontaneous preterm labour, the rest being iatrogenic. Timing of delivery of twins is a hot topic. NW is currently participating in a multicentre study. Hopefully the results will guide us as to when we should deliver twins when there are no complications in pregnancy.

Table 16: Mode of birth among twin pregnancies

	Twin pregnancies							
	2000 n=207		2004 n=188		2005 n=184		2006 n=157	
	n	%	n	%	n	%	n	%
Spontaneous vaginal birth/vaginal breech both twins	84	41	52	28	53	29	38	24
Spontaneous vaginal birth 1st twin, operative vaginal 2nd twin	7	3	4	2	8	4	7	4
Operative vaginal 1st twin, spontaneous vaginal 2nd twin	9	4	8	4	5	3	5	3
Instrumental vaginal birth both twins	11	5	7	4	7	4	3	2
Spontaneous vaginal birth 1st twin, caesarean section 2nd twin	4	2	4	2	1	1	1	1
Operative vaginal birth 1st twin, caesarean section 2nd twin	2	1	5	3	0		0	
CS elective both twins	90	43	48	26	52	28	46	29
CS emergency both twins			60	32	58	31	57	36

Another contentious issue is how to deliver twins. A recent study from Scottish data has suggested that there may be a place for all twins being delivered by caesarean section. This may be due to local practices in the study centre and may not apply to NW. Looking at the local data we can see that around half of twins are delivered by Caesarean section and half vaginally. It is encouraging to see that the number of cases proceeding to a second twin abdominal delivery after a first twin vaginal delivery has fallen to only one case a year for the last two years.

Table 17: Fetal/newborn outcomes of twin babies

		Twin babies n=314	
	n	n	%
Small for gestational age (<10th customised centile)		102	32.5
Apgar <7 at 5 minutes		7	2.2
Admission to NICU ≥ 2 days		157	50.0
≤34 weeks	122	107	87.7
>34 - <37	98	40	40.8
≥37 weeks	94	10	10.6

As is to be expected, twin babies are smaller and have a higher chance of going to NICU than singletons.

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Table 18: Perinatal-related deaths in twin pregnancies by gestation

	Twin pregnancies			
	One twin died n=4		Both twins died n=4	
Gestation (weeks)	**n**	**Outcome**	**n**	**Outcome**
20 – 23	0		4	ENND /ENND
				ENND / Stillbirth
				ENND / Stillbirth
				Stillbirth / Stillbirth
24 – 27	0		0	
28 – 31	2	Stillbirth	0	
32 – 36	2	LNND	0	
		Stillbirth		
37 – 40	0		0	
41+	0		0	

Summary / Implications

Multiple pregnancy rates have remained stable over the past 8 years.
Multiple pregnancy is associated with significantly worse outcome than singleton pregnancy and so should be managed in conjunction with a specialist obstetrician.
NW is participating in a multicentre study to determine ideal timing of delivery in twins.

4.4 Diabetes

Methods

The statistics given in this section relate to women with a diagnosis of pre-existing or gestational diabetes who delivered at NW. It includes women who were cared for solely by the NW Diabetic Clinic, women with some input from the Diabetic Clinic while under the care of non-Diabetic Clinic LMC, and women with no Diabetic Clinic input. It does not include women cared for by the Diabetic Clinic who delivered prior to 20 weeks or who delivered elsewhere.

Findings

In addition to the data presented here, there were 40 new pre-pregnancy referrals to the Diabetes Service. In an audit of 68 women with Type 2 diabetes referred for pre-pregnancy counselling between 2003-2005, the mean HbA1c at referral was 8.0±2.0% and improved to 6.8±1.5% prior to pregnancy. Additionally, 61.5% of smokers stopped and uptake of preconception folic acid treatment improved from 35% at the time of referral to 87% prior to conception.

The figure below shows that the number of women with Type 2 diabetes diagnosed prior to pregnancy has consistently risen over the past 15 years. This probably relates to the general increase in obesity and Type 2 diabetes in the community and to more awareness of the need to screen for Type 2 diabetes in young people. We would expect an increase in GDM to parallel the increase in Type 2 diabetes. It is recommended that all pregnant women should be offered screening for GDM.

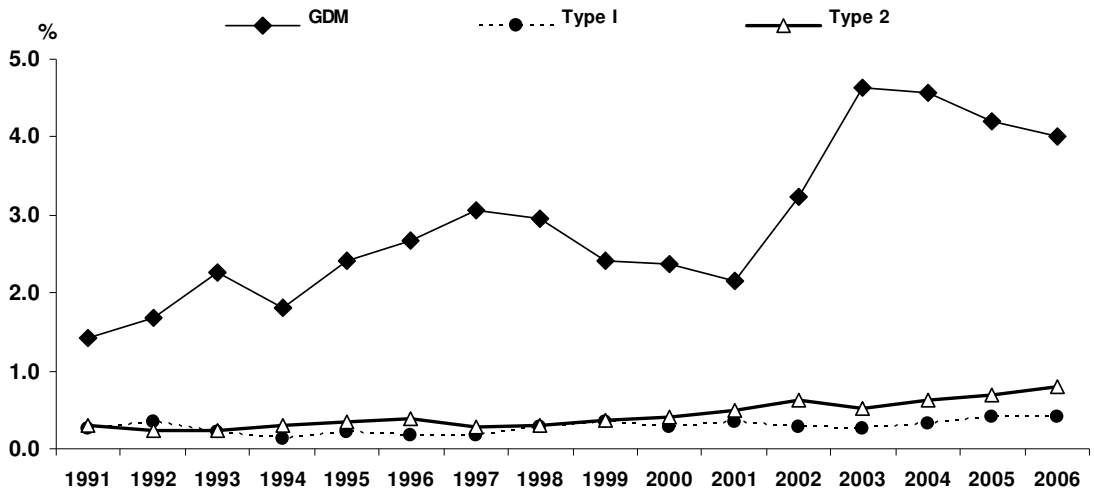

Figure 21: Incidence of diabetes (% of all inborn and BBA births) time trends

4.4.1 Demographics of women with diabetes

Of note, 54% of women with Type 2 diabetes are over the age of 35 years and over 40% have a BMI >35 kg/m^2 . Of women with GDM, 31% are over the age of 35 years and over 20% have a BMI >35 kg/m^2. In contrast 23% of women without diabetes are older then 35 years and only approximately 5% have a BMI >35 kg/m^2. Rates of smoking are also higher in women with diabetes.

The incidence of GDM is highest in Indian women, with rates over 10%. We would expect the incidence of GDM to be higher in Pacific and Maori women, as they have the highest rates of Type 2 diabetes. The explanation for this may be that screening is not as frequent in Pacific and Maori women or that there are more false negative results (it is not clear if a higher BMI is associated with more false negative results).

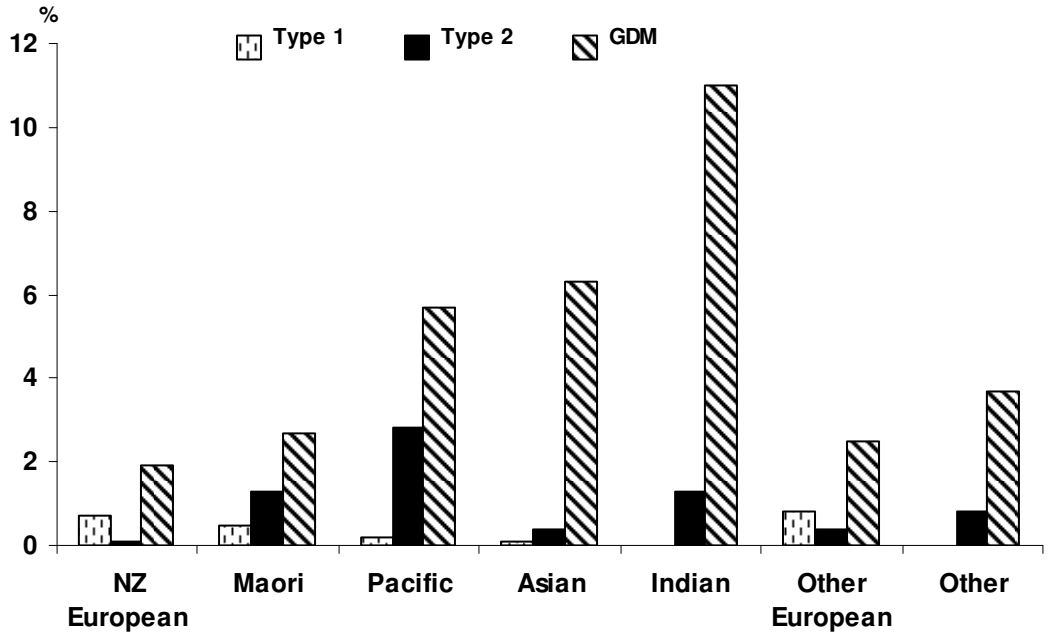

Figure 22: Incidence of diabetes by ethnic group 2006

4.4.2 Outcomes of pregnancies complicated by diabetes

Maternal outcomes

This year, the striking finding is that almost half the women with Type 1 diabetes were delivered <37 weeks. In women with Type 2 and GDM 17.5% and 15.2% of women were delivered preterm, compared with 9.5% of the background delivery population.

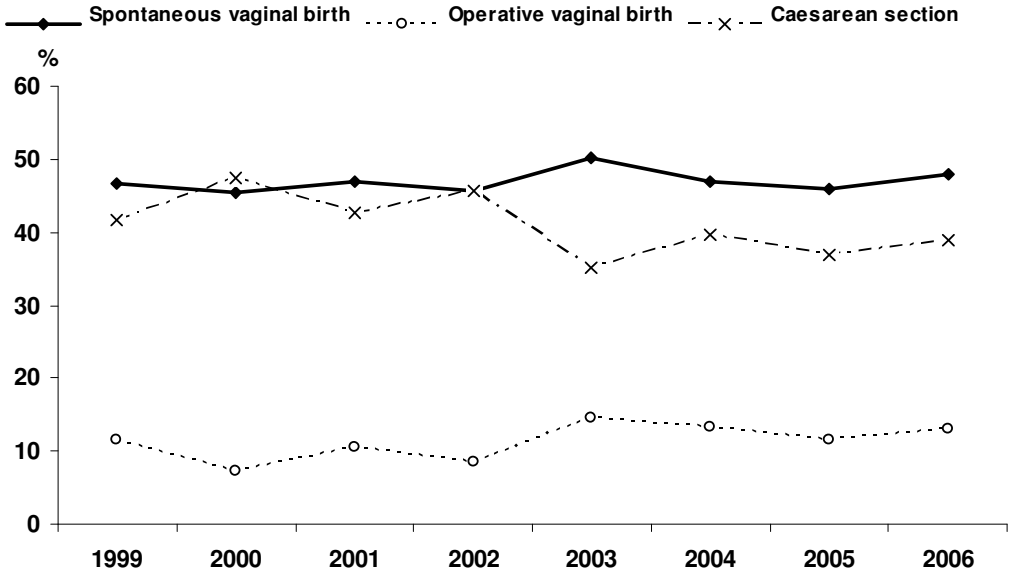

Figure 23: Mode of birth among women with GDM (1999-2006)

4.4.3 Maternal postpartum glucose tolerance testing

Table 19: Rates of postnatal glucose tolerance testing (GTT) among women with GDM (1999-2006)

	1999 n=183		2000 n=180		2001 n=163		2002 n=253		2003 n=352		2004 n=342		2005 n=304		2006 n=286	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Postnatal GTT	129	70	121	67	132	81	171	68	260	74	260	76	238	78	206	72
No postnatal GTT	54	30	59	33	31	19	82	32	92	26	82	24	66	22	80	28

A 70% rate of postpartum glucose tolerance testing (GTT) is good compared with many centres. Some women who have not had a test may have undiagnosed Type 2 diabetes so we make a big effort to liaise with the woman and her GP to follow this up.

Table 20: Results of postnatal glucose tolerance testing (GTT) among women with GDM (1999-2006)

	1999 n=129		2000 n=121		2001 n=130		2002 n=169		2003 n=260		2004 n=260		2005 n=238		2006 n=206	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Normal	89	69	89	74	90	69	116	69	196	75	194	75	190	80	158	77
IFG/ IGT*	22	17	17	14	23	18	37	22	39	15	49	19	34	14	39	19
Type 2	18	14	15	12	17	13	16	9	25	10	17	7	14	6	9	4

*IFG =Impaired fasting glucose
IGT= Impaired glucose tolerance

Fewer women with GDM have undiagnosed Type 2 diabetes compared with previous years. This may reflect improved screening for Type 2 diabetes outside pregnancy.

4.4.4 Perinatal losses

Seven women with diabetes had perinatal losses during 2006.

In women with Type 2 diabetes, one perinatal loss was at 20 weeks gestation in a woman whose risk factors were poor diabetes control (booking HbA1c 11.3%), obesity and smoking. She presented with a stillbirth in spontaneous labour at 20 weeks. The baby was SGA by customised centiles. A second woman had risk factors of poor control (booking HbA1c 8.7%), obesity, and twin pregnancy. She presented in labour at 23 weeks. The twins died shortly after birth and one was small for gestational age.

In women with Type 1 diabetes, one perinatal death was due to a congenital anomaly “heterotaxy syndrome”. This woman had a booking HbA1c over 11%. A second woman entered pregnancy with an HbA1c of 8.6% and went on to deliver at 22 weeks following SRM. A third woman had excellent diabetes control and no vascular complications. She presented at 28 weeks with threatened preterm labour possibly due to silent abruption or maternal urinary tract infection. After settling, further contractions and sudden fetal demise occurred. The fourth loss was in a woman who presented with ketoacidosis and intrauterine death at 23 weeks. The woman had a history of substance abuse and had no medical care during her pregnancy, which had been concealed.

The final perinatal loss was in a woman with good diabetes control after initial HbA1c of 7.6%. She was booked for induction at 38 weeks because of a large for gestational age fetus on scan. Fetal movements were reported as normal the day prior to induction, but the fetal heart was absent when admitted. The baby weighed 3785g.

4.4.5 Neonatal outcomes among babies of women with diabetes in pregnancy

The increased rate of SGA is again noted in women with Type 2 diabetes. SGA infants are more likely to have mothers who smoke or develop pre-eclampsia. Data from a recent audit at NW of women with Type 2 diabetes in pregnancy suggest that the use of customised growth charts is useful for women with Type 2 diabetes; they are predominantly Pacific women whose small babies would not be noted on a standard growth chart. The clinic now uses standard charts to look at the relative percentile growth of the abdominal circumference in particular, plus a customised birth weight chart.

Table 21: Neonatal outcomes among babies of women with diabetes

	Type I n=34	**Type 2 n=58**	**GDM n=281**	**Postnatally diagnosed Type 2 n=9**	**No diabetes n=6998**
	n %	**n %**	**n %**	**n %**	**n %**
Birthweight (Mean(sd))	2829 (1174)	3003 (867)	3253 (591)	3571 (475)	3316 (691)
<1500g	7 20.6	5 8.6	5 1.8	0	194 2.8
<2500g	11 33.3	9 15.5	28 10.0	0	639 9.1
SGA <10th Percentile	2 5.9	10 17.2	28 10.0	1 11.1	848 12.1
LGA >90th Percentile	13 38.2	5 8.6	50 17.8	3 33.3	618 8.8
Admission to NICU					
<2 days	14 41.2	8 13.8	34 12.1	3 33.3	720 10.3
≥2 days	13 38.2	8 13.8	31 11.0	3 33.3	654 9.3
Assisted ventilation	8 23.5	4 6.9	9 3.2	0 22.2	364 5.2
Hypoglycaemia <2.3 mmol/l	13 38.2	9 15.5	29 10.3	2 22.2	
Hypoglycaemia <2.6 mmol/l	18 52.9	16 27.6	54 19.2	5 55.6	
IV Dextrose	12 35.3	4 6.9	10 3.6	1 11.1	

Summary

The pre-pregnancy care provided to women with diabetes is effective in improving glycaemic control, in reducing the number of women who smoke and increasing the number of women who take preconception folic acid. This should translate into improved outcomes.

Among women with Type 1 diabetes, 2006 has been a challenging year, with high rates of preterm delivery and associated morbidity. The outcomes vary each year, depending on the women's underlying combination of risk factors plus ability to maintain tight glycaemic control.

Women with Type 2 diabetes appear to be increasingly recognised pre-pregnancy and outcomes this year were better than in women with Type 1 diabetes.

The metformin in gestational diabetes (MiG) trial will be reporting its outcomes in late 2007 or early 2008.The Principal Investigator is from NW and more than one-third of the 750 recruits were from NW.The trial will answer whether metformin treatment compared with insulin treatment is associated with similar neonatal morbidity and other pregnancy outcomes.

Recommendations

To promote the pre-pregnancy diabetes service provided by NW and include a report of outcomes in future Annual Reports.

Women should be offered appropriate screening for GDM.Intervention is associated with maternal delivery outcomes similar to the background delivery population; neonatal morbidity is still increased, but may improve further as we screen women in a timely manner and improve our understanding of appropriate management strategies.

4.5 Antepartum Haemorrhage

Methods

Antepartum haemorrhage has been defined here to include vaginal bleeding from any cause at or beyond 20 weeks during pregnancy and labour, and includes placenta praevia without bleeding.

Data cleaning involved reconciling antenatal summary data and intrapartum complication data with indications for induction and operative delivery. Data were also reconciled with inpatient coding data.

Findings

Table 22: Antepartum haemorrhage incidence

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2005	2006
Total APH	286	365	515	460	451	453	451	484	594	398	411
Incidence %	6.3	4.1	5.6	5.0	4.9	5.6	6.0	6.5	7.6	5.5	5.7
Proven abruption	58	72	94	101	96	115	82	49	54	41	44
Proven placenta praevia	38	65	61	86	67	94	91	74	69	81	68
APH (uncertain origin)	190	227	365	273	287	281	278	361	471	276	299

In 2006, 5.7% of women were recorded as experiencing an antepartum haemorrhage or placenta praevia. In the majority of cases the cause of bleeding was unknown. Approximately 1% of mothers were reported to have placenta praevia and half this number to have had an abruption. There is no consistent pattern of change in rates of antepartum haemorrhage over time.

Placenta praevia is associated with maternal age over 35years. Abruption is associated with maternal smoking and hypertensive disease.

All subgroups of antepartum haemorrhage are associated with poorer maternal outcome, including higher caesarean section rates and higher rates of blood transfusion. They are also associated with poor neonatal outcome, including preterm birth, low birthweight, SGA, admission to neonatal intensive care and perinatal death.

The association with perinatal death is consistently seen with both abruption and bleeding of unknown cause. Among these perinatal deaths, half were growth restricted by customised centile charts.

Antepartum haemorrhage occurred during 30% of pregnancies where a perinatal-related loss occurred, and in 19% of births <37 weeks and 31% of birth <32 weeks, making it an important marker of fetal and neonatal risk.

4.6 Hypertensive Disease

The following definitions of hypertension in pregnancy have been used in this report:

- **Gestational hypertension**: diastolic BP≥90mmHg without proteinuria, when diastolic BP <90mmHg at booking.
- **Pre-eclampsia**: diastolic BP≥90mmHg with proteinuria > '+' or >0.3g/24h, when diastolic <90mmHg at booking.
- **Chronic hypertension**: diastolic BP≥90mmHg at booking or a medical history of essential hypertension.

The accuracy of hypertension data has been improved by reconciling data from booking history, indication for induction and operative delivery, reason for admission to the ward or to High Dependency Unit, data collected at birth and coded data from the Decision Support Unit.

Findings

The rate of gestational hypertension in the population of women who delivered at NW in 2006 was 4.5%. This is slightly lower then in previous years (6.8% in 1996 and 5.9% in 2005). The rate of pre-eclampsia was 3.4% in 2006 compared to 3.8% in 2005 and 2.7% in 1996. Only one patient suffered eclampsia in 2006 and there were no maternal deaths. Gestational hypertension and pre-eclampsia showed a predilection for nulliparous women whereas chronic hypertension was more common in the multiparous women.

Table 23: Hypertensive disease in pregnancy (2006)

	All women n=7212		Nullipara n=3499		Multipara n=3713	
	n	%	n	%	n	%
Any hypertensive disease	730	10.1	437	12.5	293	7.9
Chronic hypertension	163	2.3	58	1.7	105	2.8
Gestational hypertension	322	4.5	212	6.1	110	3.0
Preeclampsia	245	3.4	167	4.8	78	2.1
Eclampsia antepartum	1		1			

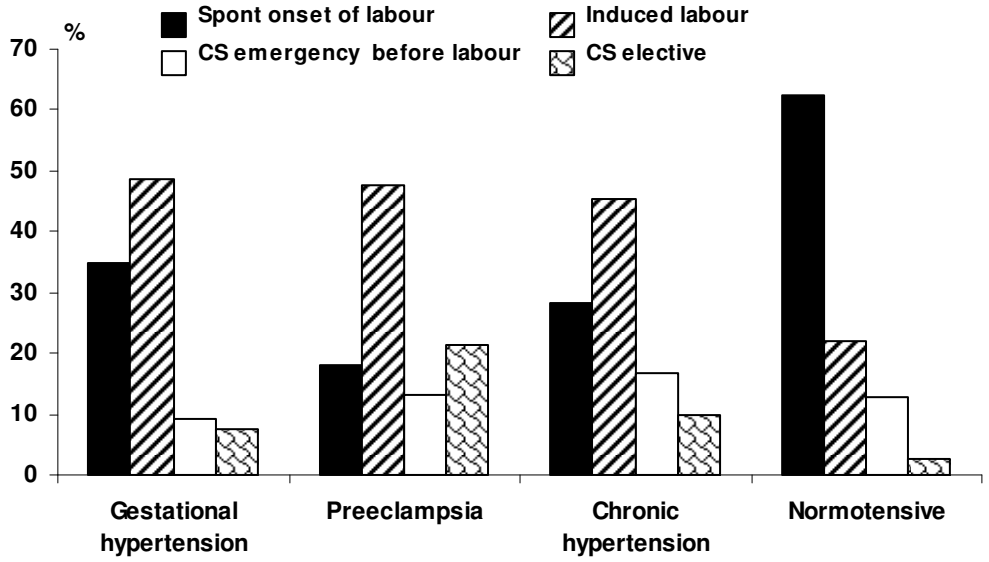

Figure 24: Onset of birth and hypertensive disorders of pregnancy

Hypertensive disorders are significantly associated with interventions to interrupt pregnancy, with 63% of normotensive women spontaneously going into labour compared to 35%, 18% and 28% in the gestational hypertension, pre-eclampsia and chronic hypertension populations respectively. The rate of vaginal birth is significantly lower in all hypertensive groups compared to normotensive women.

Table 24: Mode of birth for women with hypertensive disease

	Gestational hypertension n=322		Pre-eclampsia n=245		Chronic hypertension n=163		Normotensive n=6482	
	n	%	n	%	n	%	n	%
Mode of birth								
Normal vaginal	139	43.2	74	30.2	77	47.2	3576	55.2
Operative vaginal	53	16.5	30	12.2	15	9.2	858	13.2
CS elective	31	9.6	32	13.1	27	16.6	834	12.9
CS emergency	99	30.7	109	44.5	44	27.0	1214	18.7

Table 25: Perinatal outcomes and hypertensive complications of pregnancy

	Gestational hypertension n=339		Pre-eclampsia n=270		Chronic hypertension n=166		Normotensive n=6604	
	n	%	n	%	n	%	n	%
Gestation at birth								
<37 weeks	50	14.7	109	40.4	33	19.9	644	9.8
<32 weeks	11	3.2	32	11.9	10	6.0	192	2.9
SGA	46	13.6	101	37.4	34	20.5	708	10.7
NICU Admission	54	15.9	99	36.7	27	16.3	591	9.0
≥2 days in NICU	49	14.5	98	36.3	26	15.7	534	8.1
Apgars <7 at 5 mins	4	1.2	7	2.6	4	2.4	72	1.1
Perinatal deaths	4	1.2	1*	0.4	4	2.4	90	1.4

*A second perinatal death born to an unbooked mother with pre-eclampsia is not represented in these figures

Very preterm delivery was significantly associated with having chronic hypertension or pre-eclampsia. This was most marked in those with a diagnosis of pre-eclampsia with 12% of babies delivered prior to 32 weeks of pregnancy compared to 3% in the normotensive population. SGA (by customised birth weight centiles) was also increased in patients with pre-eclampsia (37%) and chronic hypertension (21%). NICU admission and the requirement for a prolonged admission was more frequent in all hypertensive groups, particularly the pre-eclamptics, likely reflecting the greater risk of prematurity and SGA in this group. There were no significant differences in the perinatal mortality rates but the numbers in each group were small. There were ten perinatal deaths in women who had a hypertensive disease although maternal hypertension was the major cause in only three cases. These babies were stillborn at 22 and 23 weeks and one born at 24 weeks died as a neonate.

Rising maternal age is significantly associated with any hypertensive disease with a relative risk of around 1.5 in women over 35 years compared to women up to age 35 years. Increasing BMI is also associated with marked rise in the hypertensive conditions with relative risk in women with a BMI > 35 of 1.9 (1.5-2.4) compared to women with a BMI of ≤ 35. Hypertensive conditions were less common in women of Asian ethnicity compared to NZ European women.

Summary / Implications

The rates of hypertensive disorders are slightly higher then reported internationally. This possibly relates to a combination of better case ascertainment and an aging and heavier population.

The hypertensive conditions are associated with negative pregnancy outcomes on a number of levels including increased caesarean section rates, premature birth, SGA babies and babies requiring NICU care. Prematurity and SGA are both factors associated with increased long-term negative health outcomes in the baby.

There were no maternal deaths but in future it would be useful to look at serious maternal morbidity among women with hypertensive disease.

This year's data highlight raised BMI as a modifiable risk factor for the hypertensive conditions of pregnancy. Education and support around the areas of exercise and diet are important in pre-conceptual and antenatal care.

Chapter 5

LABOUR and BIRTH

5 LABOUR AND BIRTH

This chapter includes data on labour and birth interventions and outcomes, including induction of labour, mode of birth and outcomes for low risk women including those giving birth at Birthcare Auckland. For further data relating to this chapter, see Appendix 5.

5.1 Induction of labour

Methods

The four pathways to birth described in this report are: (1) induction of labour, (2) elective caesarean section, (3) emergency caesarean prior to onset of labour, and (4) spontaneous onset of labour. If any woman had a failed induction followed by elective caesarean, she has been categorised as an induced labour for the purposes of this section.

Input of induction-related data to the Healthware database requires active opening of an induction screen. We suspect this is not consistently done, especially if 'inductions' are performed on the Labour and Birth Suite. To improve capture of these inductions, clinical notes were reviewed if the indication for ARM (artificial rupture of membranes) was induction or if an ARM was performed or syntocinon commenced before the onset of contractions. However, the possibility remains that the numbers given *under*-represent the true induction rate.

Findings

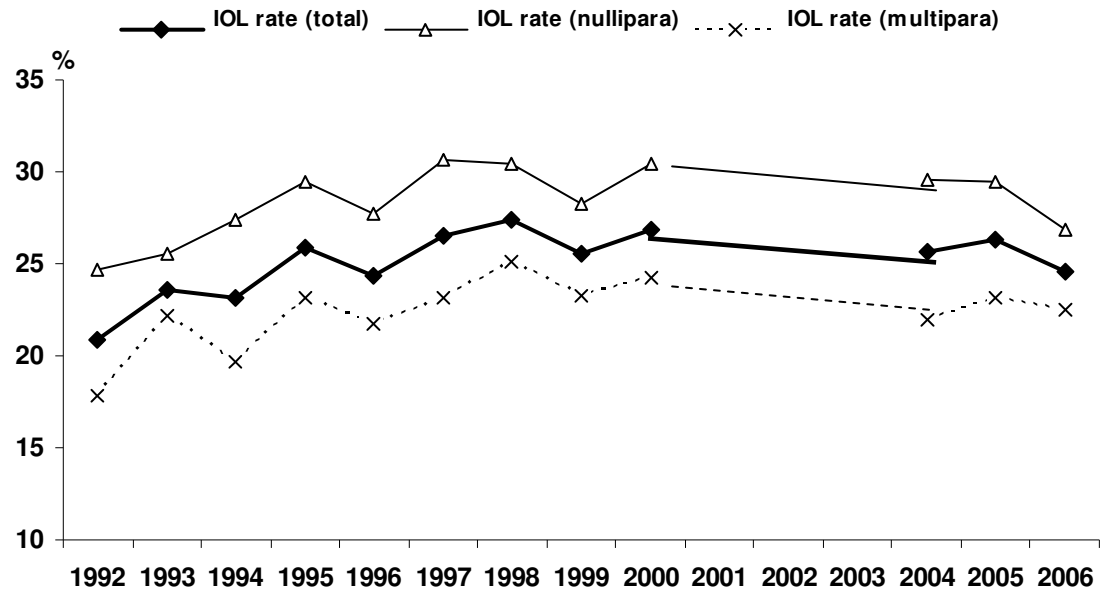

Figure 25: Induction of labour rates (1992-2006)

The induction of labour rate in 2006, at 24.6% is the lowest annual rate since 1996. This reduction is primarily among nullipara. It may be a result of prioritisation of inductions and limitation of its availability at NW.

Rates of induction are similar at term and preterm, though the indications obviously vary. The most common indication for induction at term is post-dates for both nullipara and multipara and at all maternal ages.

Table 26: Demography of onset of birth at term

	Total	Spontaneous labour		Induction		CS elective		CS emergency before labour	
	N	n	%	n	%	n	%	n	%
Total	6496	3921	60.4	1614	24.8	840	12.9	121	1.9
LMC at birth									
IMW	2680	1940	72.4	597	22.3	116	4.3	27	1.0
Private Obstetrician	1539	616	40.0	404	26.3	468	30.4	51	3.3
GP	143	107	74.8	27	18.9	9	6.3	0	
NW Community	404	292	72.3	86	21.3	22	5.4	4	1.0
NW Domino	1267	810	63.9	283	22.3	149	11.8	25	2.0
NW Medical	185	31	16.8	116	62.7	33	17.8	5	2.7
NW Diabetes	231	87	37.7	96	41.6	42	18.2	6	2.6
Other DHB	18	10	55.6	5	27.8	1	5.6	2	11.1
Unbooked	29	28	96.6	0		0	0	1	3.4
Maternal age									
≤ 20	272	212	77.9	56	20.6	3	1.1	1	0.4
21-25	787	592	75.2	160	20.3	30	3.8	5	0.6
26-30	1579	1052	66.6	380	24.1	119	7.5	28	1.8
31-35	2362	1398	59.2	587	24.9	329	13.9	48	2.0
36-40	1286	596	46.5	359	27.9	297	23.1	34	2.6
41+	210	71	33.8	72	34.3	62	29.5	5	2.4
Ethnicity									
NZ European	2731	1451	53.1	758	27.8	465	17.0	57	2.1
Maori	502	328	65.3	124	24.7	42	8.4	8	1.6
Pacific	926	616	66.5	231	24.9	68	7.3	11	1.2
Asian	1028	728	70.8	186	18.1	97	9.4	17	1.7
Indian	471	292	62.0	120	25.5	46	9.8	13	2.8
Other European	614	348	56.7	158	25.7	98	16.0	10	1.6
Other	224	158	70.5	37	16.5	24	10.7	5	2.2
BMI									
<19	280	195	69.6	57	20.4	25	8.9	3	1.1
19-25	3052	1866	61.1	708	23.2	426	14.0	52	1.7
26-35	1486	843	56.7	418	28.1	193	13.0	32	2.2
>35	362	172	47.5	134	37.0	44	12.2	12	3.3

The induction rate is highest among the relatively small group of mothers attending high risk diabetic and medical clinics at NW. The LMC provider group with the next highest rate of induction is private obstetricians at 26%. Private obstetricians also have the lowest rate of spontaneous onset of labour at 40% compared to 64-75% among the other major LMC provider groups. This is largely due to an elective section rate in this group of 30% compared to 4-12% in the other principal groups. Among standard primipara, these rates are only slightly less striking with private obstetrician spontaneous onset of labour rates 20% below any of independent midwives (IMW), NW Community midwives and NW Domino midwives, and induction of labour and elective caesarean rates each 10% above any other LMC group.

Rates of induction increase with maternal age from 21% among women under 20 to 34% among women over 40. There is an association between increasing BMI and rate of

induction. There are also variations by ethnicity which presumably reflect other factors such as age, BMI, parity and choice of LMC.

Indication for induction

Indication for induction is prioritised at data entry to primary and secondary indication. Primary indications are given here.

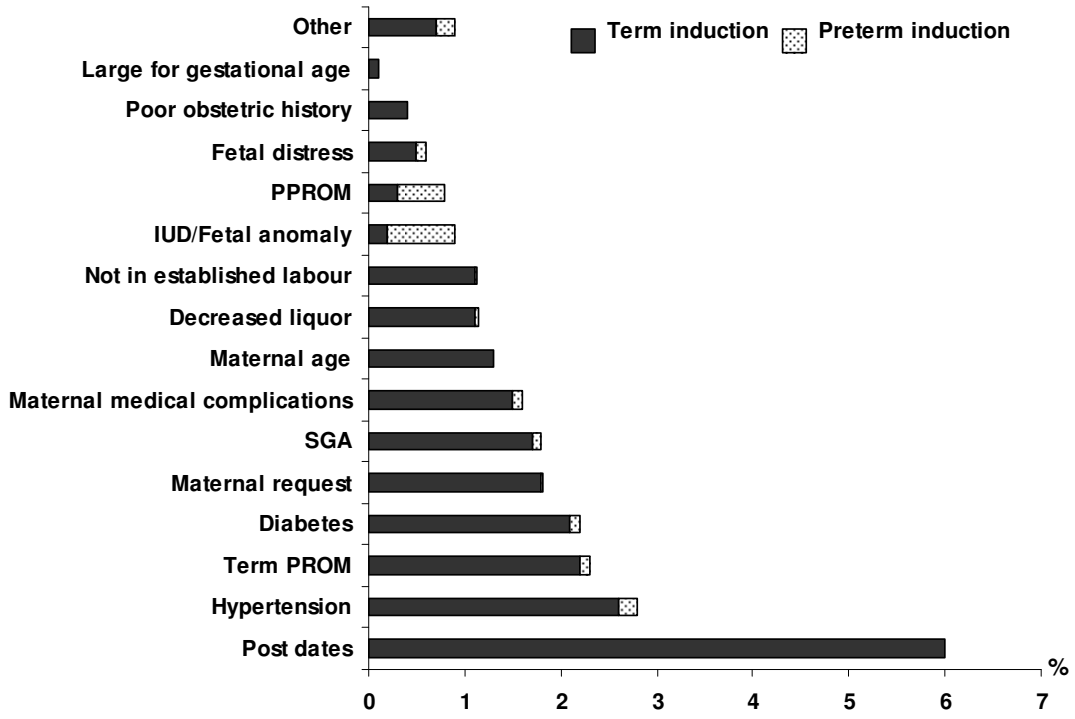

Figure 26: Primary indication for induction as a percentage of all births (n=1776 inductions /7212 birthing mothers)

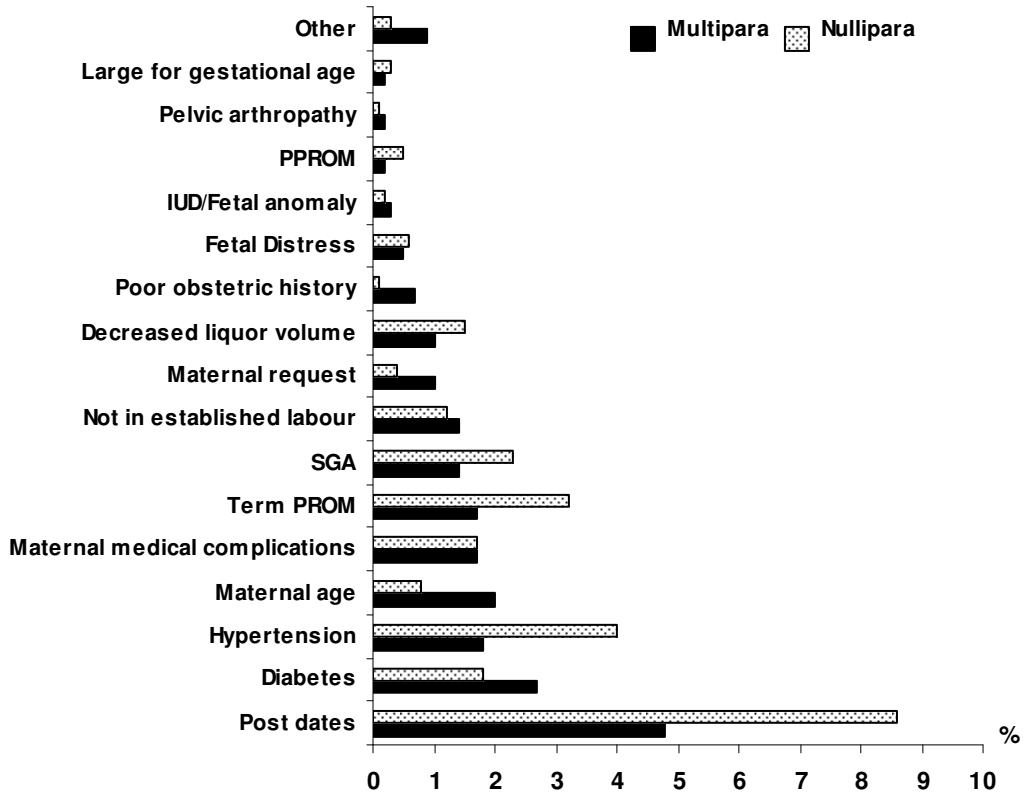

Figure 27: Primary indication for induction at term by parity (as a percentage of term births)

Induction for post dates continues to result in birth prior to 41 weeks in 21% of post dates inductions. Fifty-five of these 92 "non-post-dates" post dates inductions occurred in mothers under 35 years of age. Sixty-one percent of post dates inductions occur from 41 weeks to 41 weeks and 6 days. Nineteen percent occur at 42 weeks and beyond.

Mode of birth following induction and spontaneous onset of labour

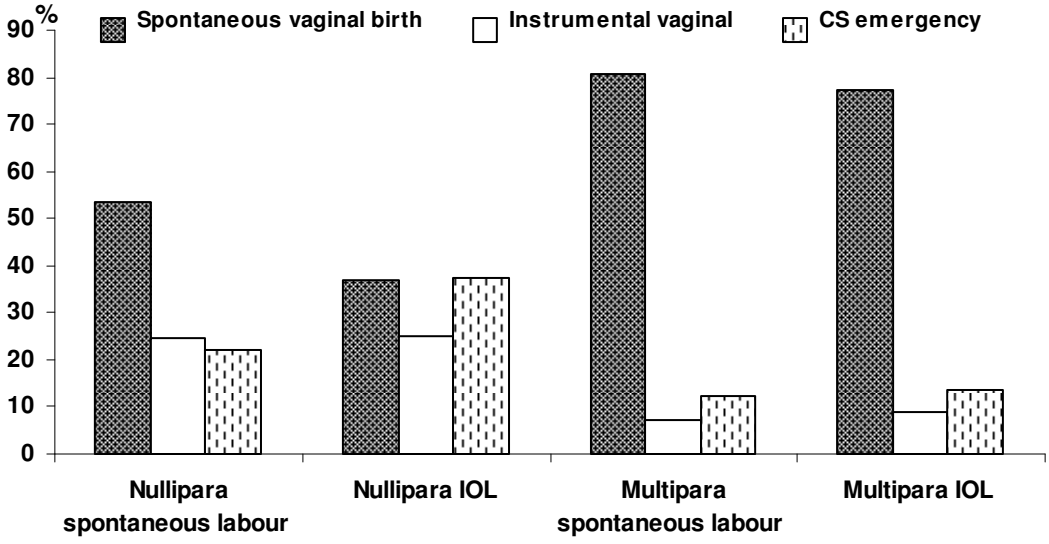

Figure 28: Mode of birth among intended vaginal births at term by parity and onset of labour (IOL=induction of labour)

Rates of emergency caesarean section at term are substantially higher among nullipara following induction of labour than following spontaneous labour. No difference is apparent

among multipara. The spontaneous vaginal birth rate is only 37% among nullipara induced at term at NW, even among those induced for post dates. Epidural rates are consistently higher among women induced at NW compared to women labouring spontaneously.

5.2 Use of Syntocinon

Table 27: Use of syntocinon by onset of labour and parity

	Total births	Syntocinon	
	N	n	%
Total	7212	2522*	35.0
Induction of labour			
Nullipara	940	687	73.1
Multipara	836	508	60.8
Spontaneous onset of birth			
Nullipara	2125	1007	47.4
Multipara	2131	318	14.9

* 2 women had syntocinon followed by emergency CS prior to onset of labour

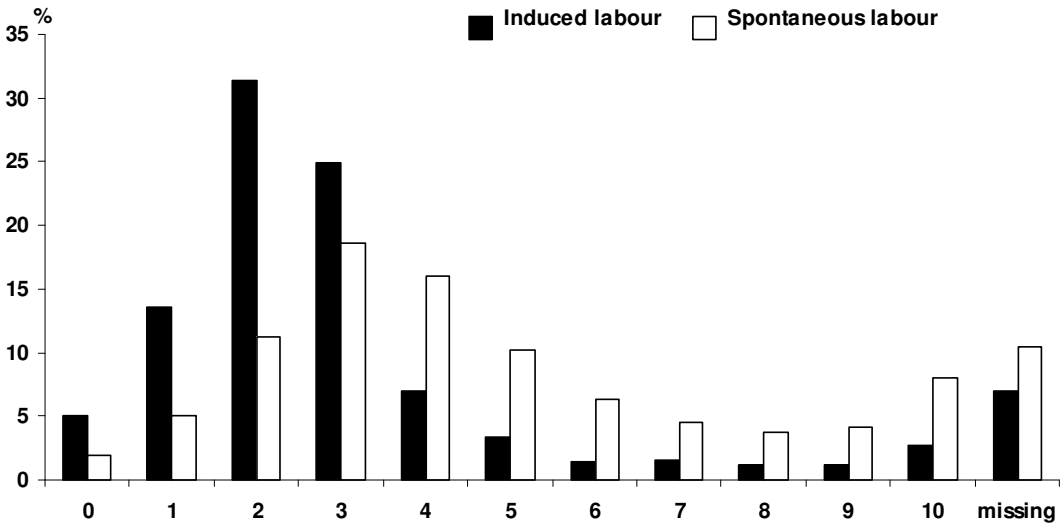

Figure 29: Dilatation at commencement of syntocinon infusion among all women by induction status

Syntocinon for augmentation of labour was used in 35% of mothers birthing at NW in 2006. It is used significantly less often among women labouring spontaneously than among induced women. However, among women labouring spontaneously, it is used at less than 4 cm in 37% and at less than 3cm in 18%. It could be argued that labour did not establish spontaneously in these women.

5.3 Mode of birth

Findings

Table 28: Mode of birth trends (1991-2006) (n = mothers)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Number of births	8833	8315	8690	8812	9125	9157	8055	7531	7501	7827	7452	7775	7611	7491	7194	7212
	%	%	%	%	%	%	%	%	%	%		%	%	%	%	%
Spontaneous vertex	67.9	68.8	68.0	67.4	65.9	65.5	63.5	62.0	61.8	59.4		55.7	56.1	54.4	53.5	52.9
Vaginal breech	1.8	1.8	1.2	1.1	1.0	1.1	1.1	1.0	1.1	1.1		0.8	0.8	0.7	0.8	0.7
Forceps/ ventouse	14.4	12.2	12.1	12.5	12.3	12.8	13.1	12.3	12.6	12.9		13.9	14.0	15.6	14.2	13.3
Caesarean	16.6	17.2	18.6	19.0	20.8	20.8	22.3	24.7	24.5	26.6		29.6	29.2	29.3	31.6	33.1
Elective														10.4	11.6	12.8
Emergency														18.8	20.0	20.3

From 1998, data exclude postnatal transfers.

In the case of twins only one mode of birth is given and mode of birth is prioritised as caesarean, forceps/ventouse, vaginal breech, then spontaneous vaginal.

Data from 2001 are not available

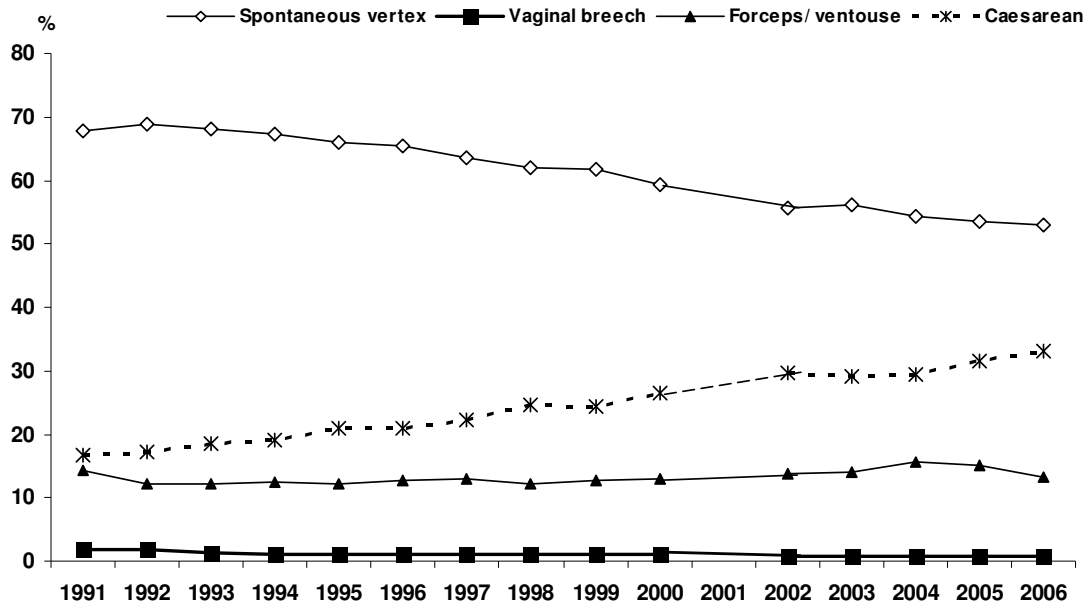

Figure 30: Mode of birth (1991–2006)

There is a continuing reduction in the spontaneous vaginal birth rate. There has been no overall change in the instrumental delivery rate, though there was a temporary rise from 2002 to 2005. Therefore the declining spontaneous vaginal birth rate is directly attributable to a rise in caesarean section rate.

Although the majority of births are still spontaneous vaginal, at current trajectory the lines would be expected to cross in about 5 year's time, assuming a static rate of instrumental vaginal delivery.

The neonatal outcomes presented in table 49, show no obvious trends over time in neonatal morbidity associated with the decline in spontaneous vaginal births and rise in caesarean section rate.

Overall perinatal mortality is stable, although there is a decline in both early and late neonatal mortality. Most neonatal deaths are of babies born at extremely preterm gestations and therefore any trends in neonatal death at later gestations would be undetectable due to very small numbers.

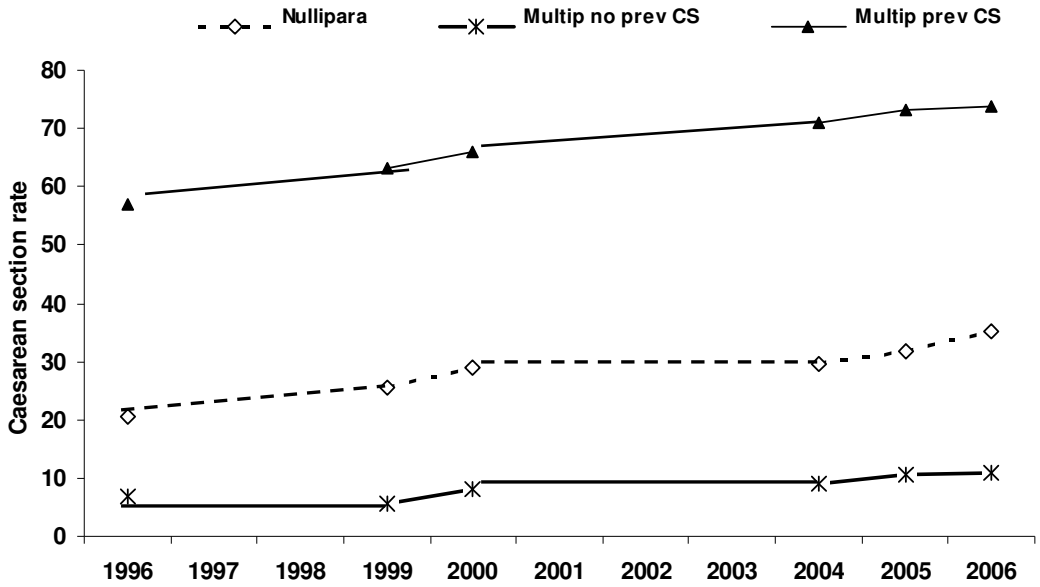

Figure 31: Caesarean section rates at term by parity and previous caesarean status (1996 – 2006)

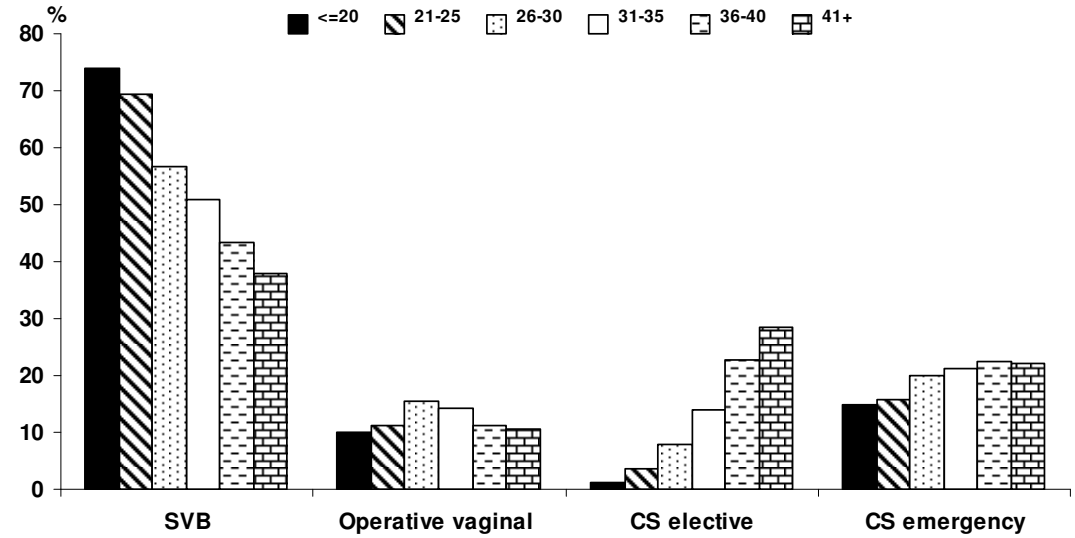

Figure 32: Mode of birth by maternal age

The rate of spontaneous vaginal birth declines markedly with maternal age at NW, whilst the rate of elective caesarean section increases equally markedly. However, there is no apparent trend in CS with instrumental delivery rates by maternal age.

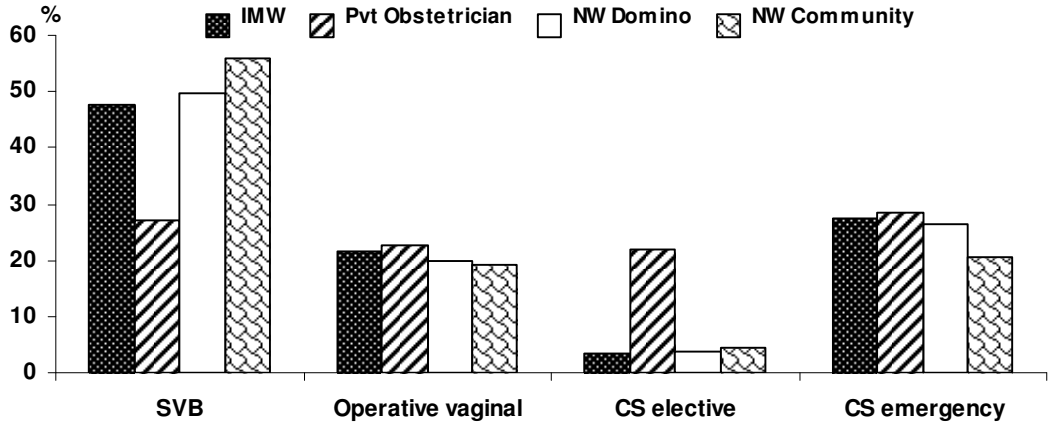

Figure 33: Mode of birth by LMC at birth among primipara

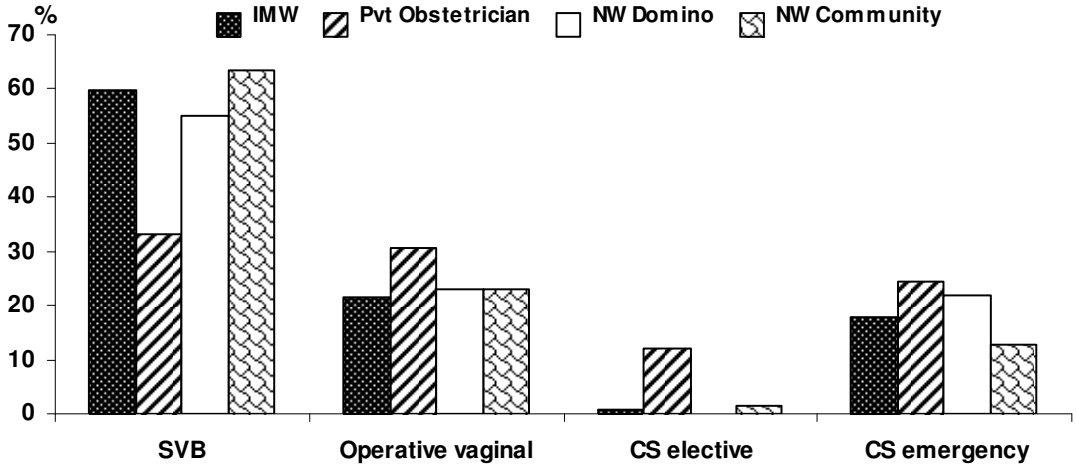

Figure 34: Mode of birth by LMC at birth among standard primipara

There are clear differences in rates of elective caesarean section and spontaneous vaginal birth by LMC among primipara. These differences remain large even among standard primipara. Given that standard primipara are the lowest risk group we are able to define, this disparity in elective caesarean section rates by practitioner is likely to represent non-clinical indications, either maternal or LMC obstetrician. It is difficult to clarify this as we are unable to reliably identify maternal choice as an indication for caesarean section. Waitemata DHB has recently instituted a policy to support elective caesarean section for clinical indication only and this may ultimately benefit women and practitioners.

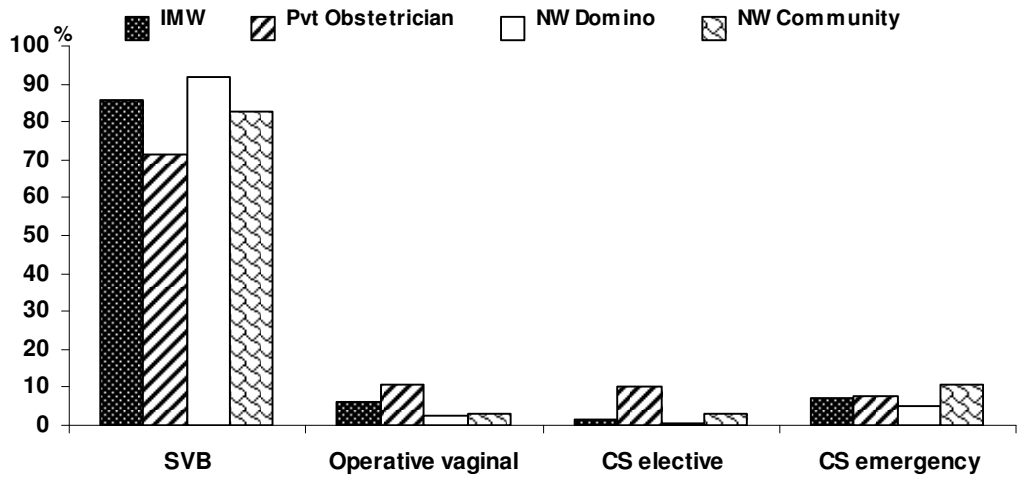

Figure 35: Mode of birth by LMC at time of birth among multipara with no previous caesarean

Similar trends exist by LMC for multipara without scar, though they are less marked.

Mode of birth data are not presented for the high risk clinic services at NW because total numbers are small and case mix is substantially different from the other LMC groups.

5.4 Spontaneous vertex birth

Table 29: Spontaneous vertex birth rates (2004-2006)

	2004	2005	2006
	n	%	n
Total births (mothers)	7491	7194	7212
Spontaneous vertex birth	4073	3845	3815
Incidence %	54.4	53.5	52.9
Total nullipara	3597	3522	3499
Spontaneous vertex birth	1584	1535	1484
Incidence %	44.0	43.6	42.4
Total multipara	3894	3672	3713
Spontaneous vertex birth	2489	2331	2331
Incidence %	63.9	63.5	62.8

5.5 Caesarean section

Methods

Since 2004, we have collected data on elective and emergency caesarean. An elective caesarean is defined as a caesarean which was scheduled in advance and prior to the onset of labour. Therefore, caesarean sections performed after the onset of labour but scheduled electively prior to labour are included with elective caesareans. Conversely, unscheduled caesarean section prior to onset of labour has been classified as emergency caesarean section.

Table 30: Caesarean section rates

	1992	1993	1994	1995	1996	1997	1998*	1999	2000	2001	2002	2003	2004	2005	2006
Total births (mothers)	**8315**	**8690**	**8812**	**9125**	**9157**	**8055**	**7492**	**7501**	**7827**	**7471**	**7775**	**7611**	**7491**	**7194**	**7212**
Caesarean sections	1420	1620	1670	1900	1905	1797	1851	1837	2084		2301	2219	2193	2273	2390
Incidence %	17.1	18.6	19.0	20.8	20.8	22.3	24.6	24.5	26.6		29.6	29.2	29.3	31.6	33.1
Total nullipara	**3700**	**3649**	**3814**	**4037**	**4018**	**3591**	**3263**	**3262**	**3454**				**3597**	**3522**	**3499**
Caesarean	726	755	790	936	888	912	900	898	1047				1118	1178	1253
Incidence %	19.6	20.7	20.7	23.2	22.1	25.4	27.6	27.5	30.3				31.1	33.4	35.8
Elective %													6.5	7.0	8.5
Emergency %													24.6	26.4	27.4
Total multipara	**4615**	**5041**	**4998**	**5088**	**5139**	**4464**	**4229**	**4239**	**4372**				**3894**	**3672**	**3713**
Caesarean	694	865	880	964	1017	885	951	939	1037				1075	1095	1137
Incidence %	15	17.2	17.6	18.9	19.8	19.8	22.5	22.2	23.7				27.6	29.8	30.6
Elective %													14.1	15.9	16.9
Emergency%													13.5	13.9	13.7

From 1998, data excludes postnatal transfers

* Excludes 39 BBAs

Table 31: Modified Robson 10-Group Classification (1997-2006)

The letters a, b, c and m represent subgroups (a,b,c) and modifications (m) of the original Robson groups

		NW 1997			NW 2000			NW 2004			NW 2005			NW 2006		
		CS	Total Births	CS Rate	CS	Total Births	CS Rate	CS	Total Births	CS Rate	CS	Total Births	CS Rate	CS	Total Births	CS Rate
		n	n	%	n	n	%	n	n	%	n	n	%	n	n	%
	Totals	1801	8055	22.4	2084	7827	26.6	21	7491	29.3	22	7194	31.6	2390	7212	33.1
1	**Nullip, singleton, cephalic, term, spontaneous labour**	274	1991	13.8	319	1896	16.8	33	1955	17.3	35	1892	19.0	396	1920	20.6
2a	**Nullip, singleton cephalic, term, induced**	243	883	27.5	268	839	31.9	32	932	35.0	33	931	35.4	316	845	37.4
2b	**Nullip, singleton, cephalic, term, prelabour CS**		100			135			124			149			179	
3	**Multip,singleton, cephalic, no previous CS, term, spontaneous labour**	63	2280	2.8	60	2084	2.9	63	1805	3.5	76	1607	4.7	79	1601	4.9
4a	**Multip,singleton, cephalic, no previous CS, term, induced**	42	703	6.0	61	723	8.4	55	631	8.7	60	652	9.2	59	646	9.1
4b	**Multip, singleton, cephalic, no previous CS, term, prelabour CS**		61			58			44			48			68	
5a	**Multip, previous CS, singleton, cephalic, term, spontaneous labour**	93	372	25	141	363	38.8	15	379	42.0	13	340	38.5	143	342	41.8
5b	**Multip, previous CS, singleton, cephalic, term, induced**	59	165	35.8	74	151	49.0	57	123	46.3	58	106	54.7	38	98	38.8
5c	**Multip, previous CS, singleton, cephalic, term, prelabour CS**		265			303			419			449			496	
6m	**Nullip,singleton,breech, term**				122	132	92.4	12	130	96.9	13	136	100	148	150	98.7
7m	**Multip singleton, breech, term**				93	104	89.4	86	91	94.5	87	89	97.8	80	82	97.6
8m	**Multiples, term**				31	79	39.2	35	58	60.3	32	69	46.4	33	47	72.3
9m	**Abnormal lie, singleton term**				43	48	89.6	43	44	97.7	36	41	87.8	21	22	95.5
10 m	**All preterm**		906		376	912	41.2	31	756	42.1	32	685	47.0	334	716	46.6

The caesarean section rate is rising in both nullipara and multipara, and even in multipara with no previous caesarean section.

Nulliparous women with a singleton pregnancy, cephalic, in term spontaneous labour, are classified as Robson Group 1 and the caesarean section rate in this group has now reached 20%, as compared with 7.3% (National Maternity Hospital, Dublin, 2005) and 15.4% (Royal Women's Hospital, Melbourne, 2005). Although Robson Group 1 is one way of defining a nulliparous woman at low obstetric risk, it does not take into account other clinical risk factors that may influence the mode of birth. Therefore we have also used a more detailed definition (standard primipara) using clinical data available from our database (see Chapter 1, section 1.6.4). It is difficult to benchmark because of the variation in definition of "low risk" and in the data collected at different maternity units. NW is the only hospital in NZ that reports mode of birth for "standard primipara"; however it is possible to make some comparisons with other centres by using the Robson Group 1 definition. In the near future the "selected primipara" definition will be used by the Women's Health Australasia group as they determine a consistent definition for standard primipara. The "selected primipara" is defined as a woman 20 – 34 years of age, giving birth for the first time with a singleton pregnancy at term (37 – 41 weeks gestation) and a cephalic presentation.

In multipara at term, cephalic, singleton with no scar and spontaneous labour (Robson Group 3), the caesarean section rate has increased from 2.8% in 1997 to 4.9% in 2006. This compares with rates of 1.7% (National Maternity Hospital, Dublin, 2005) and 3.6% (Royal Women's Hospital, Melbourne, 2005). It is concerning that this lowest risk group is not immune from the increase in caesarean section rate at NW. A number of factors may be responsible, such as maternal age, BMI, and undeclared induction of labour. It is recommended that further data be collected in this group to identify what may be remediable changes in practice.

5.5.1 Vaginal birth after caesarean section

Table 32: VBAC: Parity 1, all gestations by mode of onset of labour (n=718)

	Parity 1, previous caesarean, all gestations				
	Spontaneous n=261	**Induced n=69**	**CS elective n=345**	**CS emergency before onset of labour n=43**	**Total n=718**
	n %	**n %**	n	**n**	**n %**
Spontaneous vertex	74 28.4	22 31.9	0	0	96 13.4
Vaginal breech	1 0.4	1 1.4	0	0	2 0.3
Forceps	13 5.0	7 10.1	0	0	20 2.8
Ventouse	30 11.5	8 11.6	0	0	38 5.3
CS elective	0	0	345	0	345 48.1
CS emergency	143 54.8	31 44.9	0	43	217 30.2

Table 33: VBAC: Parity 1, singleton, cephalic, term, by mode of onset of labour (n=615)

	Parity 1, previous caesarean, singleton, cephalic, term				
	Spontaneous n=230	Induced n=60	CS elective n=299	CS emergency before onset of labour n=26	Total n=615
	n %	n %	n	n	n %
SVB	68 29.6	18 30.0	0	0	86 14.0
Forceps	11 4.8	5 8.3	0	0	16 2.6
Ventouse	29 12.6	8 13.3	0	0	37 6.0
CS elective	0	0	299	0	299 48.6
CS emergency	122 53.0	29 48.3	0	26	177 28.8

In 2006 there were 162 women who had 2 or more prior caesarean sections. Of these, 156 women (96%) had a further caesarean section birth.

In the group with a uterine scar the caesarean section rate is now over 70% and shows no signs of dropping. This group corresponds to Robson Group 5 (excluding preterm births) and was responsible for 8.3% of our caesareans in 2005. There are only two ways to achieve a slowing of this relentless rise: increasing the proportion of women who are offered and accept a trial of labour after caesarean section, and improving the management of labour with a scar.

Of all parity 1 women in 2006 with one previous caesarean section and no prior vaginal birth, who were at term (n=615), only 47% (230+60) had a trial of labour (table 33). Of these, 48% had a vaginal birth. Overall 23% of all parity 1 women at term with one previous caesarean section had a vaginal birth. The overall VBAC rate in this group appears to have declined from 26% in 2005. However of those who did have a trial of labour the rate of vaginal birth has remained stable. Therefore what has changed is that a smaller proportion of women are having a trial of labour, i.e. down from 52% to 47%.

In terms of benchmarking for VBAC, the WHA collects data on VBAC in women who have had one baby previously by CS and no other babies. Comparing NW data with WHA data shows that women at NW are more likely to be offered a trial of labour, but that of the women offered a trial the trial is less likely to lead to vaginal birth. The overall VBAC rate for NW is not significantly different from the WHA average.

The emergency peripartum hysterectomy rate does not appear to have changed substantially since 2001. Hysterectomy may be performed for many reasons and further work is being done to look at the precise indications. Data on uterine scar rupture per se is not collected at present and this may be something to look at in future if a strong push toward VBAC is initiated.

Interestingly, induction of labour in women with a previous caesarean section did not seem to be associated with a lower vaginal birth rate (Table 32). This may be due to selection of only women favourable for induction with a previous scar, with the remaining women having elective caesarean section. Bishop's score data would be helpful in determining this.

5.5.2 Indication for caesarean section

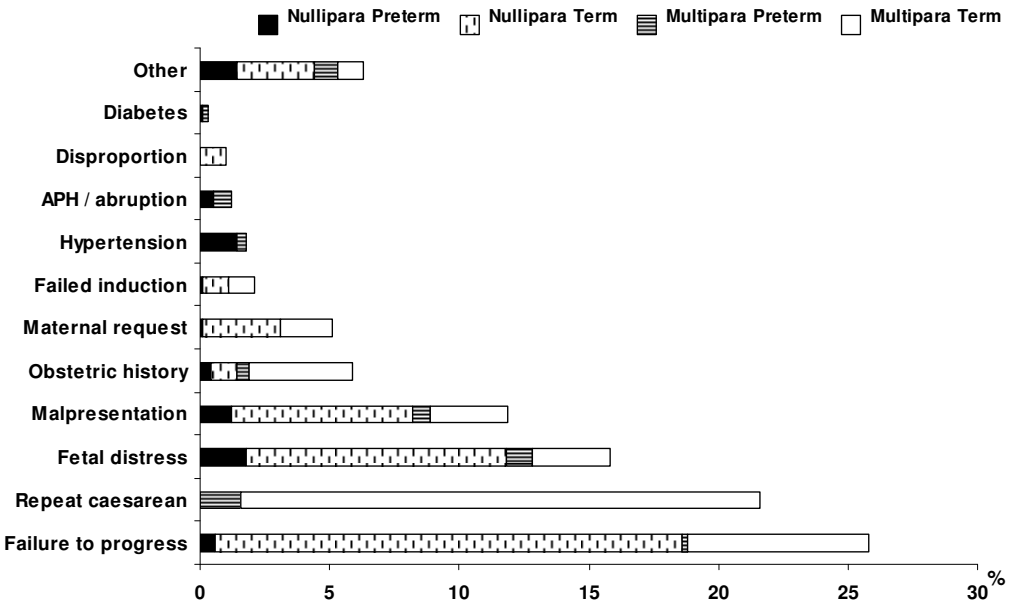

Figure 36: Contribution of gestation and parity to principal indications for caesarean section

Declared maternal request constitutes a significant proportion (about 6%) of indications for caesarean section. It is now the sixth most frequent indication and has a similar frequency to obstetric history. This appears to be evenly spread with regards to parity.

The three most common indications for caesarean section (apart from repeat caesarean) are malpresentation, fetal distress, and failure to progress.

The recently commenced Emergency Caesarean Section audit focuses on the two largest contributors to the caesarean section rate. Detailed information is collected including documentation, induction of labour (recognized or not), diagnosis of active labour, use of syntocinon and fetal blood sampling. An alternative classification of indications for caesarean section is used, based on the work of Mike Robson, which elucidates the exact reason for not achieving vaginal birth in women who have aimed for this. Some data collection will be incorporated into Healthware after the pilot period is completed.

5.6 Instrumental vaginal birth

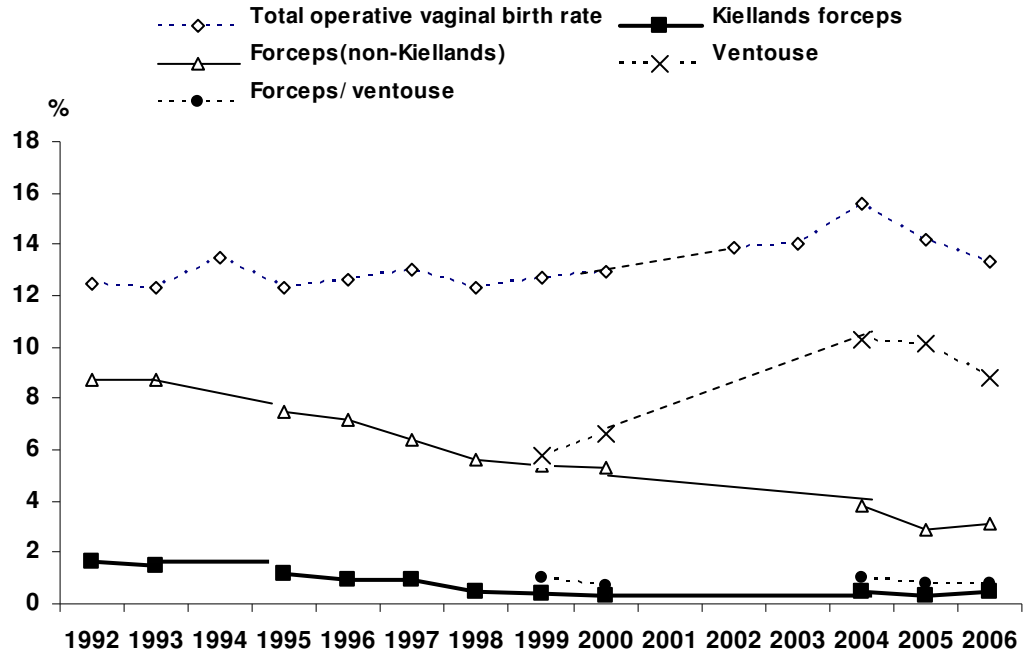

Figure 37: Operative vaginal birth (1992-2006)

Although the overall rate of operative vaginal birth is unchanged, there are significant trends in the instrument used. Kiellands forceps are phasing out internationally and there are few experienced practitioners left. NW is no exception. Their use has been replaced by the rotational Ventouse and probably by caesarean section. This is reflected in the rising Ventouse rate. However it also appears that non-Kiellands forceps are used less often at NW and this may be of concern with regards to neonatal outcome. Given the rising Ventouse rate, it is recommended that data be presented on cranial trauma in the next Annual Clinical Report. Certainly it does not seem that the declining forceps rate has done anything to prevent perineal trauma so far – this may well be an issue of training for junior medical staff.

Table 34: Indication for operative vaginal birth by parity and gestation at birth

	Nullipara term n=698		Nullipara preterm n=39		Multipara term n=207		Multipara preterm n=12		Total n=956	
	n	%	n	%	n	%	n	%	n	%
Failure to progress	430	61.6	17	43.6	115	55.6	4	33.3	566	59.2
Fetal distress	234	33.5	20	51.3	74	35.7	8	66.7	336	35.1
Maternal distress	20	2.9	0		9	4.3	0		29	3.0
Maternal request	1	0.1	0		3	1.45	0		4	0.4
Other	13	1.9	2	5.1	6	2.9	0		21	2.2

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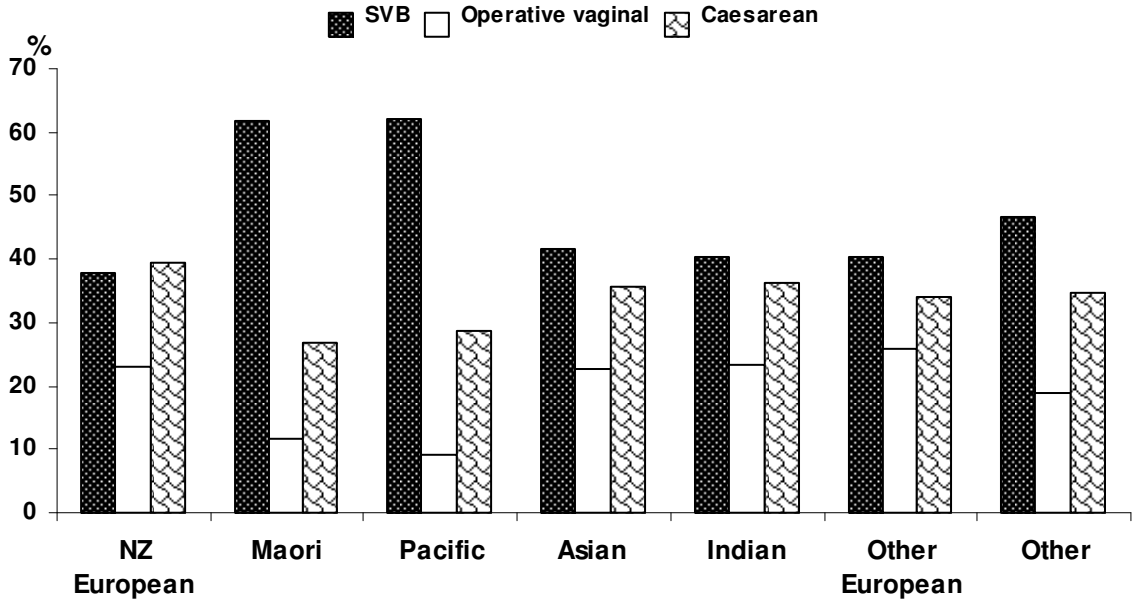

Figure 38: **Mode of birth by ethnicity among nullipara**

The excellent obstetric outcomes in the Maori and Pacific Island groups are noteworthy, despite these groups having a predominance of some risk factors such as smoking and diabetes. It is likely that maternal age and parity are confounding factors here, since the differences by ethnicity all but disappear when controlled for maternal age and parity. Epidural usage may also be a factor.

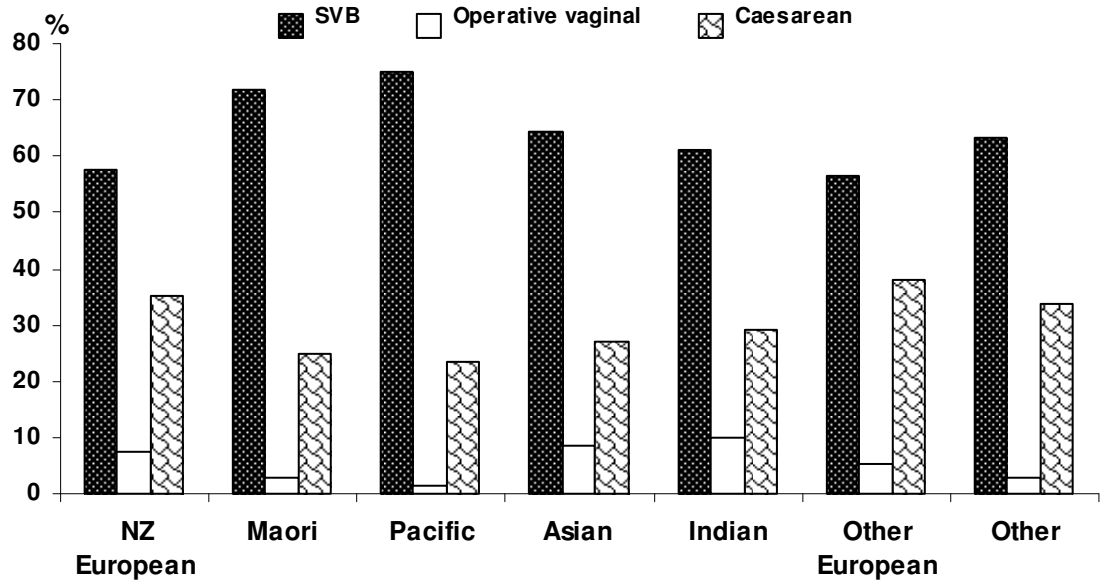

Figure 39: Mode of birth by ethnicity among multipara

5.7 Breech birth

Table 35: Mode of birth by breech presentation (singletons)

	N	Total breech	% Breech /total singleton births	Breech & CS	% CS/ total breech
Total singleton births	7050	328	4.7	293	89.3
20-31 weeks	245	53	21.6	26	49.1
32-36 weeks	591	43	7.3	39	90.7
≥37 weeks	6543	232	3.5	228	98.3

The influence of the Term Breech Trial is seen in NW data, with most breech babies at term now delivered by caesarean section. Although NW has a policy of encouraging ECV at term, and provides a well-structured ECV service with excellent results, it is unclear how well utilized this service is. It is strongly recommended that for all women undergoing elective caesarean section for breech, data are collected regarding whether they have been offered an ECV.

It is concerning that the caesarean section rate for preterm breech is so high (90.7%) in the 32 to 36 week group. There is insufficient evidence to recommend a policy of caesarean section for preterm breech. It is likely that practitioners are extrapolating from the Term Breech Trial.

5.8 Obstetric analgesia

Methods

Data are collected on use of analgesia and anaesthesia for birth by staff in Labour and Birth Suite. These data include method of analgesia and time and dilatation at which epidural is inserted. During 2006 we began to also collect reason for epidural. This will allow us to separate epidural inserted primarily for pain relief from epidural inserted for operative birth. Data below exclude elective caesarean section and emergency caesarean before labour where appropriate.

Findings

Table 36: Analgesia use by parity and mode of onset of birth

	Total	Epidural		Entonox		Pethidine		TENS		Water	
	N	n	%	n	%	n	%	n	%	n	%
All women	**7212**	**4554**	**63.1**	**2670**	**37.0**	**1308**	**18.1**	**77**	**1.1**	**477**	**6.6**
Mode of onset of birth											
CS elective	917	884	96.4	7†	0.8	9†	1.0	0		0	
CS emergency before onset labour	263	233	88.6	2†	0.8	2†	0.8	0		2	0.8
Labouring women*	**6032**	**3437**	**57.0**	**2661**	**44.1**	**1297**	**21.5**	**77**	**1.3**	**475**	**7.9**
Nullipara	3065	2150	70.1	1404	45.8	762	24.9	52	1.7	346	11.3
Multipara	2967	1287	43.4	1257	42.4	535	18.0	25	0.8	129	4.3
Induced labour	**1776**	**1269**	**71.5**	**663**	**37.3**	**400**	**22.5**	**18**	**1.0**	**86**	**4.8**
Nullipara	940	777	82.7	345	36.7	241	25.6	13	1.4	67	7.1
Multipara	836	492	58.9	318	38.0	159	19.0	5	0.6	19	2.3
Spontaneous labour	**4256**	**2168**	**50.9**	**1998**	**46.9**	**897**	**21.1**	**59**	**1.4**	**389**	**9.1**
Nullipara	2125	1373	64.6	1059	49.8	521	24.5	39	1.8	279	13.1
Multipara	2131	795	37.3	939	44.1	376	17.6	20	0.9	110	5.2

* Excludes elective caesarean and emergency caesarean before onset of labour.
† Pain relief given prior to caesarean

Rates of use of various methods of analgesia by labouring women are largely unchanged from 2005. Overall, 63% of all women giving birth at NW and 57% of labouring women had an epidural. Rates of epidural use were 20% higher among induced mothers (72%) than among mothers labouring spontaneously (51%). Induction had no impact on pethidine use but spontaneously labouring women were more likely to use entonox and water.

There are associations between age, parity, ethnicity, LMC and the analgesic choices that women make, however it is not possible to determine from these analyses whether these influences are independent of the others listed and of other obstetric risk factors.

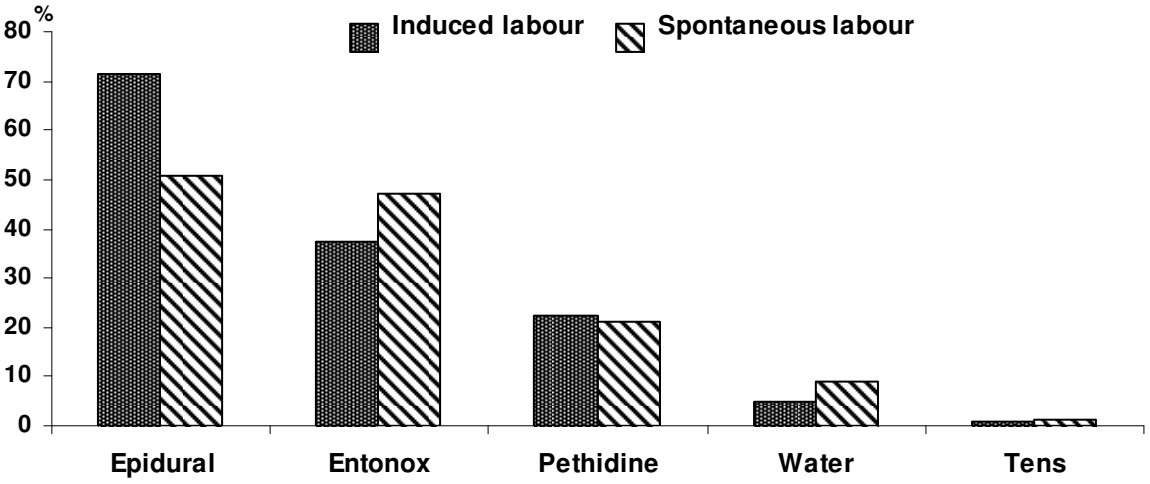

Figure 40: Analgesia use by induction status among spontaneous and induced labours

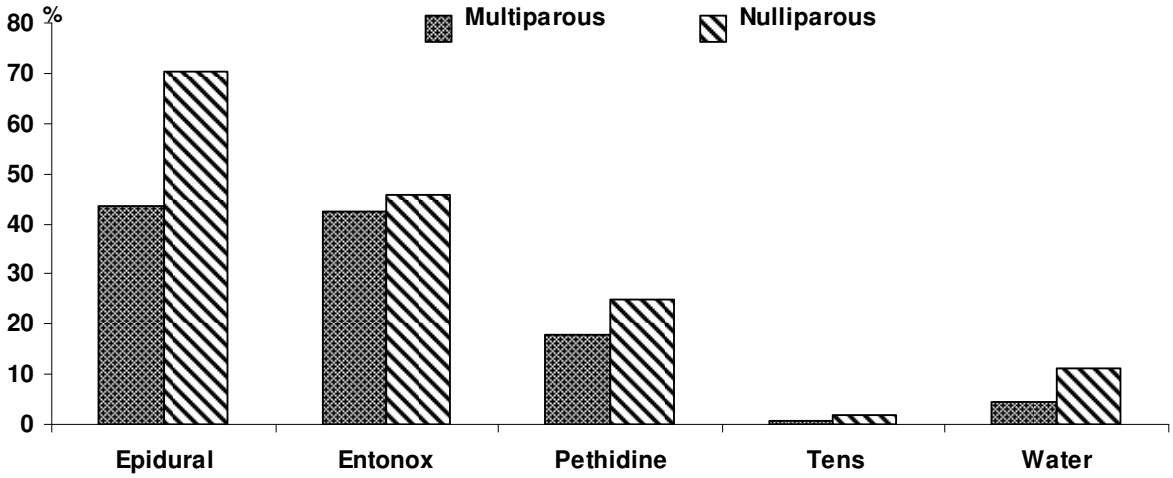

Figure 41: Use of analgesia by parity among labouring women

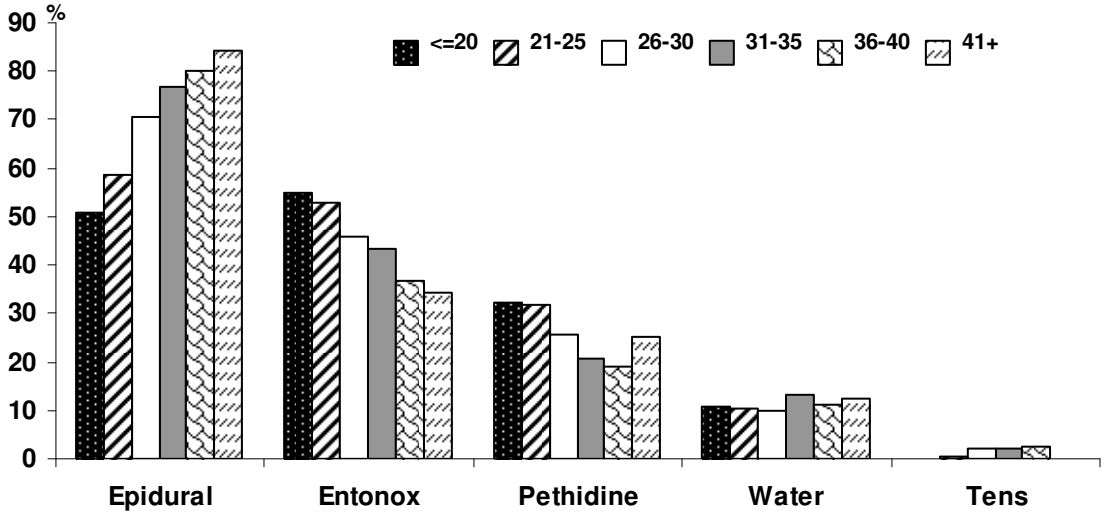

Figure 42: Analgesic use and maternal age among nulliparous labours

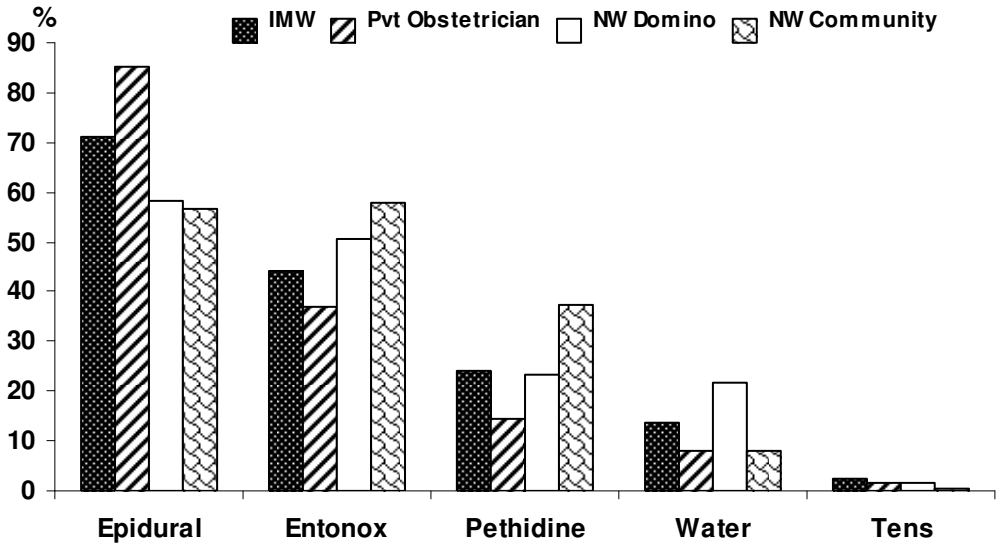

Figure 43: Analgesic use and LMC type among nulliparous labours

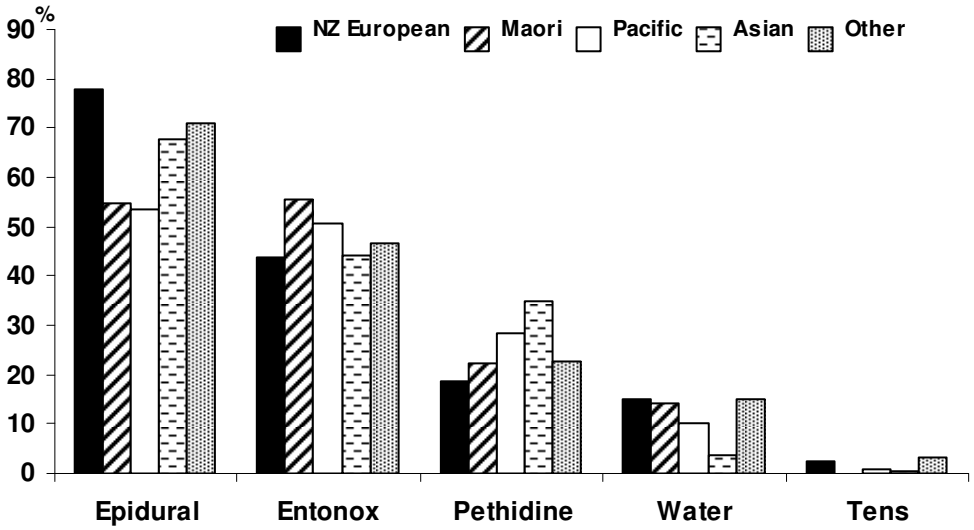

Figure 44: Analgesic use and ethnicity among nulliparous labours

Table 37: GA use and mode of birth

	Total	GA* only		GA* + epidural		Total GA*	
	N	n	%	n	%	n	%
Total	7212	129	1.8	68	0.9	197	2.7
Vaginal birth	3866	9	0.2	1		10	0.3
Operative vaginal	956	1	0.1	0		1	0.1
CS elective	924	33	3.6	7	0.8	40	4.3
CS emergency	1466	86	5.9	60	4.1	146	10.0

*General anaesthetics administered to women who had vaginal births were given postpartum for management of retained placenta, postpartum haemorrhage or for women whose epidural pain relief was inadequate for an operative vaginal birth.

The table above describes use of general anaesthesia during birth or in the immediate postnatal period. Overall 197 general anaesthetics were administered, to 10% of women having emergency caesareans and 4% of women having elective caesareans. Eleven women, who had vaginal births had a general anaesthetic for management of retained placenta, postpartum haemorrhage or for operative vaginal birth. The Healthware database does not collect data on outcomes following epidural or general anaesthesia.

5.9 Labour and birth at Birthcare Auckland

Birthcare Auckland is a Level 1 obstetric facility located close to Auckland City Hospital. It is able to provide labour and birth care and postnatal care in normal pregnancies and labours. It does not have anaesthesists or obstetricians available and so does not provide for epidurals or operative births.

Methods

The data for mothers birthing at Birthcare (n=299) during 2006 were provided by Birthcare. The data on mothers transferred to NW in labour and birthing at NW and for mothers transferred to NW after birthing at Birthcare have been obtained from the NW clinical database Healthware.

Table 38: Demographic characteristics of women labouring at Birthcare by place of birth

	Birthed at Birthcare n=299*		Intrapartum transfer to NW n=43		Total n=342	
	n	%	n	%	n	%
Parity						
Nullipara	60	20	31	72	91	27
Multipara	238	80	12	28	250	73
Age						
<21	8	3	1	2	9	3
21-25	39	13	6	14	45	13
26-30	69	23	17	40	86	25
31-35	135	45	15	35	150	44
36-40	43	14	3	7	46	13
>40	4	1	1	2	5	1
Ethnicity						
NZ European	162	54	19	44	181	53
Maori	34	11	5	12	39	11
Pacific	38	13	3	7	41	12
Asian	12	4	4	9	16	5
Indian	0		0		0	
Other European	42	14	10	23	52	15
Other	11	4	2	5	13	4

* Unknown parity for one woman

Table 39: Interventions and outcomes by parity among women commencing labour at Birthcare (includes 43 intrapartum transfers to National Women's)*

	Nullipara n=91		Multipara n=249	
	n	%	n	%
Intrapartum transfer to NW	31	34	12	5
Analgesia				
Epidural	26	29	9	4
Pethidine	1	1	6	2
Entonox	39	43	52	21
TENS	5	5	2	1
Water	46	51	109	44
Syntocinon	17	19	5	2
Mode of birth				
Normal vaginal	58	64	188	76
Water birth	15	16	57	23
Operative vaginal	11	12	2	1
Emergency caesarean	7	8	2	1
Perineal trauma				
Episiotomy	9	10	7	3
Third/fourth degree tear	1	1	0	
Blood Loss				
≥500 mls	13	14	10	4
≥1000 mls	1	1	4	2
Apgars				
1min <7	5	5	4	2
1min <4	0		0	
5min <7	1	1	1	0.4
NICU admission	3	3	2	1
Postpartum transfer to NW	4	4	6	2

* Many of these interventions occurred at National Women's

Three hundred and forty women began their labour care at Birthcare. Of these, 43 (13%) transferred to NW for birth. Nullipara were more likely to transfer (34%) than multipara (5%).

5.10 Labour interventions and birth outcomes for low risk women birthing at NW

This analysis arises out of requests from staff and consumers who want to know how a low risk mother is cared for at our facility.

Methods

Low risk is defined here (limited by the data available in our clinical database) as singleton, cephalic, term (37 – 41+6), with no history of previous perinatal death, no previous caesarean section, and no history of hypertension, diabetes, medical disease (and not under care of medical clinic or transferred from other DHB or unbooked), antepartum haemorrhage, placenta praevia, transfusion in current pregnancy, no evidence of "suspected" SGA or LGA (defined as SGA or LGA as an indication for induction or operative birth), and with spontaneous onset of labour. There is no restriction on maternal age or BMI (this is in part because high BMI is not a referral recommendation in the "Guidelines for consultation with obstetric and related specialist medical services" at this time). Data presented in the tables include all women who birthed at National Women's.

Table 40: Labour interventions by risk among mothers entering labour spontaneously

	High risk n=1389		Low risk total n=2867		Low risk nullipara n=1566		Low risk multipara n=1301	
ARM	568	40.9	1475	51.4	765	48.9	710	54.6
ARM for:								
Fetal distress	16	1.2	29	1.0	19	1.2	10	0.8
Labour augmentation	500	36.0	1275	44.5	684	43.7	591	45.4
Maternal request	24	1.7	108	3.8	37	2.4	71	5.5
Other	28	2.0	63	2.2	25	1.6	38	2.9
Anaesthesia/Analgesia								
Epidural	810	58.3	1358	47.4	1004	64.1	354	27.2
Pethidine	269	19.4	628	21.9	404	25.8	224	17.2
Entonox	607	43.7	1391	48.5	792	50.6	599	46.0
Water	82	5.9	307	10.7	222	14.2	85	6.5
Syntocinon augmentation	362	26.1	963	33.6	787	50.3	176	13.5
Episiotomy	195	14.0	609	21.2	476	30.4	133	10.2

The spontaneous vaginal birth rate was 55% among low risk nullipara and 91% among low risk multipara entering labour spontaneously and birthing at NW in 2006. Of these women, 64% of nullipara and 27% of multipara had an epidural, while 50% of nullipara and 14% of multipara were augmented with syntocinon.

Table 41: Maternal outcomes by risk among mothers entering labour spontaneously

	High risk n=1389		Low risk total n=2867		Low risk nullipara n=1566		Low risk multipara n=1301	
Mode of birth								
SVB	797	57.4	2042	71.2	862	55.0	1180	90.7
Operative vaginal	203	14.6	456	15.9	385	24.6	71	5.5
CS emergency	389	28.0	369	12.9	319	20.4	50	3.8
Third/fourth degree tear	25	1.8	55	1.9	47	3.0	8	0.6
PPH ≥500 mls	456	32.8	585	20.4	417	26.6	168	12.9
PPH ≥1000mls	113	8.1	141	4.9	84	5.4	57	4.4
Transfusion	42	3.0	44	1.5	29	1.9	15	1.2

Table 42: Baby outcomes by risk among mothers entering labour spontaneously

	Low risk n=2867		High risk n=1439	
Preterm	0		378	26.3
Term	2867	100	1061	73.7
SGA	220	7.7	180	12.5
1 min Apgar <4	23	0.8	35	2.4
1 min Apgar <7	166	5.8	192	13.3
5 min Apgar <7	16	0.6	32	2.2
Admitted to NICU	79	2.8	286	19.9
≥2 days in NICU	61	2.1	272	18.9
Assisted ventilation	33	1.2	156	10.8
Stillbirth	2	0.07	10	0.7

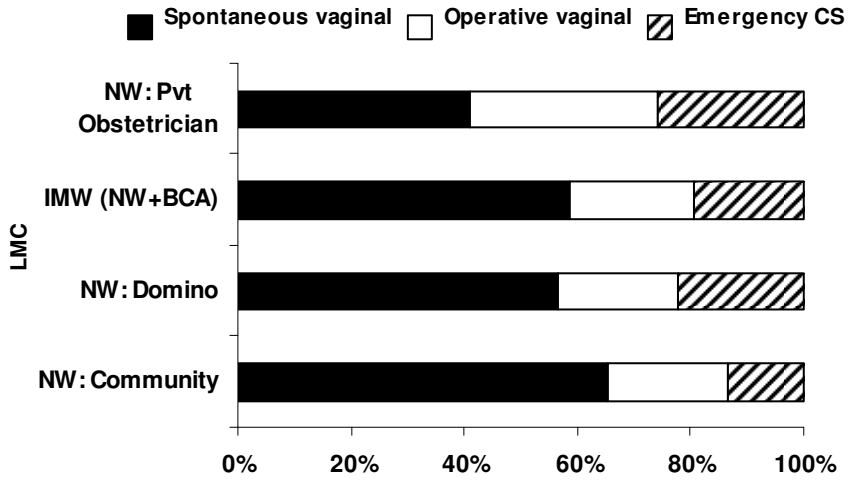

Figure 45: Comparison of mode of birth among low risk nulliparous women by caregiver (BCA=Birthcare Auckland)

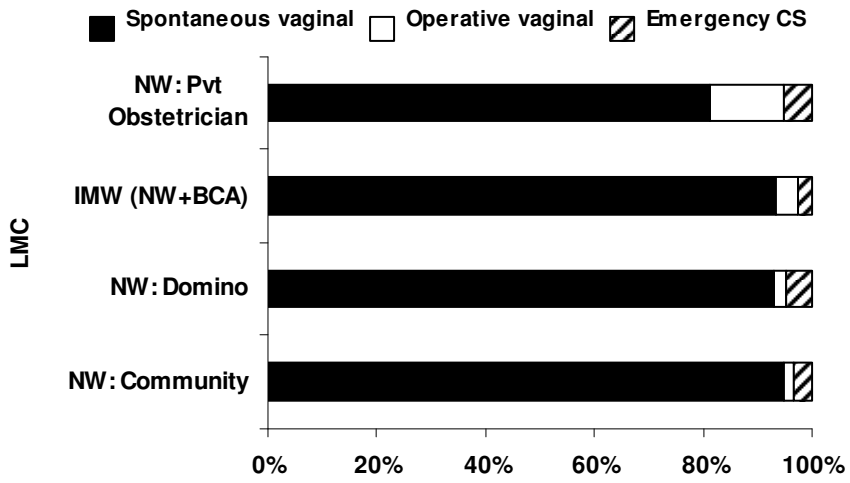

Figure 46: Comparison of mode of birth among low risk multiparous women by caregiver (BCA=Birthcare Auckland)

The two figures above show a comparison of spontaneous vaginal birth rates for low risk mothers birthing at NW by LMC group. These figures include Birthcare data, both for women birthing at Birthcare and women transferred to NW in labour, within the IMW LMC caregiver group. They also include transfers of women from other units or from home if the LMC has an access agreement at NW provided these women are low risk by the definition given in the methods. They do not include births at home.

Differences in normal birth rates are significantly different by caregiver in low risk nulliparous and multiparous women. Some of the differences may be due to the way "low risk" has been defined. However, this type of definition is used worldwide in an effort to benchmark similar women so it would seem unlikely that this explains all of the variance. Self-selection may also explain some of the difference, and if this is so, then do low risk women really want interventional births when there is no clear evidence that they will have any worse outcomes with normal birth?

"As a consumer advocate I would like to challenge LMCs providing care to low risk women to carefully reflect on their outcomes, particularly in regards to induction, ARM, epidurals, use of water in labour and physiological third stage care. I would ask that LMCs are mindful of eliminating any unnecessary trauma during the labour and birth and also by default during the immediate postnatal period. A lowering of the intervention rates will not only increase satisfaction but also empower women as they embark on the role of parenting their newborn infant.

It is important to acknowledge that there continues to be a significant number of birthing women who choose to birth at a secondary or tertiary hospital to ensure they have medical back-up in case something "goes wrong". However, I would also question whether there are LMCs who are also working on this premise, and together - in partnership - women and their LMC are utilising some of the very services or "back-up" that they should be working hard to avoid. Women and their LMC, in fact everyone working in the maternity sector, must place value on normal birthing and promote this as the gold standard for well women and their babies."

Jennie Valgre
Consumer representative NW Quality committee

5.11 Mothers of NICU babies

Methods

The following tables describe the mothers of babies born at NW who are admitted for any period of time to the NW newborn intensive care unit (NICU).

Table 43: Demographic characteristics among mothers of NICU babies

	Mothers with babies admitted to NICU n=682		Not admitted n=6530	
	n	%	n	%
Age				
<20	40	5.9	283	4.3
20-25	83	12.2	786	12.0
26-30	167	24.5	1568	24.0
31-35	233	34.2	2386	36.5
36-40	132	19.4	1289	19.7
41+	27	4.0	218	3.3
Ethnicity				
NZ European	304	44.6	2730	41.8
Maori	82	12.0	515	7.9
Pacific	100	14.7	921	14.1
Asian	70	10.3	1045	16.0
Indian	55	8.1	465	7.1
Other European	53	7.8	629	9.6
Other	18	2.6	225	3.4
DHB of residence				
ADHB	368	54.0	4732	72.5
CMDHB	87	12.8	910	13.9
Waitemata	165	24.2	827	12.7
Northland	26	3.8	13	0.2
Other	36	5.3	48	0.7
Smoking				
Currently smoking	59	8.7	299	4.6
Stopped smoking in pregnancy	6	0.9	105	1.6
Not smoking	348	51.0	4663	71.4
Missing	269	39.4	1463	22.4

Table 44: Clinical characteristics of mothers with babies in NICU

	Mothers with babies admitted to NICU n=682		Not admitted n=6530	
	n	%	n	%
Nos of babies				
Singleton	601	88.1	6449	98.8
Multiples	81	11.9	81	1.2
Antenatal complications				
SGA	191	28.0	645	9.9
Hypertension	153	22.4	577	8.8
APH	111	16.3	300	4.6
Preterm birth	407	59.7	309	4.7
Mode of onset of birth				
Induction of labour	142	20.8	1634	25.0
Spontaneous onset of labour	332	48.7	3924	60.1
CS elective	76	11.1	841	12.9
CS emergency before labour	132	19.4	131	2.0
Mode of birth				
SVB	247	36.2	3619	55.4
Operative vaginal	74	10.9	882	13.5
CS elective	76	11.1	848	13.0
CS emergency	285	41.8	1181	18.1

Mothers whose babies are admitted to NICU do not differ by age from mothers whose babies are not admitted, but are more likely to be Maori, less likely to be Asian, and more likely to be smokers. They are also more likely to be from outside the ADHB catchment area. Not surprisingly, their pregnancies are significantly more likely to have been complicated by growth restriction, hypertension, antepartum haemorrhage and preterm birth. Further, 50% have had a caesarean section. These factors may be of importance in provision of care to these mothers and their families.

Summary / Implications

Induction of labour

There appears to have been a fall in induction rate in 2006, which is desirable given the data presented in this chapter on reduced spontaneous vaginal birth rates among nullipara at term following induction of labour.

Intervention prior to spontaneous labour is strikingly more common among women under private obstetrician care than among other groups other than high risk clinic patients, even among standard primipara.

Epidural analgesia and emergency caesarean section more often follow induction of labour for all indications among primipara at term than spontaneous onset of labour. This should be discussed with primipara consenting to induction of labour.

The rate of birth prior to 41 weeks following induction for post-dates remains at 21% of inductions for this indication, suggesting that evidence-based guidelines for management of post dates pregnancy are still not established or followed at NW.

A standard definition of onset of spontaneous labour is still not apparent from the data presented on syntocinon use.

Mode of birth

The spontaneous vaginal birth rate at NW continues to drop while the caesarean section rate continues to rise. There is no evidence of a drop in neonatal morbidity coincident with this.

There are clear differences in rates of elective caesarean section and spontaneous vaginal birth by LMC which are likely to represent non-clinical indications, either maternal or LMC obstetrician. Waitemata DHB has recently instituted a policy to support elective caesarean section for clinical indication only and this may ultimately benefit women and practitioners.

The proportion of women who are offered VBAC continues to fall. Only 23% of women who had had one previous caesarean birth and no other births had a vaginal birth in 2006.

Clinical Governance was introduced to Labour and Birth Suite at NW in late 2006. One of the first projects undertaken by this group was to commence audit of emergency caesarean sections. An alternative classification of indications for emergency caesarean section has been used and has now been incorporated into Healthware. Feedback from this audit along with other clinical governance activities may impact on outcomes at NW later in 2007.

A comparison of mode of birth among low risk women birthing at NW and Birthcare Auckland suggests that place of birth and caregiver impact on normal birthing rates. These findings may be addressed by normal birthing initiatives underway at NW.

Chapter 6

LABOUR and BIRTH OUTCOMES

6 LABOUR and BIRTH OUTCOMES

This chapter includes maternal and neonatal outcomes following labour and birth, including perineal trauma, postpartum haemorrhage, and emergency peripartum hysterectomy.

6.1 Perineal trauma

Table 45: Episiotomy rates (n=vaginal births)

	1995 n=7224	1996 n=7250	1997 n=6253	1998 n=5676	1999 n=5661	2000 n=5739	2004 n=5298	2005 n=4921	2006 n=4822
Number of episiotomies	1473	1434	1252	1195	1251	1367	1181	1093	1103
Incidence %	20.4	19.8	20.0	21.1	22.1	23.8	22.3	22.2	22.9
Episiotomy with 3rd/4th degree tear	14	25	8	9	5	17	15	23	47
Incidence %	0.2	0.3	0.1	0.2	0.1	0.3	0.3	0.5	1.0
All 3rd/4th degree tears	47	61	41	35	29	47	72	97	103
Incidence %	0.7	0.8	0.7	0.6	0.5	0.8	1.3	2.0	2.1

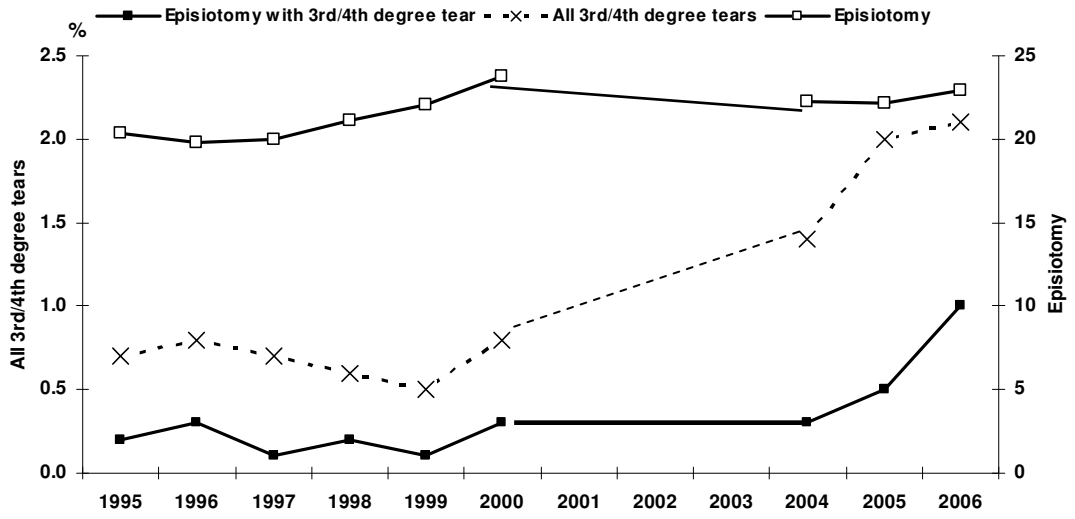

Figure 47: Perineal trauma rates

During 2006 there has been a further increase in the number of women suffering third and fourth degree tears and there has been a doubling of the rate of these major tears in association with episiotomy. As mentioned in 2005, some of this rise may be an increase in the reporting of these perineal injuries. However, it is unlikely that this is the only explanation. The increase in major perineal trauma has occurred despite a stable episiotomy rate and a drop in operative vaginal birth rate. Some of the increase may be due to the increase in obesity in our population and to ethnic differences in rates of episiotomy and perineal trauma. The rise warrants further review.

There are a wide range of views about episiotomy from a belief that there is no benefit through to routine use. The rate in the United States of America is 30% to 35% of vaginal births (Hartmann, K JAMA 2005) and in Swedish hospitals rates may vary from 4% to 50% (Rockner, G Brit J Obstet Gynaecol 1999). The conventional view is that there is a place for episiotomy for maternal and fetal indications, such as avoiding severe maternal lacerations and facilitating or expediting difficult deliveries (ACOG Practice Bulletin; Obstet Gynecol 2006).

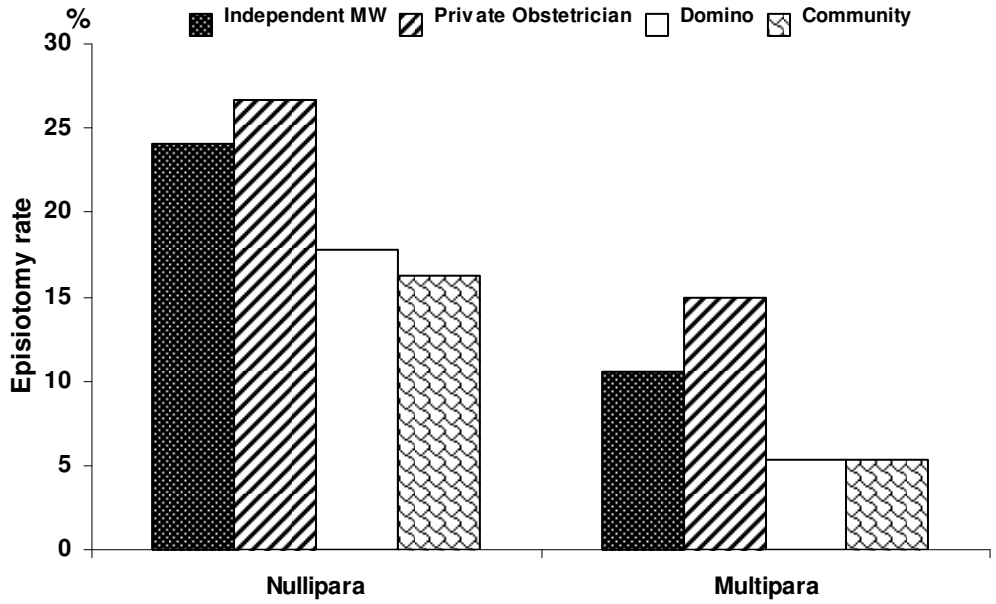

Figure 48: Episiotomy associated with spontaneous vaginal birth by LMC at birth and parity

6.2 Postpartum haemorrhage

Table 46: Postpartum haemorrhage rate (1992-2006)

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2004	2005	2006
Total Births	8315	8690	8812	9125	9157	8055	7531	7501	7827	7491	7194	7212
Primary PPH (≥500mls)	881	1211	1390	1655	1633	1882	1818	1921	2088	2056	2158	2512
Incidence %	10.6	13.9	15.8	18.1	17.8	23.4	24.1	25.6	26.7	27.4	30.0	34.8
Primary PPH (≥1000mls)	127	249	227	267	344	303	318	381	423	262	366	554
Incidence %	1.5	2.9	2.6	2.9	3.8	3.8	4.2	5.1	5.4	3.5	5.1	7.7

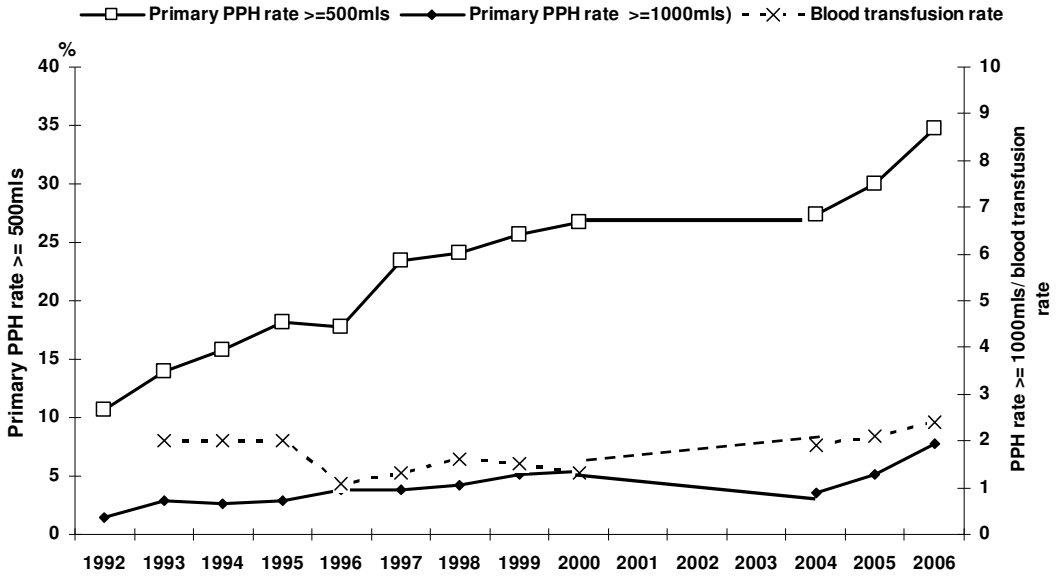

Figure 49: Postpartum haemorrhage rates (1992-2006)

There is a continuing rise in rate of postpartum haemorrhage over 1000ml which is in part due to the increased caesarean section rate. A high rate of blood loss over 1000 ml is evident in women who have both elective and emergency caesareans. Placenta praevia and/or accreta are also associated with high blood loss and are in themselves associated with previous caesarean section.

Over-estimation of the blood loss has been mentioned as a factor in the rise in primary postpartum haemorrhage, but in practise the usual behaviour is to under-estimate anything that might adversely reflect on our clinical performance.

More women are obese and there has been an increase in the rate of perineal trauma during the past year which may both contribute to an increase in blood loss. Consideration also needs to be given to the conduct of the third stage of labour. The value of oxytocin in the third stage has been known for 75 years; more recent studies have confirmed the reduction in risk of post partum haemorrhage with the active management of the third stage compared with expectant (physiological) management (Rogers, J:Lancet 1998; Prendiville, W:BMJ 1988). The risk of death and morbidity resulting from postpartum haemorrhage has lead to the introduction of a new evidence-based policy in New South Wales (Aust NZ J Obstet Gynaecol 2007).

Some complementary medicines and herbal remedies, including garlic, Gingko, and Ginseng, have been demonstrated to affect platelet function.

NW has a protocol for the management of postpartum haemorrhage once it has occurred. In face of the current increase in its rate, it would be timely to look at a policy to prevent it occurring.

Table 47: Blood transfusion

	1993	1994	1995	1996	1997	1998	1999	2000	2004	2005	2006
Antenatal	5	3	9	4	2	4	4	0	10	12	11
Antenatal & intrapartum				1	0	0		0	1	0	0
Antenatal & postpartum								1	0	3	0
Intrapartum	3	3	11	7	3	3	3	4	2	2	6
Intrapartum & postpartum				1	3	6	3	4	4	3	3
Postpartum	151	128	152	90	94	110	100	96	128	133	150
Total transfusions	159	134	172	103	102	123	110	105	145	153	170
Total transfusion rate	2.0	2.0	2.0	1.1	1.3	1.6	1.5	1.3	1.9	2.1	2.4

The rate of blood transfusion among women recorded as losing 1000mls or more was 18% in 2006 and 2% among women losing from 500mls to 1000mls.

Table 48: Postpartum blood loss by mode of birth

	Spontaneous vertex birth n=3815		Vaginal breech n=51		Ventouse birth n=639		Forceps birth n=317		CS emergency n=1466		CS elective n=924		Total n=7212	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
PPH ≥500mls	475	12.5	8	15.7	112	17.5	86	27.1	1126	76.8	705	76.3	2512	34.8
PPH ≥1000mls	131	3.4	3	5.9	18	2.8	19	6.0	252	17.2	131	14.2	554	7.7
Post partum blood transfusion	43	1.1	2	3.9	16	2.5	15	4.7	63	4.3	14	1.5	153	2.1

6.3 Emergency peripartum hysterectomy

Methods

Emergency peripartum hysterectomy is defined as hysterectomy performed for complications related to pregnancy within 6 weeks of delivery, when that pregnancy resulted in birth at NW at or beyond 20 weeks gestation. Semi-elective cases are excluded.

There were 6 emergency peripartum hysterectomies in 2006. This is a rate of 0.8/1000 births, which is consistent with rates before and following the period from 1998-2000, and is consistent with international rates.

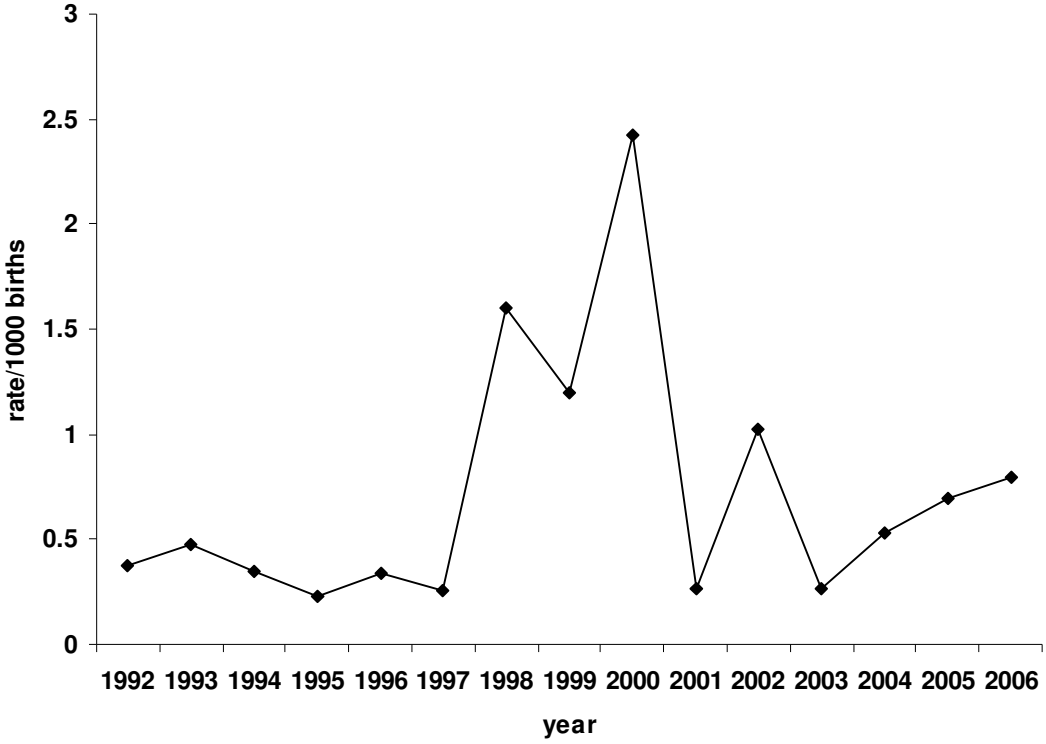

Figure 50: Emergency peripartum hysterectomy rates/1000 births (1992-2006)

6.4 Neonatal outcomes by mode of birth

Methods

The following tables include all babies born. However, in counting Apgar scores, stillbirths are **excluded** from the numerators.

Table 49: Neonatal morbidity overall and by mode of birth (all gestations)

	Spontaneous vertex n=3861		Vaginal breech n=58		Forceps birth n=318		Ventouse birth n=641		CS elective n=972		CS emergency n=1529		Total n=7379	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
1 min Apgar <4	34	0.9	12	2.07	4	1.3	8	1.3	10	1.0	43	2.8	111	1.5
1 min Apgar <7	209	5.4	22	37.9	34	10.7	82	12.8	72	7.4	268	17.5	687	9.3
5 min Apgar <7	40	1.0	9	15.5	0		3	0.5	1	0.1	34	2.2	87	1.2
Admitted to NICU	258	6.7	14	24.1	31	9.7	44	6.9	93	9.6	331	21.6	771	10.4
≥2 days in NICU	232	6.0	14	24.1	31	9.7	35	5.5	84	8.6	311	20.3	707	9.6
Assisted ventilation	113	2.9	10	17.2	11	3.5	15	2.3	49	5.0	187	12.2	385	5.2
Stillbirths	47	1.2	22	37.9	1	0.3	0		2	0.2	2	0.1	74	1.0

Table 50: Neonatal morbidity (by mode of birth) in term or post term (≥ 37 weeks) babies

	Spontaneous vertex n=3538		Vaginal breech n=10		Forceps birth n=283		Ventouse birth n=623		CS elective n=866		CS emergency n=1223		Total n=6543	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
1 min Apgar <4	20	0.6	1	10.0	4	1.4	8	1.3	9	1.0	24	2.0	66	1.0
1 min Apgar <7	151	4.3	4	40.0	30	10.6	79	12.7	53	6.1	151	12.3	468	7.2
5 min Apgar <7	19	0.5	0		0		3	0.5	1	0.1	16	1.3	39	0.6
Admitted to NICU	108	3.1	0		10	3.5	37	5.9	35	4.0	93	7.6	283	4.3
≥2 days in NICU	87	2.5	0		10	3.5	28	4.5	28	3.2	73	6.0	226	3.5
Assisted ventilation	33	0.9	0		3	1.1	14	2.2	13	1.5	36	2.9	99	1.5
Stillbirth	10	0.3	0		0		0		1	01	1	0.1	12	0.2

Table 51: Neonatal morbidity in term or post term (≥ 37 weeks) babies (2000-2006)

	2000 n=6915		2001		2002		2003		2004 n=6793		2005 n=6578		2006 n=6543	
	n	%							n	%	n	%	n	%
1 min apgar <4	106	1.5							68	1.0	69	1.0	66	1.0
1 min apgar <7	553	8.0							507	7.5	454	6.9	468	7.2
Admitted to NICU	405	5.9							349	5.1	346	5.3	283	4.3
≥2 days in NICU	*								254	3.7	275	4.2	226	3.5
Assisted ventilation	86	1.2							99	1.5	98	1.5	99	1.5

* The definition for length of stay in NICU changed following 2000 and so previous data are not comparable with data since 2001. In NICU a day is counted as any "part" of a day, e.g. admission at 2300 and discharge at 0100 would count as 2 days where as in Healthware a 24 hour clock is used so an admission at 2300 hrs and a discharge at 0100 would count as 2 hours.

Summary / Implications

During 2006 there has been a further increase in the number of women suffering third and fourth degree tears and there has been a doubling of the rate of these major tears in association with episiotomy.

Rates of large postpartum haemorrhage continue to rise. This is in part as a consequence of increased rates of caesarean section but also follows vaginal birth. Management of perineal injury and third stage need review.

Neonatal outcomes are consistent with figures in 2005 other than a drop in admissions of NW term babies to NICU.

Chapter 7

POSTNATAL CARE

7 POSTNATAL CARE

This chapter provides information on infant feeding and postnatal admissions.

7.1 Infant feeding

Methods

The breastfeeding status of infants born at NW is recorded at the time of discharge from the facility, irrespective of whether this is immediately postpartum from Labour and Birth Suite or following mothers' postnatal stay. Babies admitted to NICU are excluded from the data presented here.

Data are also collected at the time of discharge of mother and baby for those women who have post discharge care provided by NW. This is at approximately 5-6 weeks post birth.

With continued monitoring the integrity of data on breastfeeding at discharge from LMC care from the postnatal wards continues to improve, with over 99% of these discharges having data entered. Data on breastfeeding for discharges from Labour & Birth Suite and following postnatal care continues to improve with data available on 90% of mothers. The women for whom data are missing are excluded from the analyses presented here.

Findings

The breastfeeding outcomes for the 2006 year show a significant increase in exclusive breastfeeding from 64% in 2005 to 74% on discharge from the facility. The impressive result may have been attributable to some of the following:

- Improved data collection, particularly at discharge within a few hours of the birth
- Increased hours for Lactation Consultants to 1.8 FTE
- Increased Breastfeeding Study Day attendance
- Focus by Clinical Charge Midwives to ensure staff complete the required 18hrs Breastfeeding Education to meet the Baby Friendly Hospital standard.

As staff breastfeeding education has increased the skills to support mothers initiating breastfeeding have improved. There is increased awareness of the disadvantages of introducing supplements while establishing breastfeeding. Ensuring informed maternal consent is obtained, along with restricted access to breast milk substitutes in line with the WHO Code recommendations for maternity facilities, have also significantly reduced the use of supplementary feeding.

At 74% exclusive breastfeeding on discharge for 2006, NW is near the Ministry of Health requirement of 75% exclusive breastfeeding on discharge. NW is also close to the 80% midwifery and nursing staff breastfeeding education required to achieve Baby Friendly Hospital Accreditation.

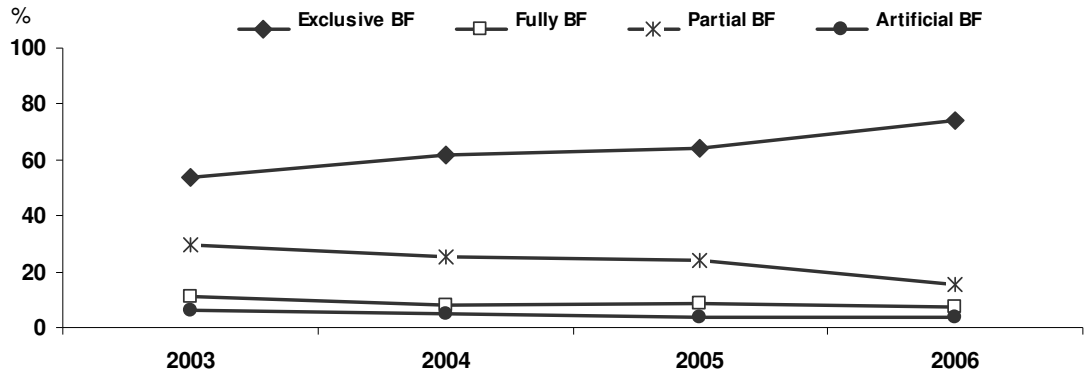

Figure 51: Method of infant feeding at discharge from NW (2003-2006)

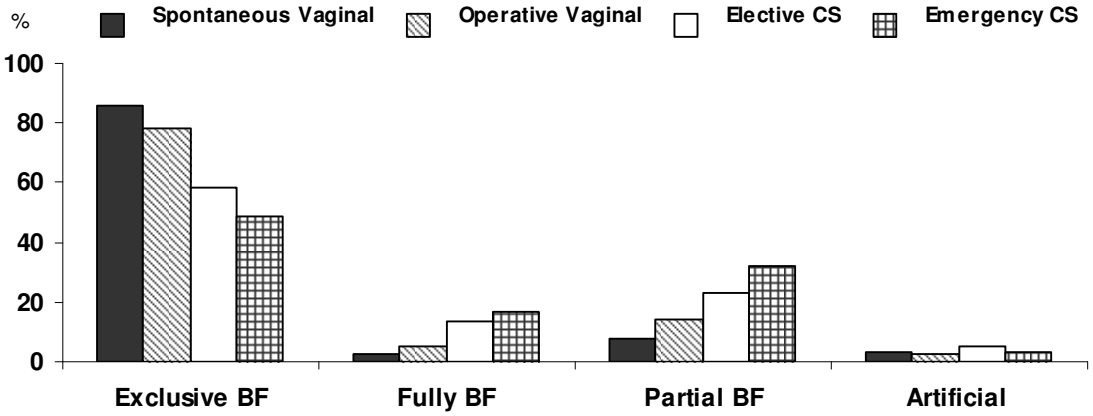

Figure 52: Infant feeding at discharge from NW by mode of birth

Table 52: Exclusive breastfeeding by mode of birth

	2004	2005	2006
	%	%	%
Spontaneous vaginal	74.2	78.6	85.9
Operative vaginal	64.9	69.1	78.3
Elective CS	38.6	41.9	58.3
Emergency CS		35.3	48.6

Delayed initiation of breastfeeding and the onset of lactation following caesarean section impacts on exclusive breastfeeding in this group of women and their babies. Encouraging early skin-to skin contact, and ongoing education on the benefits of initiating breastfeeding as soon as possible has had an impact on increased exclusive breastfeeding outcomes to 58% for elective caesarean section and 49% for emergency caesarean section.

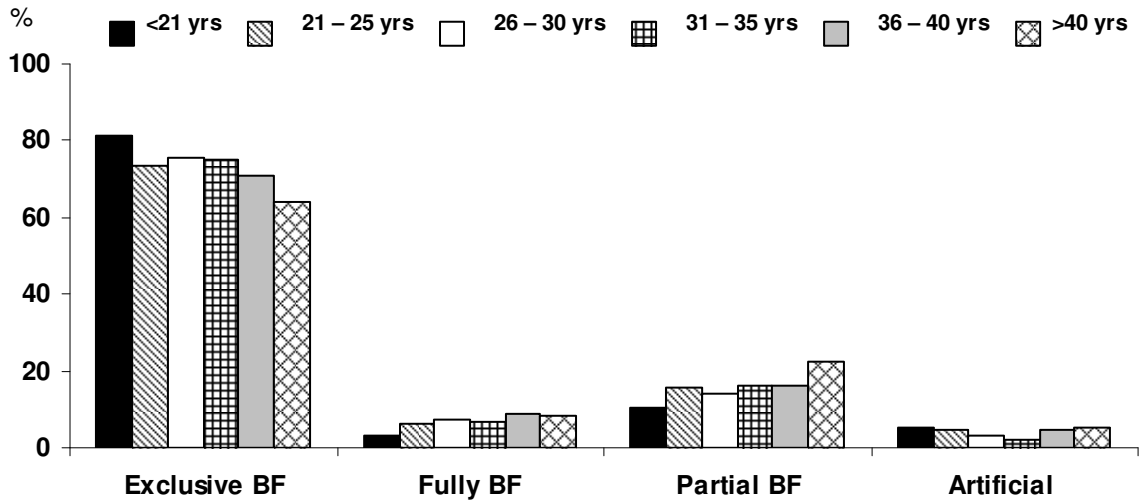

Figure 53: Infant feeding at discharge from NW by maternal age

While significant gains in the exclusive rates are seen in all age groups this is particularly evident in the youngest group from 68% in 2005 to 81% in 2006, and the older groups with 58% to 70% in the 36 – 40 year old group and 46% to 64% in the 41+ year old group. Most groups had corresponding decreases in partial breastfeeding with minimal changes in the artificial feeding rates, but for the women less than 20 years of age the artificial feeding numbers almost halved from 10.2% to 5.3%

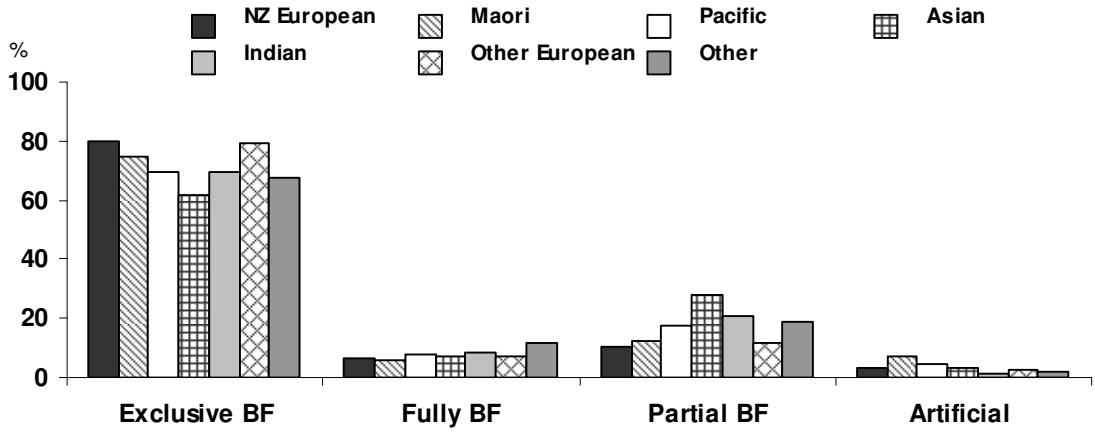

Figure 54: Infant feeding at discharge from NW by maternal ethnicity

Exclusive breastfeeding rates have improved significantly among Indian and Pacific Island women, (19% and 13%, respectively). Traditionally among the higher numbers for partial breastfeeding this swing is particularly pleasing for staff in the wards and reflects their efforts in educating women. There remain a significant number of Asian mothers (28%) who choose to provide supplements while initiating breastfeeding; this reflects a cultural custom of resting the mother and supplementing the baby until the breast milk "coming in" can be observed.

Maori exclusive breastfeeding rates have increased from 58% in 2000 to 75% in 2006 However Maori women have the highest rate (7%) of artificial feeding. Increased support for Maori women and their whanau has been provided by the appointment of a Maori Midwife Advisor.

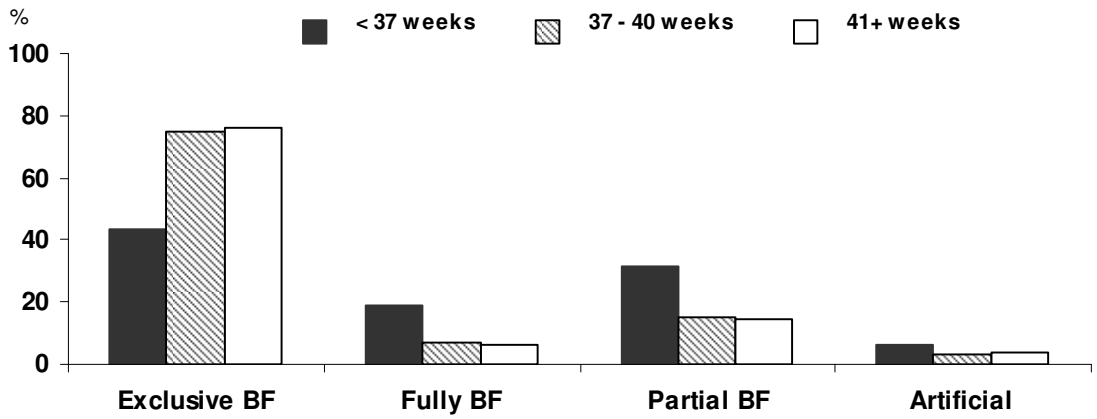

Figure 55: Infant feeding at discharge from NW by gestation at birth

There have been impressive improvements in exclusive breastfeeding rates in babies <37 weeks - 30% in 2005 to 44% in 2006. Many preterm babies are also growth restricted and therefore presented significant feeding challenges to mothers and caregivers.

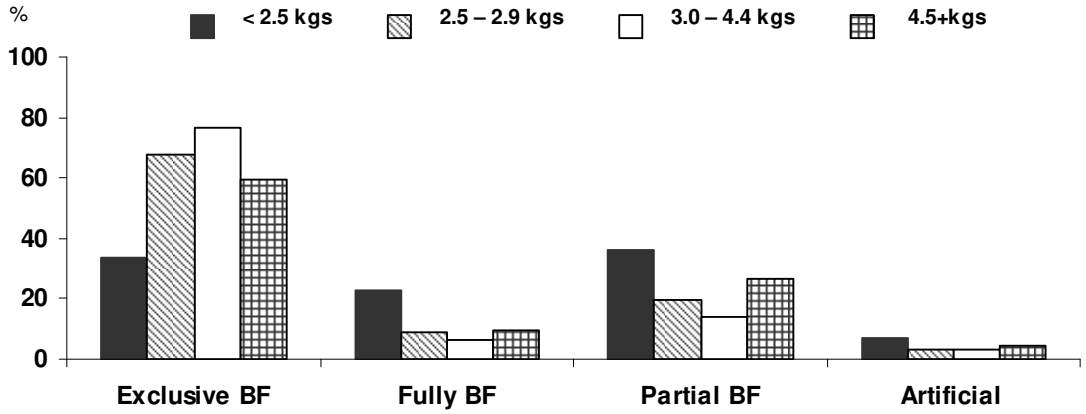

Figure 56: Infant feeding at discharge from NW by fetal birthweight

It is a credit to the staff to see an increase from 11% in 2005 to 34% in 2006 in the rate of exclusive breastfeeding in low birthweight infants. Significant increases were also seen in the 2.5 – 2.9 kgs and the over 4.5 kgs groups, 15.6% and 19.9% respectively.

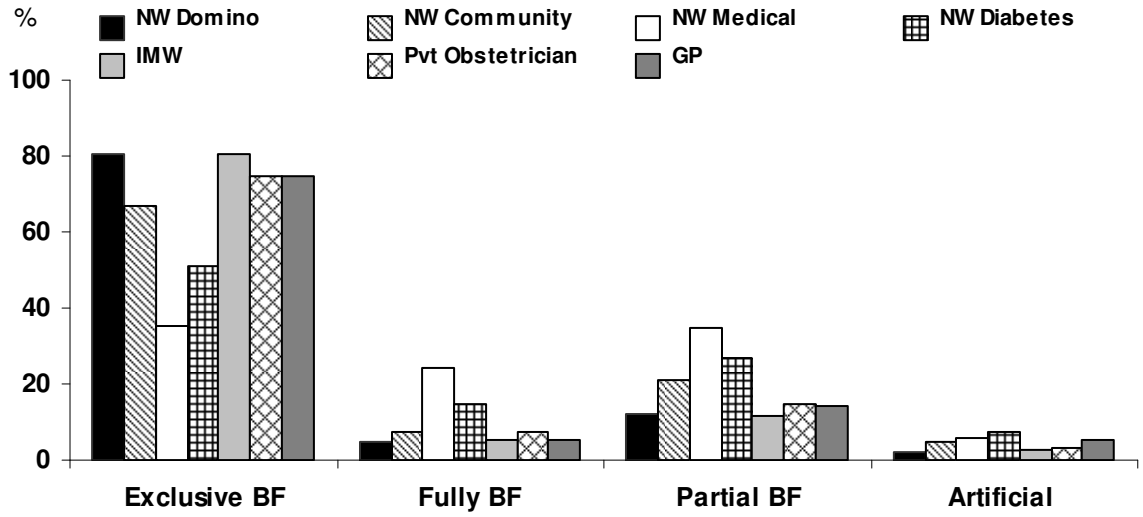

Figure 57: Infant feeding at discharge from NW by LMC

Higher rates of exclusive breastfeeding are expected among those women having Independent or Domino Midwives as LMC as these women have more continuity of care throughout the pregnancy and postnatal period. Both these groups had just over 80% exclusive breastfeeding rates with the Domino midwives increasing their rate from 68% in 2005.

Women with Community midwives as LMC also had a significant increase in exclusive breastfeeding, from 54% in 2005 to 67% in 2006 but it was the diabetic mothers, who had the greatest gain, from a very low 12% in 2005 to a more creditable 51% in 2006. This increase was associated with a significant fall in partial breastfeeding rates

The lack of increase in the breastfeeding rate of mothers cared for by the medical is of concern. It is hoped that breastfeeding rates can also be increased in this group of high risk mothers.

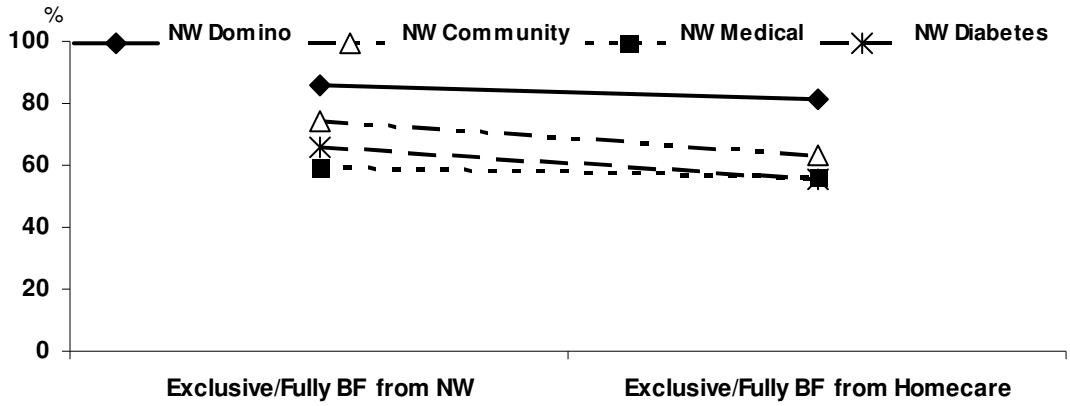

Figure 58: Comparison of exclusive or fully breastfeeding at discharge from facility to discharge from Homecare

Exclusive and fully breastfeeding are added together in these graphs as some babies had minimal amounts of formula in the first few days then breastfed well after discharge. Exclusive and fully breastfeeding rates drop slightly to discharge from Homecare at 4–6 weeks

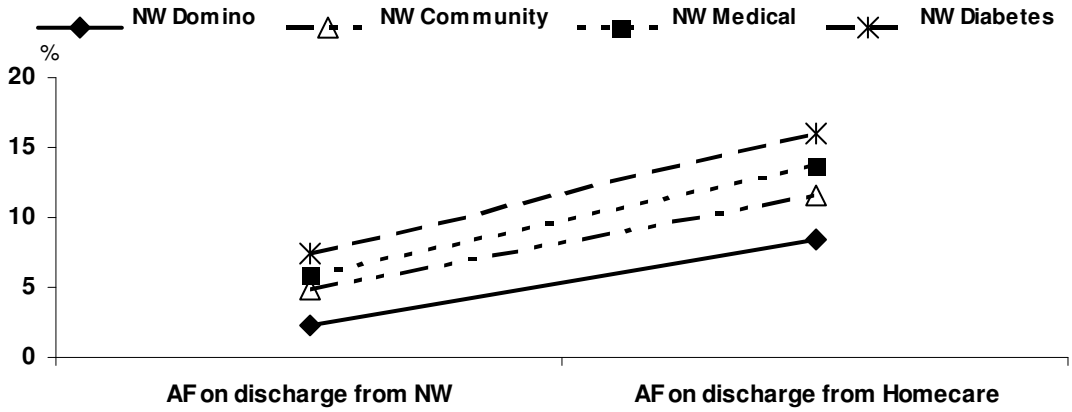

Figure 59: Comparison of artificial feeding at discharge from facility to discharge from Homecare.

Increases in Artificial Feeding from discharge from facility to discharge from Homecare varied from 6% for women with a Domino LMC and 9% for women with Diabetic midwives as their LMC.

Summary

Challenges for improvements

- Asian mothers have the highest partial breastfeeding rate and Maori mothers have the highest artificial feeding rate
- Mothers with Medical teams as LMC

The Maternity Lactation Consultant Service has been maintained by one FTE and one 0.5 FTE Lactation Consultants, increasing to 0.8 during 2006. Daily referrals are received from midwifery, nursing and medical staff, or the women themselves. Breastfeeding difficulties include babies slow to initiate breastfeeding cues, particularly following CS, attachment difficulties, management of areola and breast oedema, readmissions for mastitis, and primipara learning to master the skills to establish successful breastfeeding.

Significant progress has been made at NW towards becoming Baby Friendly and it should be acknowledged that this could not have been achieved without the dedication of the Lactation Consultants, midwives and nurses in all areas. High acuity of the tertiary facility reduced staffing due to vacancies and increased pressure of registration requirements on staff education allowance has made attendance at study days very difficult in 2006 so staff are to be commended for their role in the improved exclusive breastfeeding rates seen in this report period.

7.2 Postnatal admissions

Methods

Postnatal care following birth is provided at Auckland City Hospital for those women requiring secondary care or closer observation for themselves or their babies. The contractual arrangement for Birthcare Auckland to provide postnatal primary care continues as before.

Findings

Table 53: Maternal destination immediately following birth

	2004		2005		2006	
	n=7491		n=7194		n=7212	
	n	%	n	%	n	%
NW Wards	4618	61.6	4286	59.6	4384	60.8
Birthcare	2245	29.9	2354	32.7	2322	32.2
Home	539	7.2	510	7.1	483	6.7
Other Units	89	1.2	44	0.6	23	0.3

While there were fewer women transferring directly from Labour and Birth Suite to Birthcare in 2006 this was offset by an increase in the numbers transferring after a postnatal stay at NW. 14% of women who stayed at NW following birth transferred to Birthcare. Overall the total number of women transferred to Birthcare increased by 67 in 2006.

There has been a further decrease in the direct transfers to other units.

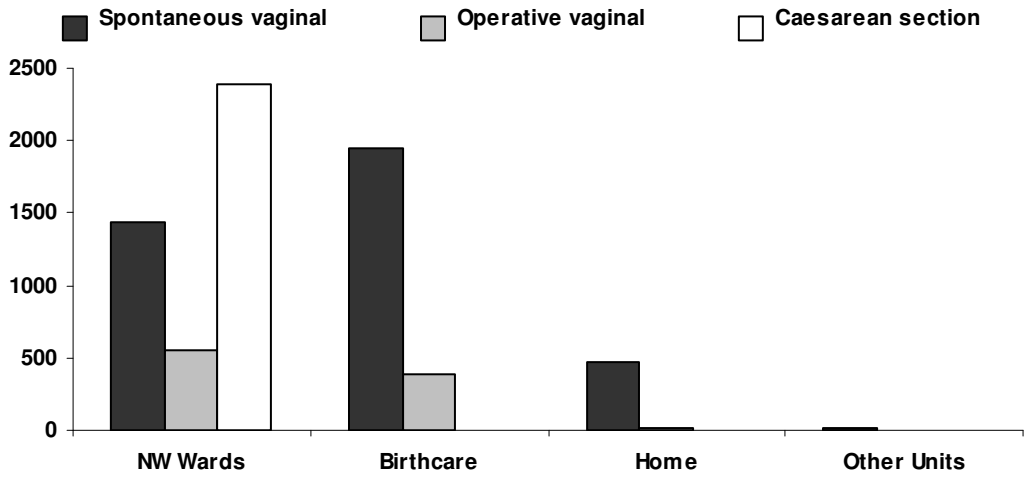

Figure 60: Maternal destination by mode of birth

51% of spontaneous vaginal births and 40% of operative vaginal births transferred to Birthcare in 2006.

Of the women with an initial stay at NW 55% had Caesarean section birth – this is a further increase from 53% in 2005 and 48% in 2004. This increasing proportion impacts on meeting contractual obligations with Birthcare and the high acuity of the workload on the wards.

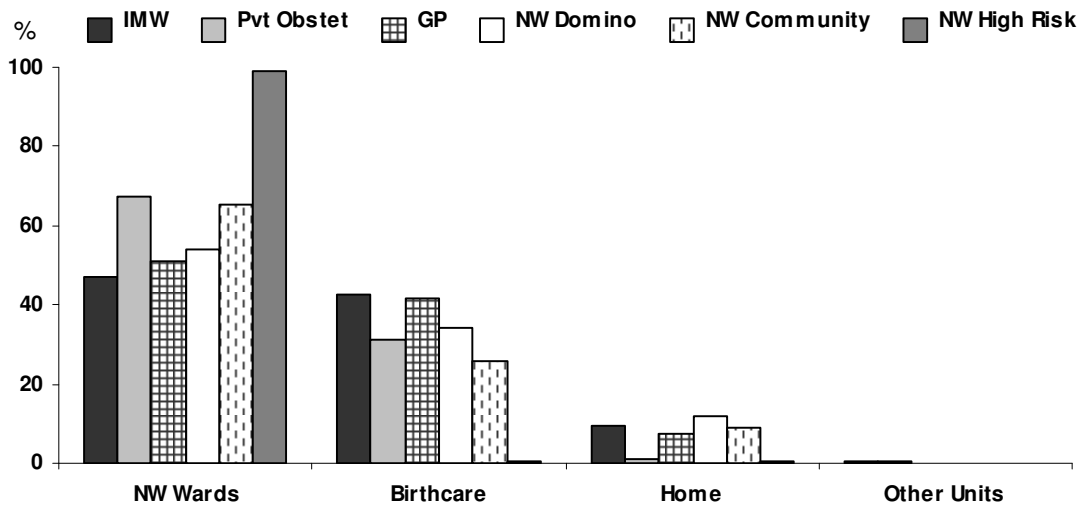

Figure 61: Postnatal destination by LMC

While the percentage of women transferring to Birthcare remains relatively stable for those cared for by Independent Midwives and General Practitioners, there is an increase (5%) for Community midwives as LMC. Decreased numbers transferring for those with Private Obstetricians (3%) and Domino Midwives (8%) as LMCs would appear to be related to increased numbers of Caesarean sections in these groups.

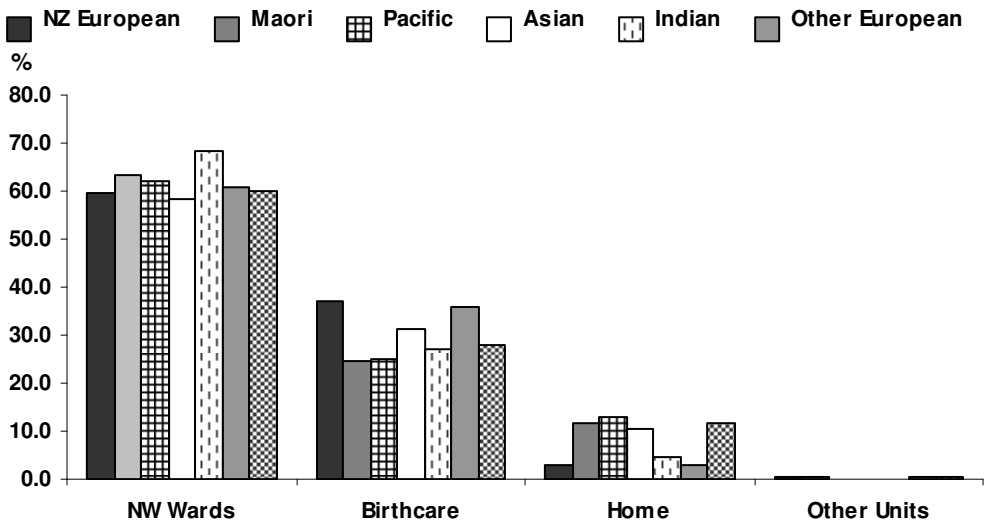

Figure 62: Postnatal destination by ethnicity

Indian women continue to have the highest rate of postnatal care at NW, possibly because they have a higher rate of diabetes, (refer to Chapter 4 - Antenatal complications). European women tend to transfer to Birthcare whereas Maori, Pacific Island and Asian women are most likely to go home directly following birth.

Women with vaginal births initially cared for postnatally at NW, stayed for the following reasons

Table 54: Reasons for admission to postnatal wards

	N = 1446	
	n	%
Neonatal reason*	483	33.4
Postpartum haemorrhage	230	15.9
Diabetes	113	7.8
Hypertensive disorder	37	2.6
Perineal trauma	44	3.0
Retained placenta / products	21	1.5
Other reasons†	119	8.2
No clinical reason given	399	27.6

* includes admission to NICU, low birth weight (<2500gms) and/or requiring paediatrician care on the ward, stillbirth or neonatal death

† includes maternal medical reasons, epidural complications, infection, tubal ligation

Table 55: Length of stay by mode of birth among admissions to NW wards

	N = 4384		Length of stay Days
	n	%	Median
Caesarean section birth - discharged to home	2197	50.1	4.5
Caesarean section birth - transferred to Birthcare	135	3.1	1.2
Caesarean section birth - transferred to other destinations	57	1.3	5.4
Operative vaginal birth - discharged to home	339	7.7	2.8
Operative vaginal birth - transferred to Birthcare	196	4.5	0.7
Operative vaginal birth - transferred to other destinations	18	0.4	3.3
Spontaneous vaginal birth - discharged to home	1120	25.5	2.1
Spontaneous vaginal birth - transferred to Birthcare	259	5.9	0.7
Spontaneous vaginal birth - transferred to other destinations	63	1.4	3.4

In the table above “other destinations” includes units within ADHB, such as Starship Hospital where an infant might require further treatment, as well as facilities outside

6.2.1 Postnatal readmissions

In 2006, as in 2005, 5% of the women who gave birth at NW had postnatal readmissions, either after their initial postnatal stay or after being discharged to other postnatal facilities or to their home. These women had 378 readmissions, as follows

- 330 had one readmission
- 21 had two readmissions
- 2 had three readmissions

Of the women readmitted, 54% were primipara and 46% were multipara.

The length of time between birth and readmission varied from 6 hours to 53 days with a median of 9.2 days. The length of stay varied from 1 hour to 9.75 days, with a median of 1.8 days.

Table 56: Reasons for readmission

	N = 378	
	n	%
Neonatal admission*	71	18.9
Infection †	59	15.6
Breast‡	61	16.0
Wound breakdown§	20	5.3
Postpartum haemorrhage	36	9.5
Hypertensive disorder	13	3.4
Retained products	12	3.2
Epidural complications	3	0.8
Other¶	103	27.2

* includes babies requiring admission to NICU and babies admitted to the wards for phototherapy or feeding problems
† includes infected caesarean section wound, urinary tract infection and other conditions where infection is suspected/diagnosed e.g. endometritis
‡ includes mastitis, breast abscess or other conditions of the breast requiring hospital admission
§ breakdown of caesarean section or perineal wound requiring further medical intervention
¶ other reasons for readmission include abdominal pain, anaemia, psychiatric reasons, deep vein thrombosis, other maternal conditions e.g. cardiac complications, asthma.

9 women had repeat readmissions for a separate indication.

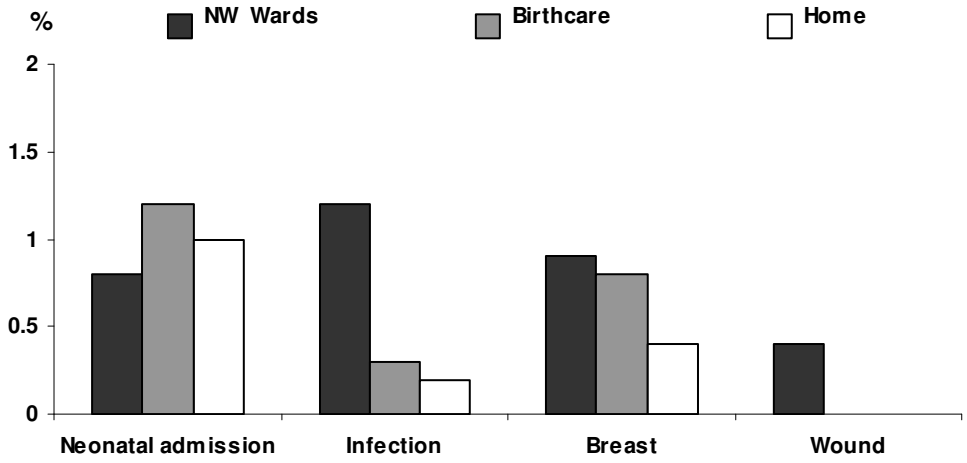

Figure 63: Rates of re-admission indication by maternal destination following birth.

The higher rate of infection as a reason for readmission at NW includes 73% Caesarean section births. Women were more likely to be re-admitted from Birthcare for neonatal reasons. Increased neonatal admissions from Birthcare likely reflect the lack of availability of paediatric review at Birthcare.

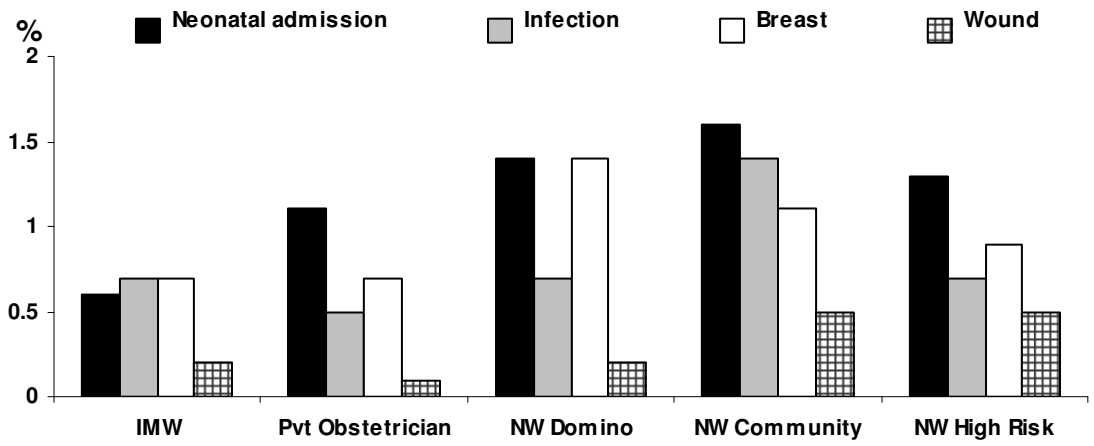

Figure 64: Indication for readmission by LMC group at time of birth

There is a higher rate of readmission among the women cared for by NW clinics. The reason for this is not immediately apparent.

6.2.2 Postnatal admissions where births occurred at other facilities

Improved data collection has identified 115 women who gave birth in 2006 at facilities other than NW who were admitted during their postnatal period. Three of these women had 2 admissions and 1 had 3 admissions. Of these admissions, 34% birthed at Waitemata DHB facilities, 24% at Counties Manukau facilities and 16% at Birthcare with the remainder coming from outside the greater Auckland area.

Table 4: Reasons for admission where birth occurred at other facilities

	N = 120	
	n	%
Neonatal admission	80	66.7
Postpartum haemorrhage	9	7.5
Breast	8	6.7
Retained products	7	5.8
Infection	5	4.2
Hypertensive disorders	1	0.8
Other	10	8.3

Chapter 8

NEWBORN SERVICES

8 NEWBORN SERVICES

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

8.1 Admissions to the Newborn Intensive Care Unit

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

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

Table 57: Admissions to the Newborn Intensive Care Unit

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

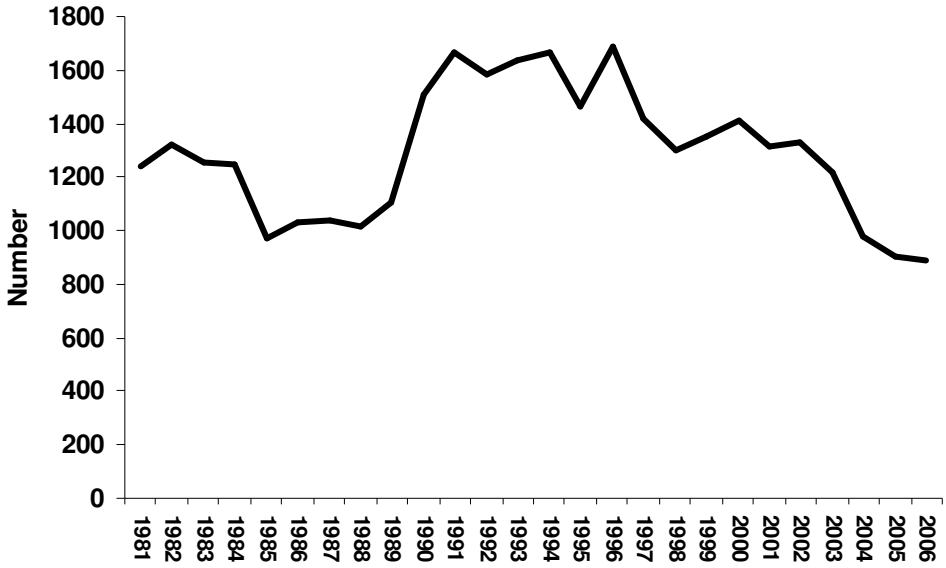

Figure 65: Admissions to NICU 1981-2006

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

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

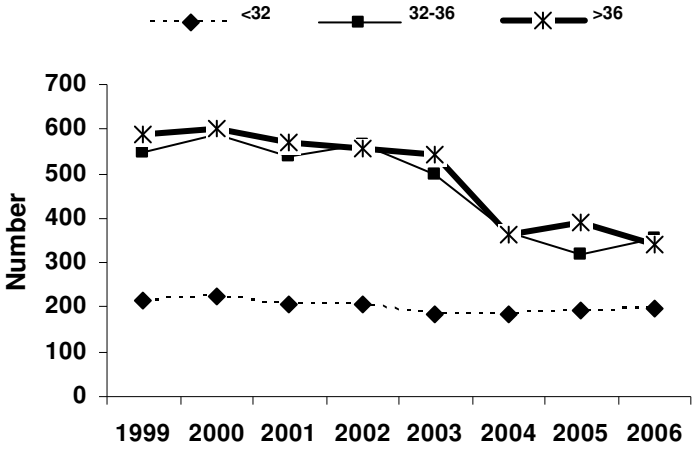

Figure 66: Admissions to NICU by gestational age

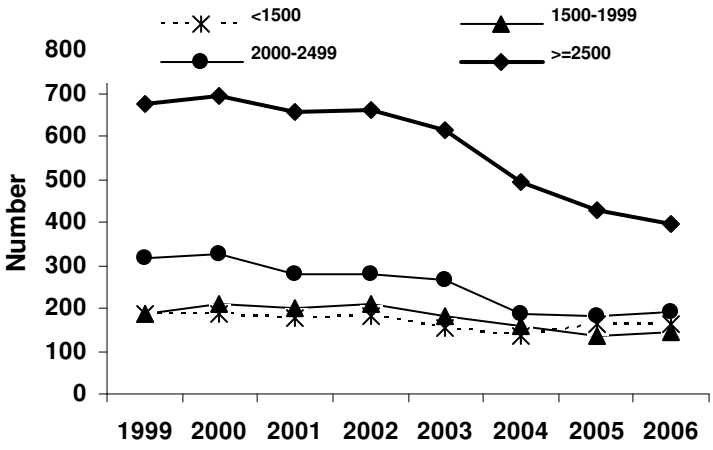

Figure 67: Admissions to NICU by birth weight

8.1.2 Admissions to NICU by domicile of mother

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

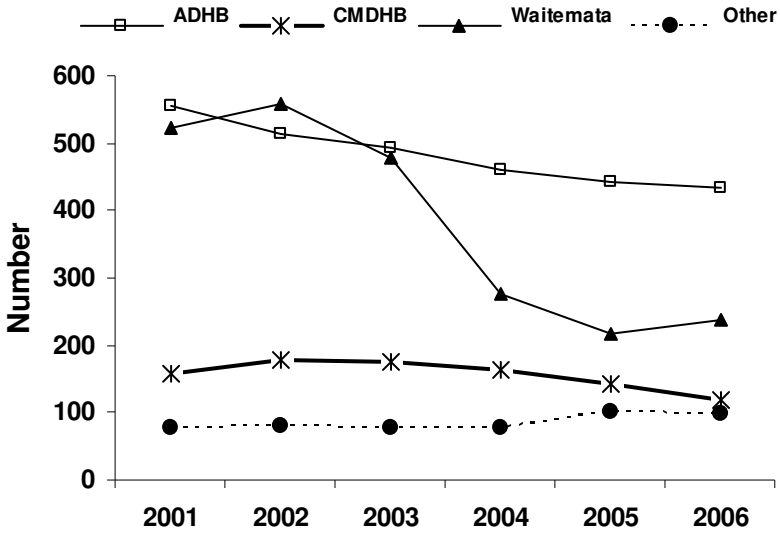

Figure 68: Admissions to NICU by maternal domicile

8.1.3 Newborn Unit occupancy

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

Table 58: Occupancy (baby days) on NICU from 1999

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

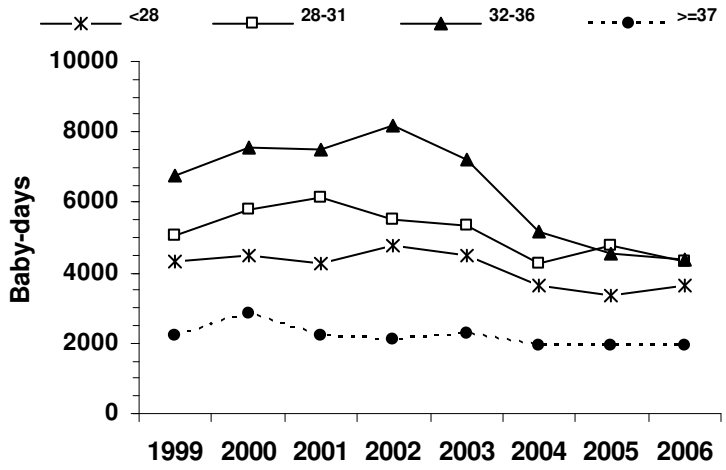

Figure 69: Occupancy (baby days per year) of NICU by gestational age

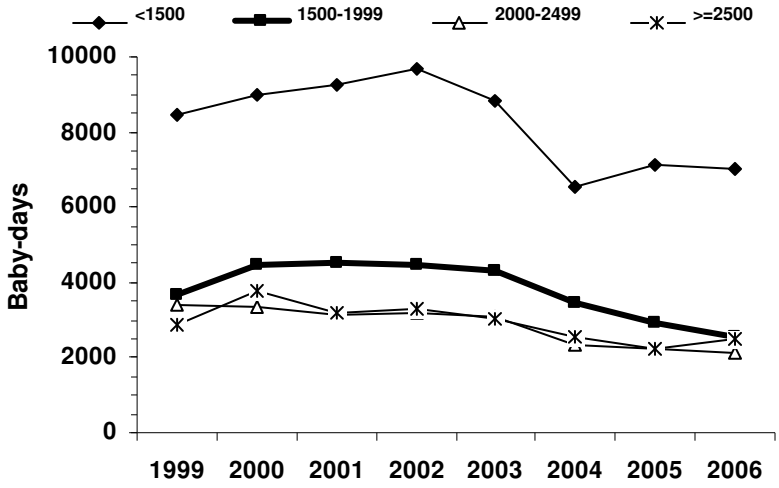

Figure 70: Occupancy (baby days per year) of NICU by birth weight

8.1.4 Ethnicity of mothers

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

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

8.1.5 Reasons for admission to NICU

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

8.2 Infection

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

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

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

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

8.3 Immunisation

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

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

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

8.4 Infant feeding in NICU admissions

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

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

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

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

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

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

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Table 59: Breast feeding data of NICU admissions by birth weight

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

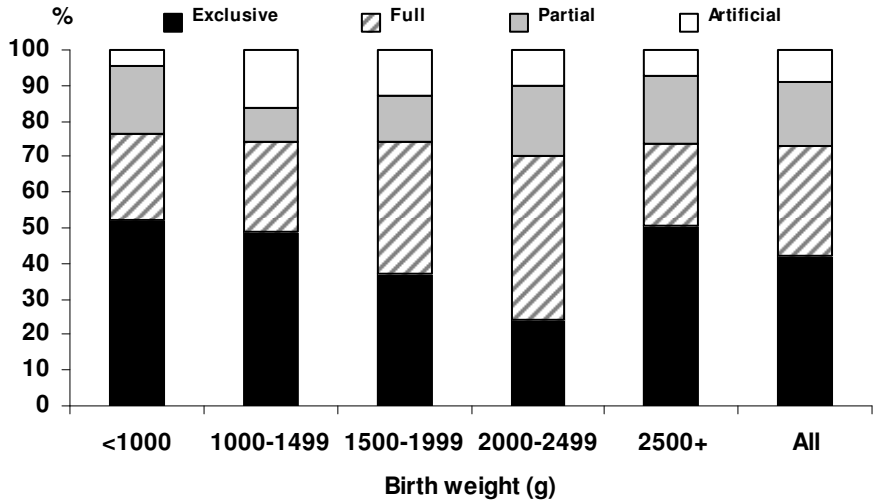

Figure 71: Infant feeding on discharge from NICU by birth weight

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

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

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

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

Table 60: Breast feeding data of NICU admissions by gestational age

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

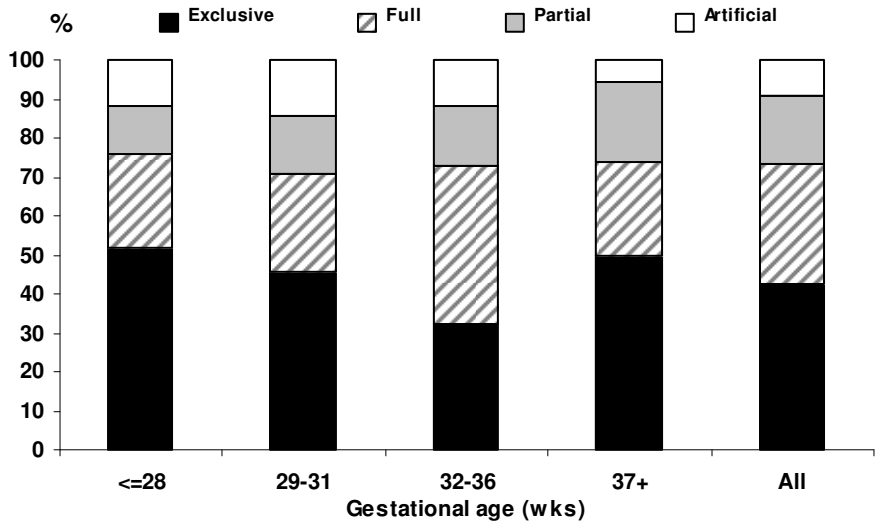

Figure 72: Infant feeding on discharge from NICU by gestational age

8.5 Hypoxic ischaemic encephalopathy (HIE)

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

Table 61: Details of Hypoxic Ischaemic Encephalopathy Stages 2 or 3.

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

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

8.6 Assisted ventilation

8.6.1 Number of babies receiving and duration of assisted ventilation

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

Table 62: Number of babies on assisted ventilation

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

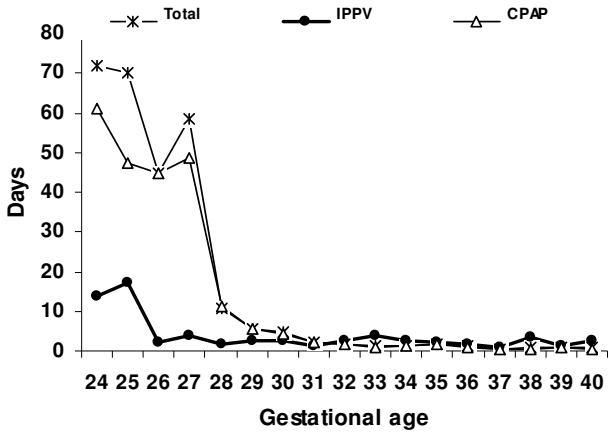

Figure 73: Median ventilation days on IPPV and CPAP and IPPV+CPAP by gestational age among survivors in 2006

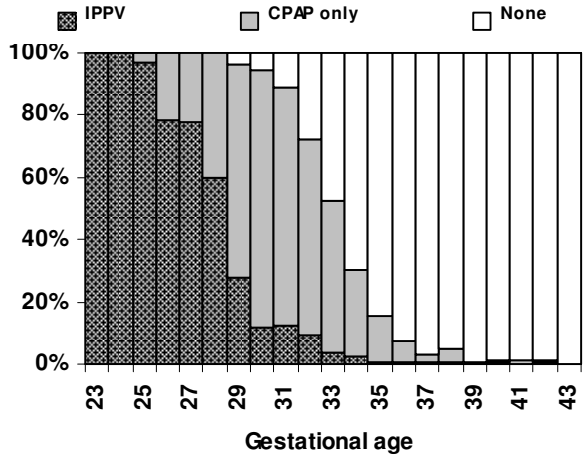

Figure 74: Proportion of babies receiving assisted ventilation (excluding for surgery or a congenital anomaly) 2003-2006

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

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

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

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

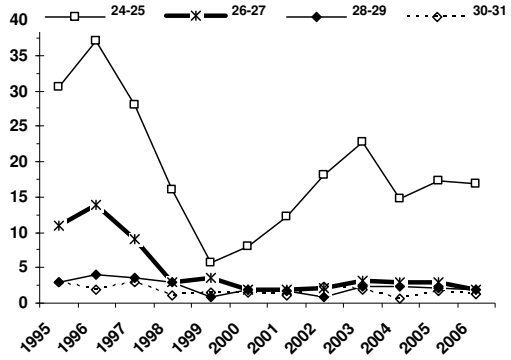

Figure 75: Median days on IPPV

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

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

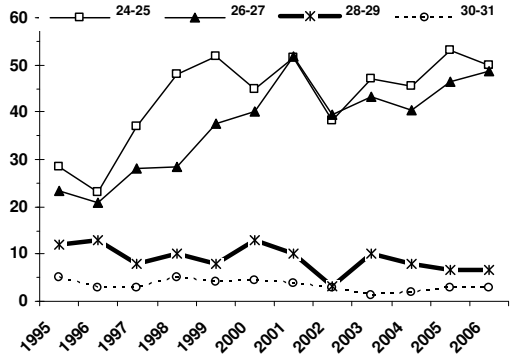

Figure 76: Median days on CPAP

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

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

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

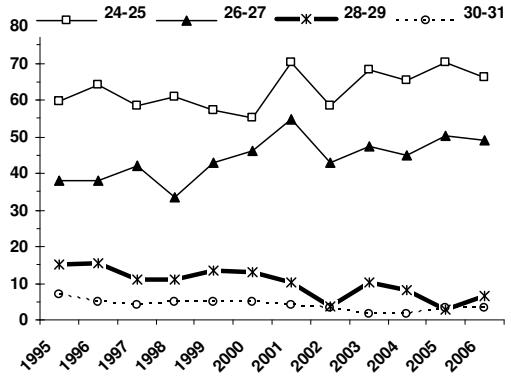

Figure 77: Median days on CPAP + IPPV

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

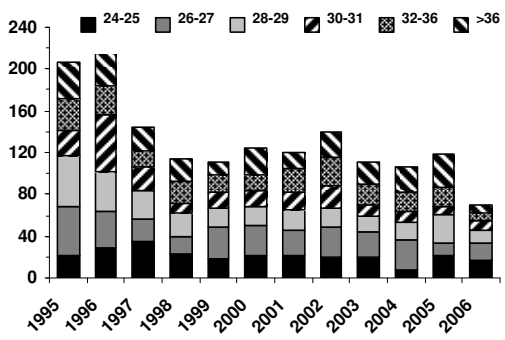

Figure 78: Number on IPPV

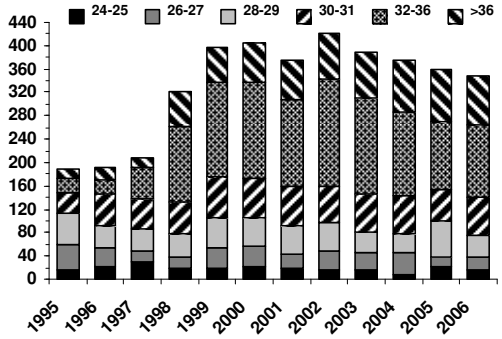

Figure 79: Number on CPAP

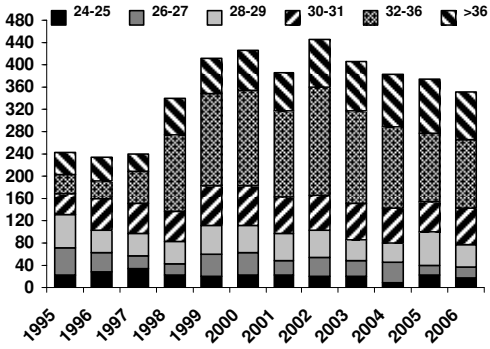

Figure 80: Number on CPAP + IPPV

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

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

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

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

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

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

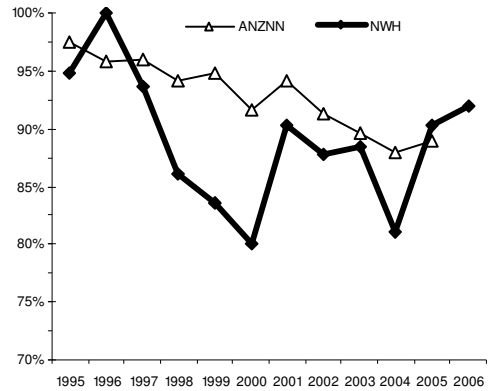

Figure 81: Percentage on IPPV

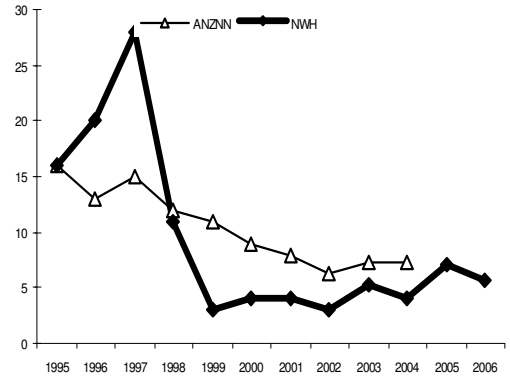

Figure 83: Median days on IPPV

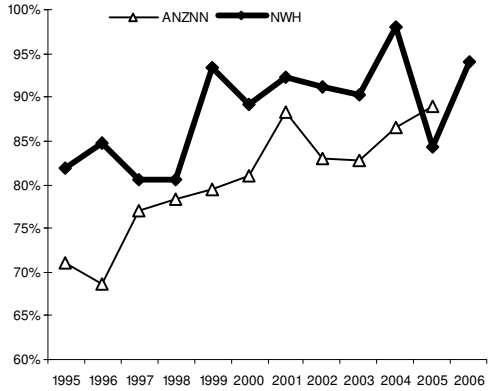

Figure 82: Percentage on CPAP

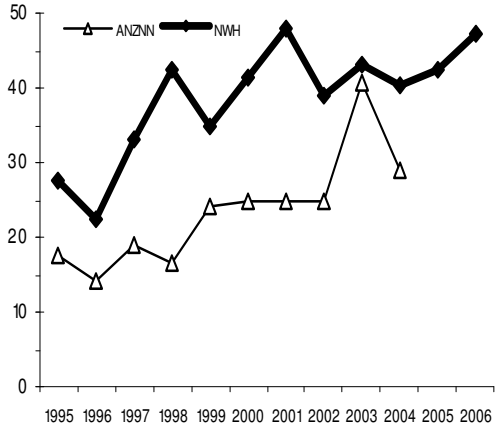

Figure 84: Median days on CPAP

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

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

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

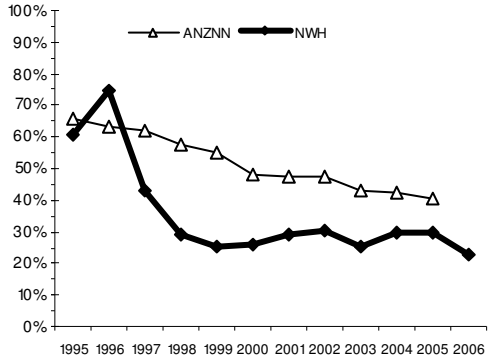

Figure 85: Percentage on IPPV

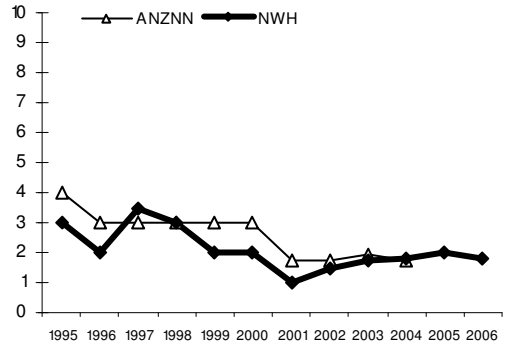

Figure 87: Median days on IPPV

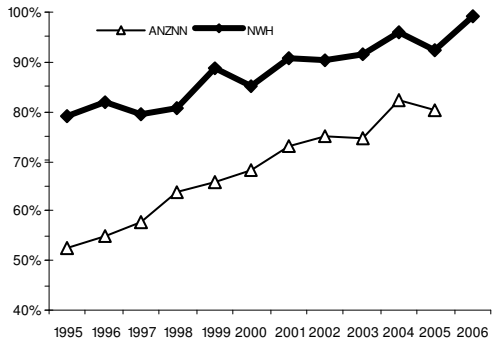

Figure 86: Percentage on CPAP

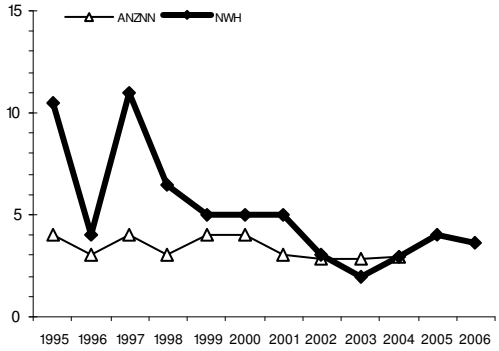

Figure 88: Median days on CPAP

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

8.6.6 High frequency oscillatory ventilation and inhaled nitric oxide

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

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

Table 63: HFOV and inhaled nitric oxide (iNO) use and survival over the last 10 years

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

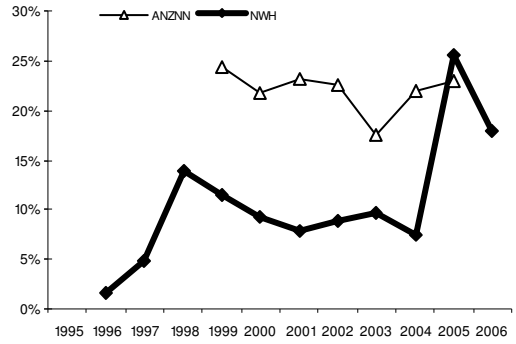

Figure 89: HFOV at 24-27 weeks

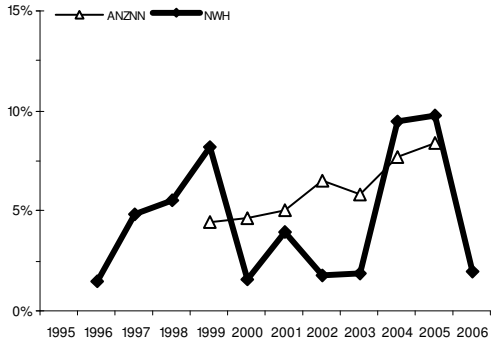

Figure 90: Inhaled nitric oxide at 24-27 weeks

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

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

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

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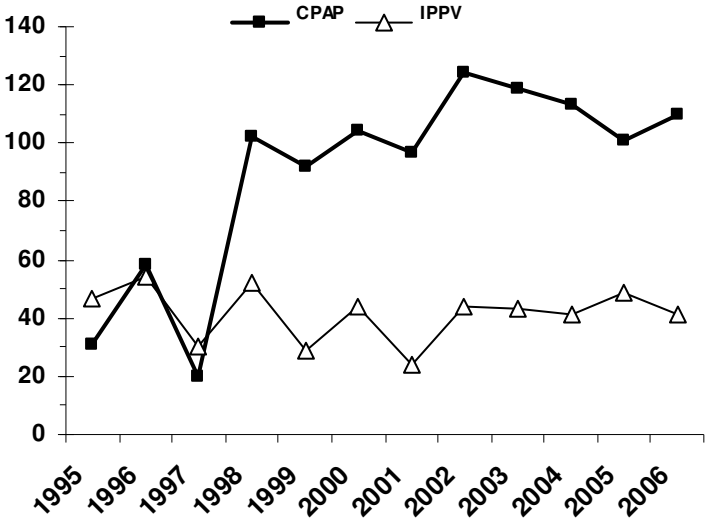

Figure 91: Number of term and post term babies needing assisted ventilation

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

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

8.7 Very low birth weight infants

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

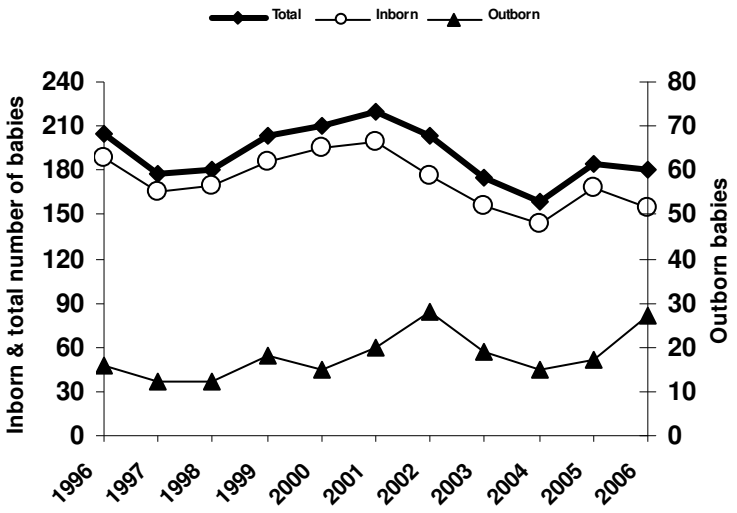

Figure 92: Number of VLBW who were born elsewhere and admitted to NICU, or were born in NW and alive at birth

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

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

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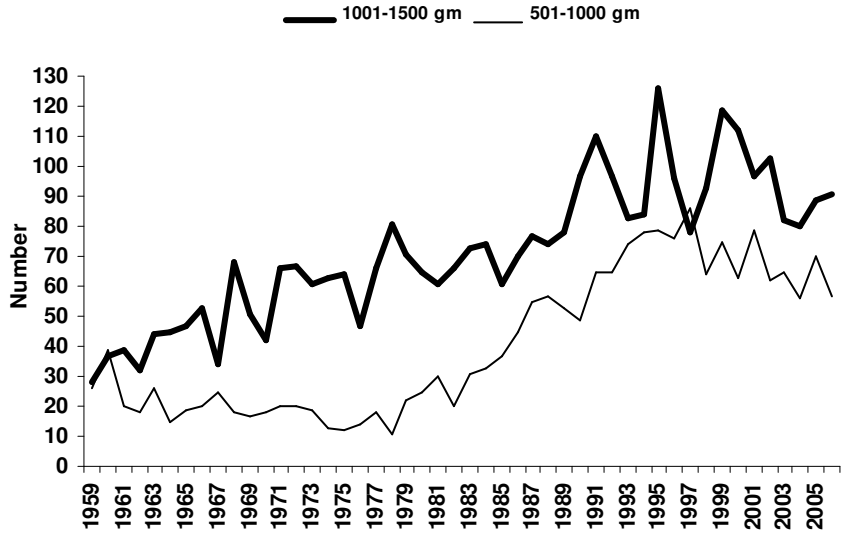

Figure 93: Number of inborn live-births ≤1500g from 1959 to 2006

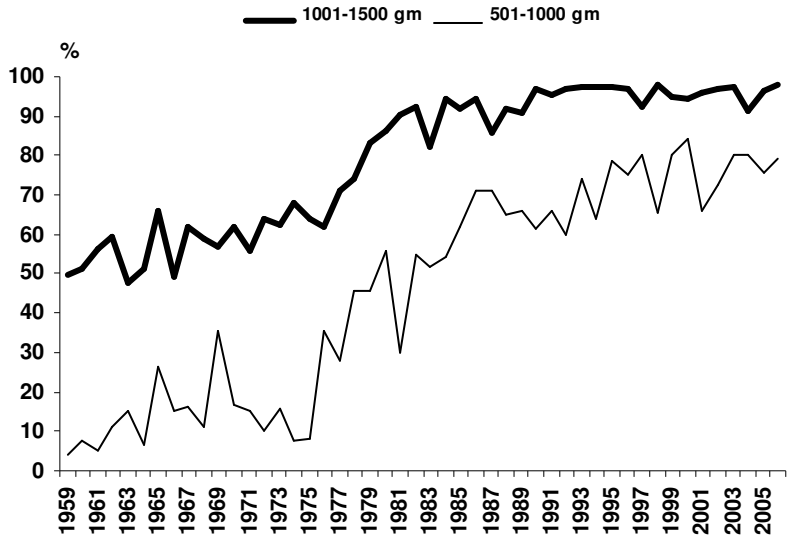

Figure 94: Neonatal survival (0-28 days) of ≤1500g inborn live-births from 1959 to 2006

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

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

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

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

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

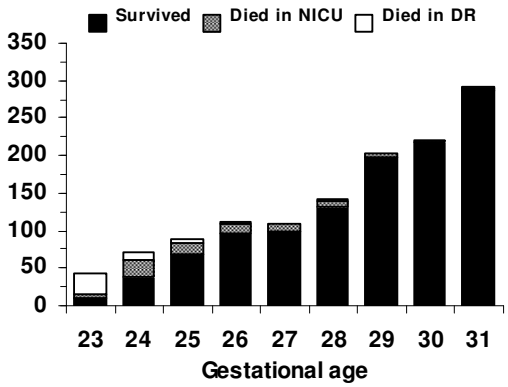

Figure 95: Numbers born alive at 23 to 31 weeks gestation in 2000-2006

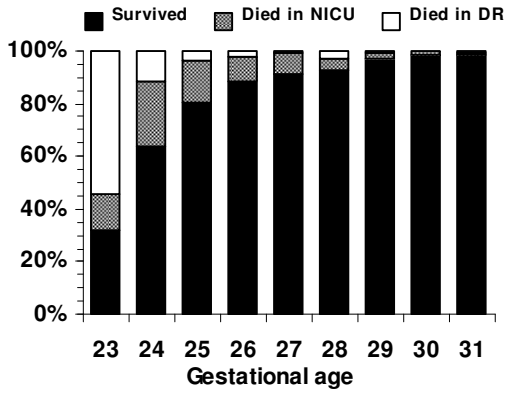

Figure 96: Survival of babies born in 2000-2006. (n= 1282) (DR = delivery room)

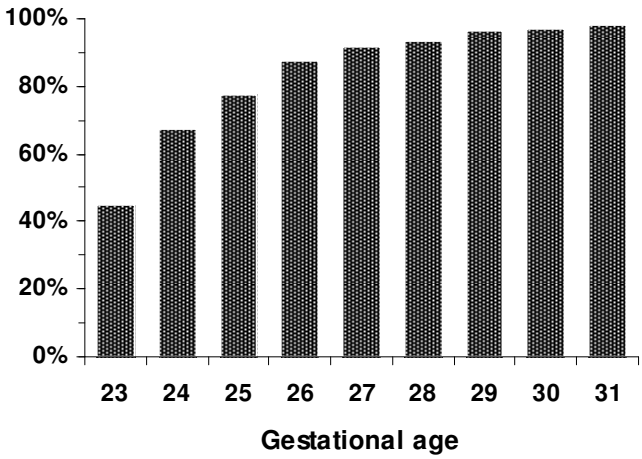

Figure 97: Survival of babies born in National Women's and admitted to NICU from 1995 to 2006 (n = 2168)

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

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

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

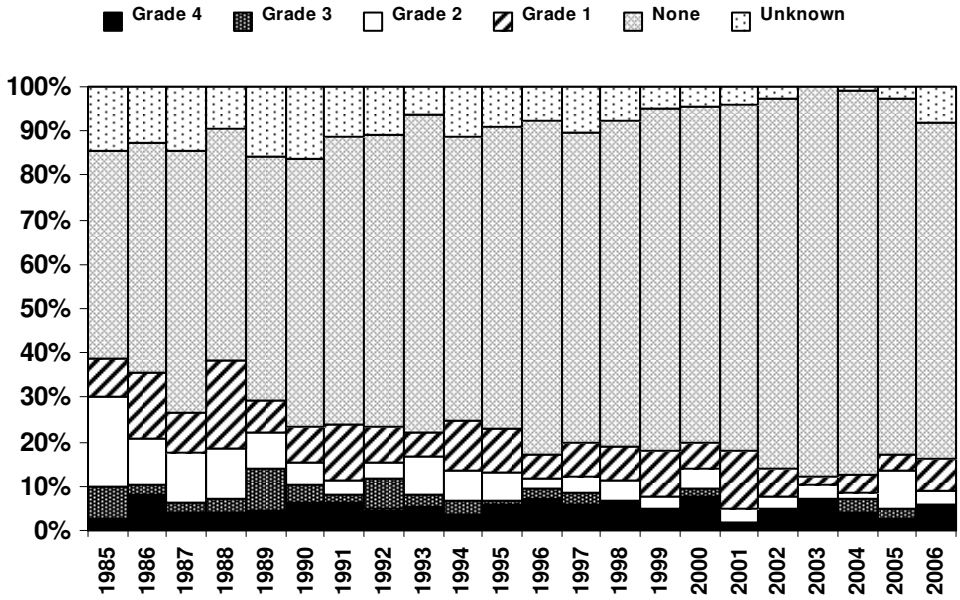

Figure 98: Intraventricular haemorrhage in all <1250 gm infants admitted to NICU from 1985 to 2006

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

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

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

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

8.10.1 Benchmarking against the Australia and New Zealand Neonatal Network

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

<1500gm birth weight,

<32 weeks gestation,

requires assisted ventilation (IPPV, CPAP or HFOV) or

has major surgery (defined as opening of a body cavity).

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

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

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

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

8.10.2 Survival

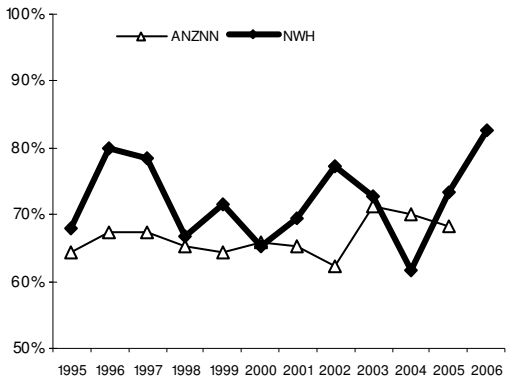

Figure 99: Survival at 24-25 weeks gestation

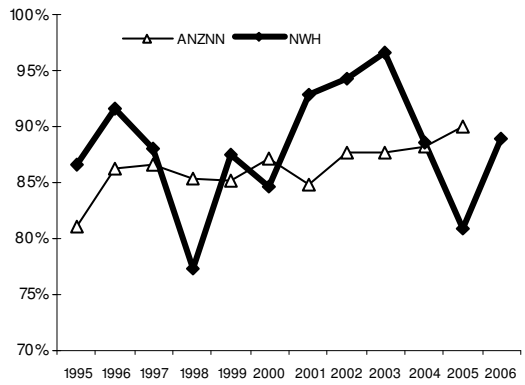

Figure 100: Survival at 26-27 weeks

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

8.10.3 Intraventricular haemorrhage

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

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

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

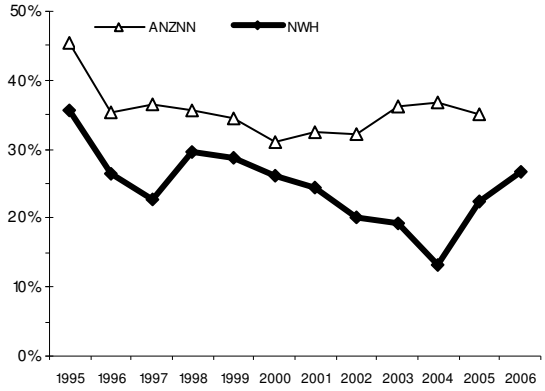

Figure 101: Any IVH at 24-27 weeks

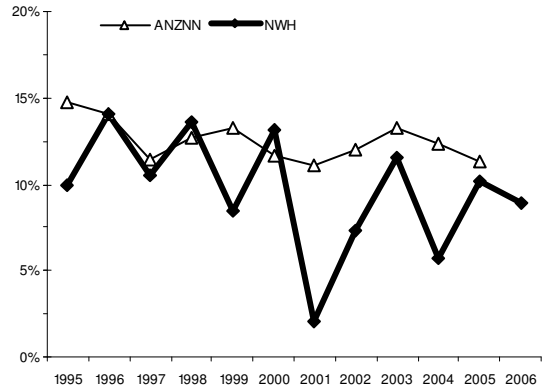

Figure 102: Severe (G3-4) IVH at 24-27 weeks

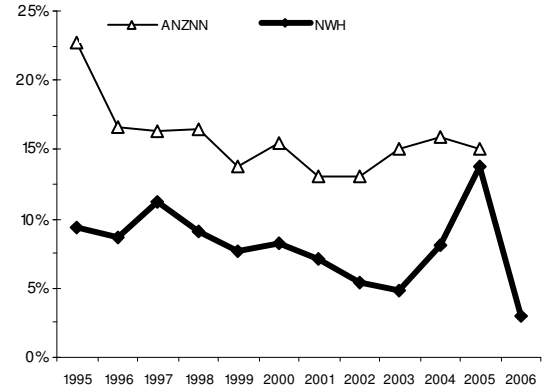

Figure 103: Any IVH at 28-31 weeks

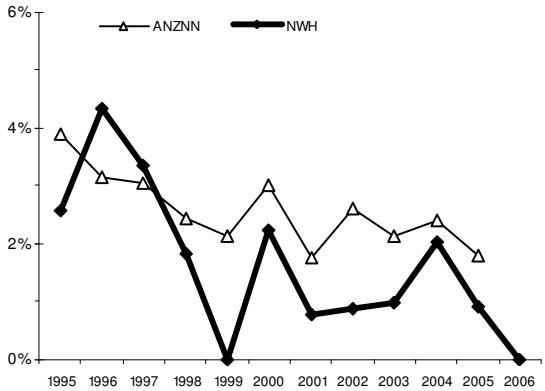

Figure 104: Severe (G3-4) IVH at 28-31 weeks

8.10.4 Cystic periventricular leukomalacia

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

8.10.5 Retinopathy of prematurity

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

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

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

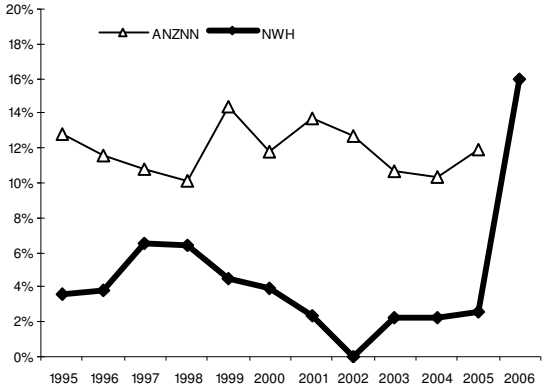

Figure 105: ROP at 24-27 weeks

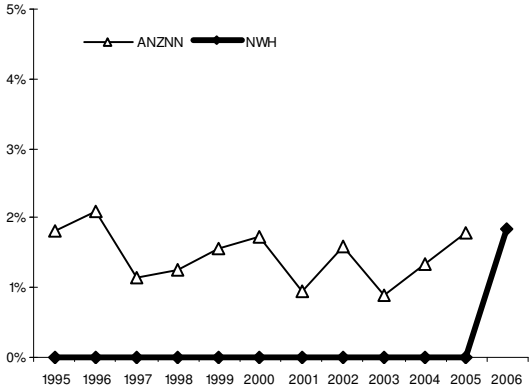

Figure 106: ROP at 28-31 weeks

8.10.6 Chronic lung disease

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

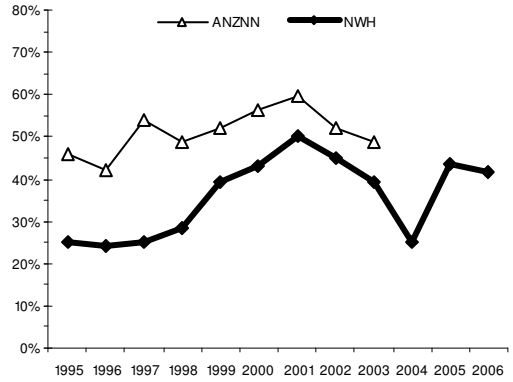

Figure 107: Chronic lung disease at 24-27weeks

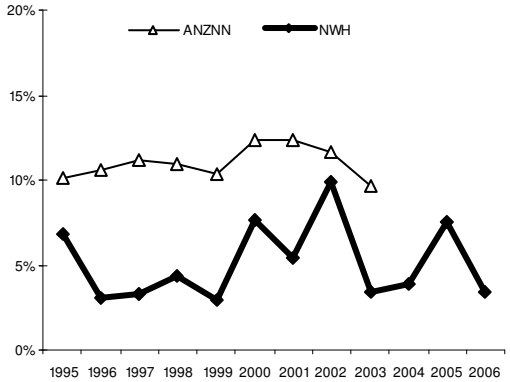

Figure 108: Chronic lung disease at 28-31weeks

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

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

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

8.10.7 Necrotising enterocolitis

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

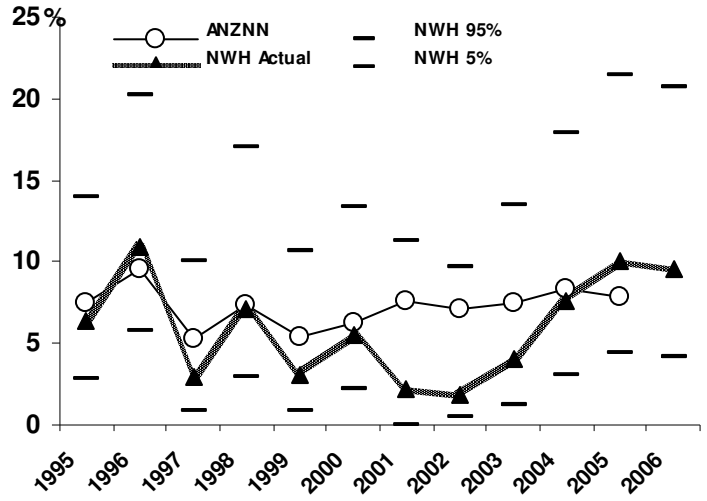

Figure 109: NEC in babies under 28 weeks gestation (with 95% confidence intervals) compared with the incidence in the ANZNN 1995-2006

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

8.10.8 Patent Ductus Arteriosus

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

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

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

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

8.10.9 Pneumothorax needing drainage

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

8.10.10 Antenatal corticosteroids

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

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

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

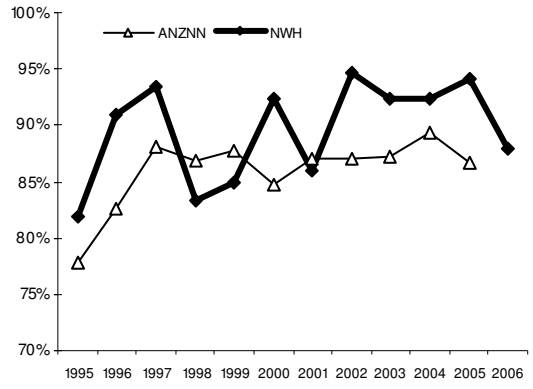

Figure 110: Any antenatal corticosteroids at 24-27 weeks

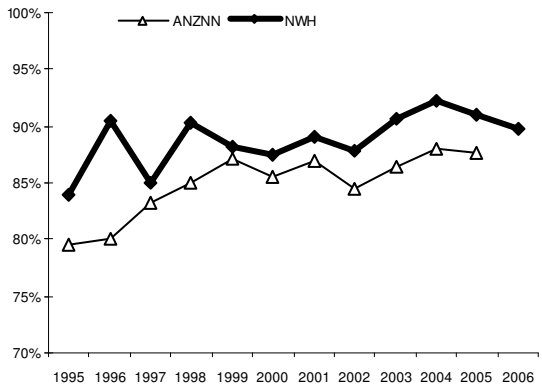

Figure 111: Any antenatal corticosteroids at 28-31 weeks

8.10.11 Postnatal corticosteroids

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

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

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

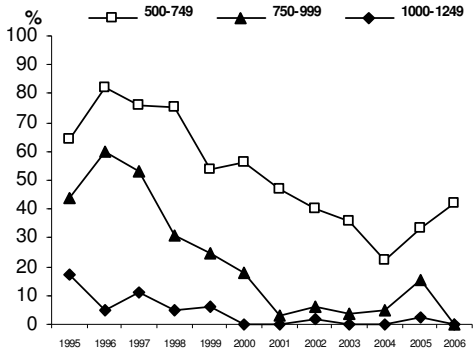

Figure 112: Percentage receiving postnatal dexamethasone by birth weight

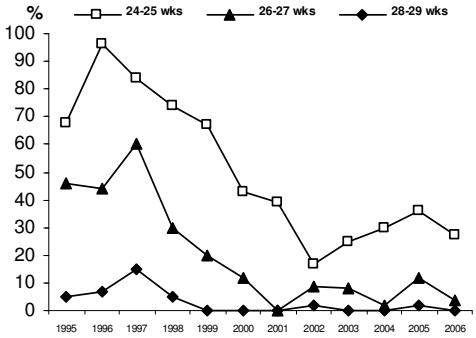

Figure 113: Percentage receiving postnatal dexamethasone by gestational age

8.10.1 Caesarean section for babies <32 weeks gestation

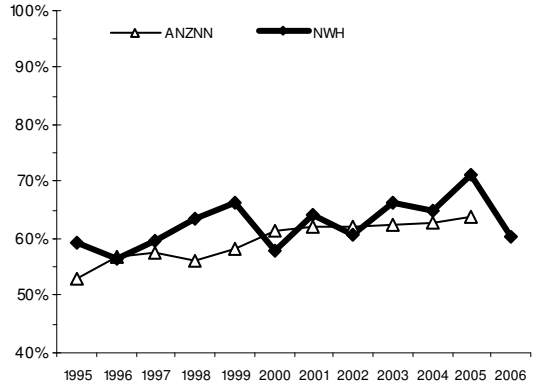

Figure 114: Caesarean section at 24-31weeks

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

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

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

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

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

At NW, parents who are expected to deliver very preterm are counselled about the likelihood of survival and long term problems. The guidelines used to counsel parents are available on the Newborn website[1]. Parents are advised that the outcomes of babies at 23 weeks' gestation are poor, both in terms of a low chance of survival and high chance of survivors having significant developmental problems. The recommended action is that such babies are not actively treated. Treatment is not offered at 22 weeks' gestation. At 24 weeks' gestation the outcomes are better and most parents elect to have their baby actively treated at birth.

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

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

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

8.12 Child Development Unit

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

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

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

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

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

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

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

Table 64: Outcome Categories for infants under 30 months of age

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

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

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

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

Table 65: Outcome Categories at 18 months for children under 1500g

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

Table 66: Outcome of children <1500g born in 2004 at 18 months by gestational age groups (n = 104)

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

Table 67: Outcome of children <1500g born in 2004 at 18 months by birth weight groups (n=104)

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

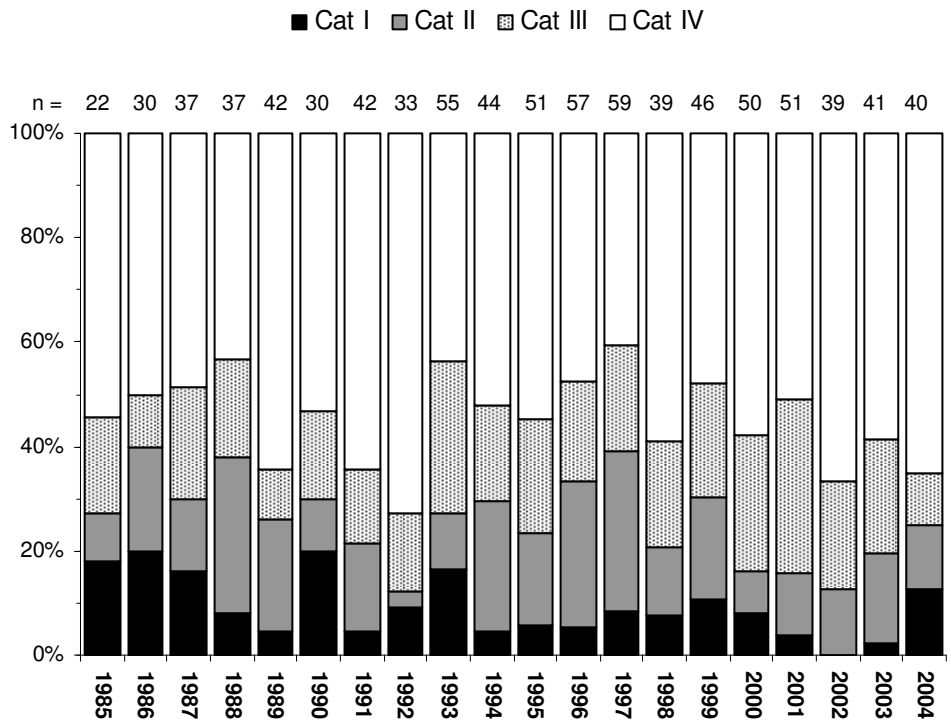

Figure 115: Outcome at 18 months of children <1000g birth weight with known outcomes born 1985-2004

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

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

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

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

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

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

Table 68: Outcome categories at 4 years

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

* *The Stanford-Binet Intelligence Scale 4th edition.*
† *Vineland Adaptive Behaviour Scales, 1984:* Motor Skills Domain.

Table 69: Outcome categories at 4 years for children under 1500g born 2002 (n = 102)

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

Table 70: Comparison of outcomes at 4 years with those at 18 months for children under 1500g born 2002

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

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

Chapter 9

PERINATAL MORTALITY

9 PERINATAL MORTALITY

This chapter provides information on perinatal and maternal deaths. Further data tables can be found in Appendix 9.

NW has a Bereavement Team who care for women with pregnancy loss, including women with stillbirth and neonatal death and also those who undergo termination for fetal abnormality.

Methods

Perinatal mortality data are obtained from the Healthware clinical database and also from a stand alone Access database. These data include classifications of cause of death assigned following multi-disciplinary discussion.

The classification of perinatal deaths uses the Perinatal Society of Australia and New Zealand (PSANZ) system which was first released in May 2003 and updated in November 2004(http://www.psanzpnmsig.org/page.asp?PID=guideline). It includes a classification system by antecedent cause (PSANZ-PDC) and, in addition for neonatal deaths, by conditions in the neonatal period, or prior to discharge home, leading to death using the PSANZ-NDC. PSANZ-PDC (PSANZ Perinatal Death Classification) is to identify the single most important factor which led to the chain of events which resulted in the death. PSANZ-NDC (PSANZ Neonatal Death Classification) is in addition to the PSANZ-PDC to identify the single most important factor in the neonatal period which caused the death. Two associated factors can also be recorded by each of these systems, but these data are not included in the analysis provided in this report. The PSANZ system was developed because of apparent shortcomings in ICD10 coding alone and in the Whitfield classification system.

Perinatal mortality rate is defined as fetal death (stillbirth of a baby of at least 20 weeks of gestation at issue or at least 400 grams birth weight if gestation is unknown) plus early neonatal death (death of a liveborn baby of any gestation and weight within completion of the first 7 days of life), and expressed as a rate per 1000 total babies born. Perinatal-related mortality rate includes, in addition, late neonatal deaths (death of a liveborn baby of any gestation and weight following 7 days of life but prior to completion of 28 days of life). Perinatal-related death risk is presented by gestation and in this case is the risk of stillbirth or neonatal death per 1000 babies remaining in utero to represent the risk at a specific point in pregnancy. Stillbirth rate is per 1000 babies, meaning babies remaining in utero if data are presented by gestation, or meaning total babies born if presented as an overall rate. Neonatal death rate is per 1000 live born babies, excepting in the perinatal mortality time trends figure where perinatal mortality rates are per 1000 total babies born. This variation is to demonstrate the contribution of stillbirths and neonatal deaths to perinatal mortality rates.

Perinatal mortality rates are also presented excluding deaths of babies with lethal abnormalities and terminations for fetal abnormalities.

9.1 Perinatal and perinatal-related mortality rates

Table 71: Inborn and BBA deaths

		2000	2001	2002	2003	2004	2005	2006
Fetal deaths	20-22 weeks	33	20	30	23	25	26	24
	23-24 weeks	12	10	10	8	18	11	12
	25-26 weeks	9	2	4	6	3	3	6
	27-28 weeks	3	1	2	1	10	6	3
	29-38 weeks	27	15	17	24	13	17	24
	>38 weeks		9	6	2	13	5	5
Total fetal deaths		**84**	**57**	**69**	**64**	**82**	**68**	**74**
Neonatal deaths	Early neonatal deaths (≤7 days)	43	32	40	34	33	38	23
	Late neonatal deaths (8-28 days)	9	5	7	7	9	5	2
Total neonatal deaths		**52**	**37**	**47**	**41**	**42**	**43**	**25**
Total deaths		136	94	116	105	124	111	99
Perinatal mortality rate/1000		15.8	11.6	13.6	12.6	15.0	14.4	13.1
Perinatal related loss rate/1000		16.9	12.3	14.5	13.5	16.2	15.0	13.4
Perinatal related loss rate (excluding lethal & terminated fetal abnormalities		12	8.4	9.4	8.9	12.4	9.9	8.4

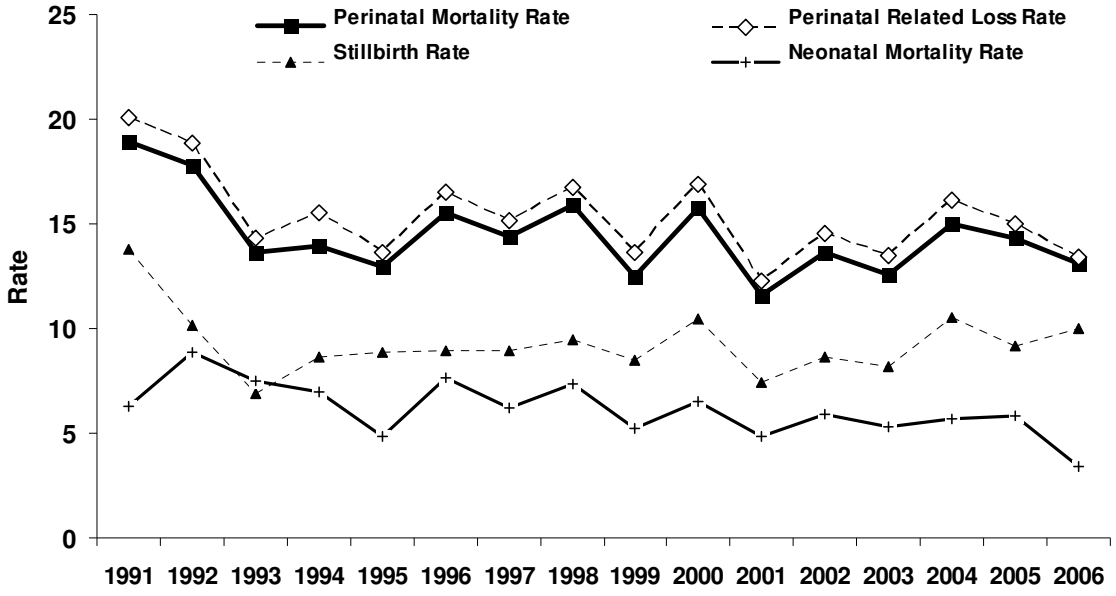

Figure 116: Perinatal mortality rate, perinatal related loss rate, stillbirth rate and neonatal mortality rate (1991-2006) (all rates expressed as deaths/1000 births)

Whilst the neonatal mortality rate seems to be continuing to show a downward trend the stillbirth rate has been very static over the last 5 years and may even be showing an upward trend. As the demographic characteristics of our population change, with increasing maternal obesity and a higher proportion of nulliparous and older women, this trend may continue to increase.

9.2 Gestational age and perinatal-related loss

Table 72: Gestational age and perinatal related mortality

	Births		Stillbirths		Neonatal deaths		Total perinatal related deaths	
	n	%	n	%	SB rate*	n	%	NND rate **	n	%	Perinatal related death risk***
20-27 weeks	109	1.0	42	57	5.7	21	84	313.4	63	64	8.5
28-31 weeks	136	1.8	10	14	1.4	1	4	7.9	11	11	1.5
32-36 weeks	591	8.0	10	14	1.4	2	8	3.4	12	12	1.7
37-40 weeks	5423	73.5	10	14	0.2	1	4	0.2	11	11	1.7
≥41 weeks	1120	15.2	2	3	1.8	0	0		2	2	1.8
Total	7379	100	74	100	10.0	25	100	3.4	99	100	13.4

* Stillbirth rate = number of stillbirths per 1000 fetuses in utero

** NND rate = number of deaths per 1000 live births in that gestation category

*** Perinatal related death risk = number of perinatal related deaths per 1000 babies remaining in utero at that gestation bracket

The perinatal related death risk (number of perinatal related deaths per 1000 babies remaining in utero at that gestation) is useful for clinicians to be able to remember and quote when assessing the risk of perinatal death for a woman in a clinical setting. It is pleasing to see that the perinatal related death risk beyond 41 weeks was not increased compared with the risk from 37-40 weeks.

9.3 Plurality and perinatal mortality

Table 73: Plurality and perinatal related mortality

	Births		Stillbirths		Neonatal deaths		Total perinatal related deaths	
	n	%	n	%	SB rate*	n	%	NND rate‡	n	%	Perinatal related death rate†
Singleton	7050	95.5	67	90.5	9.5	20	80	2.9	87	88	10.9
Multiple	329	4.5	7	9.5	21.3	5	20	15.5	12	12	36.5
Total	7379		74		10.0	25		3.4	99		13.4

* Stillbirth rate = number of stillbirths per 1000 births

‡ Neonatal Death rate = number of deaths per 1000 live births

† Perinatal-related Death rate = number of perinatal related deaths per 1000 births

Women with multiple pregnancy were 4 times more likely to experience a perinatal death compared to those with singleton pregnancy. The overall risk for perinatal death was about 4% in multiple pregnancies. The cause of death was multifactorial with 5 babies dying from spontaneous prematurity, 3 from twin-to-twin transfusion syndrome, 2 from fetal abnormality, one from fetal growth restriction and another from perinatal infection.

9.4 Maternal characteristics and perinatal mortality

Table 74: Maternal characteristics and perinatal related mortality

	Births n=7379		Stillbirths n=74			Neonatal deaths n=25			Perinatal related deaths n=99			
	n	%	n	%	SB rate*	n	%	NND rate‡	n	%	Perinatal related death rate†	RR (95%CI)§
Maternal Ethnicity												
NZ European	3124	42.3	28	37.8	9.0	6	24	1.9	34	34.3	10.9	ref
Maori	612	8.3	10	13.5	16.3	10	40	16.6	20	20.2	32.7	3.00 (1.7-5.2)
Pacific	1037	14.1	12	16.2	11.6	6	24	5.9	18	18.2	17.4	1.6 (0.9-2.8)
Asian	1129	15.3	9	12.2	8.0	3	12	2.7	12	12.1	10.6	1.0 (0.5-1.9)
Indian	525	7.1	8	10.8	15.2	0	0		8	8.0	15.2	1.4 (0.7-3.0)
Other European	707	9.6	5	6.8	7.1	0	0		5	5.0	7.1	0.7 (0.3-1.7)
Other	245	3.3	2	2.7	8.2	0	0		2	2.0	8.2	0.8 (0.2-3.1)
Parity												
Nullipara	3588	48.6	40	54.1	11.1	12	48.0	3.4	52	52.5	14.5	1.2 (0.8-1.7)
Multipara	3791	51.4	34	45.9	9.0	13	52.0	3.5	47	47.5	12.4	ref
Maternal Age												
<35	5115	69.3	53	71.6	10.4	21	84	4.1	74	75	14.5	ref
≥35	2264	30.7	21	28.4	9.3	4	16	1.8	25	25	11.0	0.8 (0.5-1.2)
Maternal Smoking												
Currently smoking	364	4.9	8	10.8	22.0	8	32	22.5	16	16.2	44.0	3.9 (2.3-6.8)
Not current	5090	70	45	60.8	8.8	12	48	2.4	57	57.6	11.2	ref
Stopped in pregnancy	113	1.5	3	4.0	26.5	2	8	18.2	5	5.1	44.2	4.0 (1.6-9.7
Missing	1812	24.6	18	24.3	9.9	3	12	1.7	21	21.2	11.6	1.0 (0.6-1.7)
Maternal BMI												
<19	306	4.2	3	4.1	9.8	1	4.0	3.3	4	4.0	13.1	1.1 (0.4-3.2)
19-25	3395	46.0	33	44.6	9.7	6	24.0	1.8	39	39.4	11.5	ref
26-35	1670	22.6	13	17.6	7.8	5	20.0	3.0	18	18.2	10.8	0.8 (0.5-1.5)
>35	409	5.5	8	10.8	19.9	3	12.0	7.6	11	11.1	27.4	2.4 (1.2-4.6)
Missing	1599	21.7	17	23.0	10.5	10	40.0	6.2	27	27.3	16.7	1.5 (0.9-2.4)

* Stillbirth rate = number of stillbirths per 1000 births
‡ Neonatal Death rate = number of deaths per 1000 live births
† Perinatal related death rate = number of perinatal related deaths per 1000 births
§ Relative Risk of perinatal death for each category compared to referent category (ref)

Demographic characteristics of women with perinatal deaths are summarised in the table below. This is the first year that we have had reliable data about maternal BMI to include in the report. It is difficult to draw too many conclusions from one year's data. However there are a number of consistencies between these NW data and the published literature. An increased risk is seen in women with BMI>35, in nullipara and in women who smoke. This year an increased risk is seen in Maori women which is made up equally of stillbirths and neonatal deaths. A previous study from NW over an 8 year period showed a higher risk in Pacific and Indian women but not in Maori, after adjustment for other risk factors such as smoking and parity. Multivariate analysis over several years of data will be necessary to determine whether any ethnic groups have increased risks.

It is interesting that the perinatal mortality rate in women who reported that they had stopped smoking during pregnancy was similar to those who continued to smoke.
The published literature suggests that if women stop smoking by 16 weeks, their perinatal mortality approximates that of non-smokers. The NW data suggest that a number of women may not have stopped until later in pregnancy (perhaps prompted by a pregnancy complication) or that some of these women have not really become smoke free. It would be interesting to collect data on gestation at which smoking was stopped in future reports.

9.5 Lead maternity carer (LMC) at birth and perinatal mortality

Table 75: LMC and perinatal related mortality

	Births		Stillbirths			Neonatal deaths			Total perinatal related deaths		
	n	%	n	%	SB rate*	n	%	NND rate‡	n	%	Perinatal related death rate†
Independent Midwife	2873	38.9	22	29.7	7.7	6	24.0	2.1	28	28.3	9.7
Private Obstetrician	1772	24.0	11	14.9	6.2	3	12.0	1.7	14	14.1	7.9
G.P.	152	2.1	0			0			0		
NW Medical	349	4.7	16	21.6	45.8	4	16.0	12.0	20	20.2	57.3
NW Diabetes	235	3.2	4	5.4	17.0	3	12.0	12.9	7	7.1	29.8
NW Domino	430	5.8	5	6.8	11.6	1	4.0	2.4	6	6.1	14.0
NW Community	1408	19.1	10	13.5	7.1	2	8.0	1.4	12	12.1	8.5
Other DHB	109	1.5	2	2.7	18.3	2	8.0	18.7	4	4.0	36.7
Unbooked	51	0.7	4	5.4	78.4	4	16.0	85.1	8	8.1	15.7
Total	7379	100	74	100	10.0	25	100	3.4	99	100	13.4

* Stillbirth rate = number of stillbirths per 1000 births
‡ Neonatal Death rate = number of deaths per 1000 live births
† Perinatal related death rate = number of perinatal related deaths per 1000 births

The high perinatal mortality in women in the medical clinic reflects the fetal abnormalities cared for in the fetal medicine service. It is hoped that in future reports, the deaths in this service will be able to be divided into those from the fetal medicine service and those from the medical clinic.

In recent years the perinatal mortality in women attending the diabetic clinic has been very low with rates similar to that seen in the general population. This year the rate has increased with 7 deaths (29.8/1000) and is perhaps more in line with what would be expected in such a high risk group. Four deaths were due to extreme prematurity, two to placental abruption and one due to fetal abnormality.

9.6 Causes of perinatal-related deaths

Table 76: Stillbirth and neonatal death by cause (PSANZ-PDC) 2006

	Fetal deaths			Neonatal deaths			Total		
	n	%	Rate*	n	%	Rate**	n	%	Rate*
Congenital abnormality	26	35	3.5	11	44.0	1.5	37	37.4	5.0
Perinatal infection	6	8.1	0.8	3	12.0	0.4	9	9.1	1.2
Hypertension	2	2.7	0.3	1	4.0	0.1	3	3.0	0.4
Antepartum haemorrhage	4	5.4	0.5	0			4	4.0	0.5
Maternal conditions	5	6.8	0.7	1	4.0	0.1	6	6.1	0.8
Specific perinatal conditions	6	8.2	0.8	1	4.0	0.1	6	6.1	0.8
Hypoxic peripartum death	0			0			0		
Fetal growth restriction	8	10.8	1.1	0			8	8.1	1.1
Spontaneous preterm	5	6.8	0.7	8	32.0	1.1	13	13.1	1.8
Unexplained antepartum death	12	16.2	1.6	0			12	12.1	1.6
Total	74	100	10.0	25	100	3.4	99	100	13.4

* Rate: per 1000 births (n=7379 in 2006) ** Rate: per 1000 live births (n=7305 in 2006)

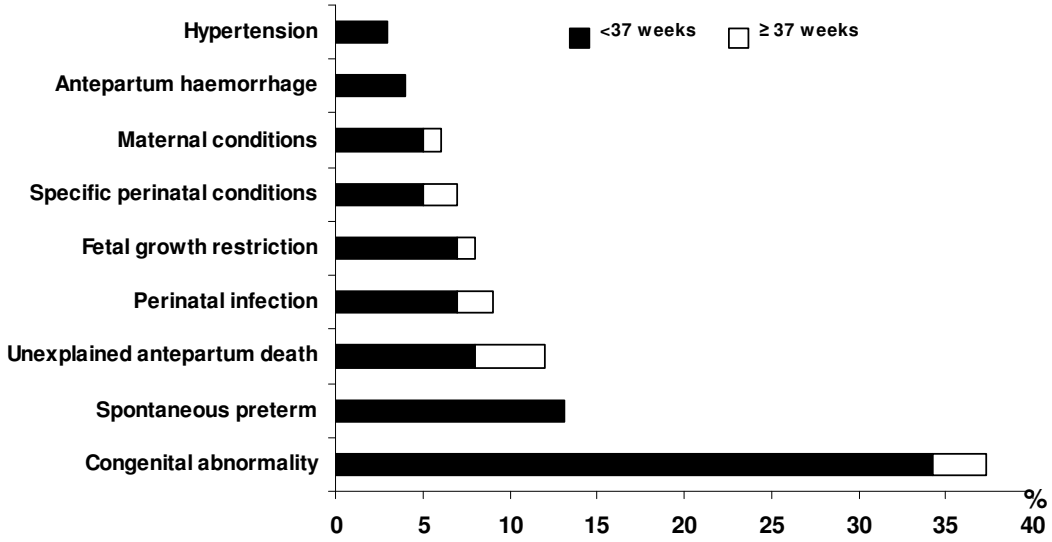

Figure 117: Contribution to perinatal death by cause (PSANZ-PDC) and gestation at birth

The distribution of causes of perinatal death is similar to recent years with congenital abnormality accounting for more than a third of cases. Unexplained was the commonest classification for late stillbirth after 37 weeks (n=12). Six of these cases had post-mortem examinations and are truly unexplained but the remaining six neither had post-mortem nor placental histology and would perhaps more appropriately be classified as "uninvestigated".

It is particularly pleasing this year that there were no hypoxic peripartum deaths.

9.7 Neonatal deaths

Table 77: Neonatal deaths by cause (PSANZ-NDC) and gestational age

	Total neonatal deaths	< 37 weeks		≥ 37 weeks	
		n	%	n	%
Total	25	24	96.0	1	4.0
Extreme prematurity	16	16	100		
Congenital abnormality	6	5	83.3	1	16.7
Infection	0	0		0	
Neurological	1	1	100	0	
Cardio-respiratory disorders	2	2	100		
Gastrointestinal	0	0		0	

9.8 Necropsy

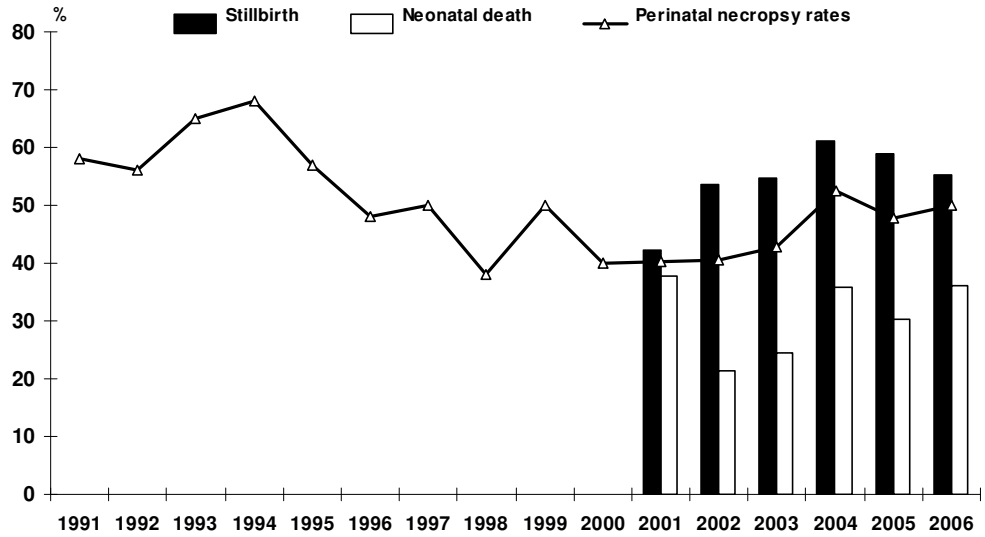

Figure 118: Necropsy rates (1991-2006)

Post-mortem is the gold standard investigation for perinatal death. NW is fortunate to have access to a world-class perinatal pathology service provided by Dr Jane Zuccollo and Dr Jeanette MacFarlane. In spite of this the post-mortem rate is fairly static at 50%. A number of babies are now having MRI carried out if consent is not given for a post-mortem. This has provided additional useful information in a number of these cases.

9.9 Maternal deaths

In 2006, there was one maternal death during pregnancy from suicide.

Chapter 10

FERTILITY SERVICES

10 FERTILITY SERVICES

This chapter documents the IVF and ICSI clinical outcomes from Fertility Plus in 2006 and a discussion on recent advancements in the service.

Table 78: Fertility PLUS IVF/ICSI clinical outcomes

	1999	2000	2001	2002	2003	2004	2005	2006
Number of cycles started	132	125	289	309	306	316	398	440
Number of cycles stopped						41	41	67
Percent cycles stopped						13%	10%	15%
NPSU 2000 benchmark for cycles stopped		10%	10%	10%	10%	10%	10%	10%
Number of Cycles reaching Oocyte pick up (OPU)	100	115	230	247	246	275	357	373
Number of cycles reaching embryo replacement	80	99	189	201	206	237	304	313
Percent cycles reaching embryo replacement						86%	85%	84%
NPSU 2002 benchmark for replacement				87%	87%	87%	87%	87%
Number of clinical pregnancies	23	24	57	65	67	83	96	124
Clinical pregnancy rate/cycle started						26%	24%	28%
NPSU 2000 benchmark for clinical pregnancy rate/cycle started		24%	24%	24%	24%	24%	24%	24%
Clinical pregnancy rate/OPU	23%	21%	25%	26%	27%	30%	27%	33%
NPSU 2002 benchmark clinical pregnancy rate /OPU				26%	26%	26%	26%	26%
Clinical pregnancy rate/embryo replacement	29%	24%	30%	32%	33%	35%	32%	40%
Clinical pregnancy rate/embryo replacement (women ≤35yrs with FSH<9)						45%	36%	42%
Clinical pregnancy rate/ER in women having single blastocyst transfer.								56%
NPSU 2002 benchmark clinical pregnancy rate/embryo replacement				31%	31%	31%	31%	31%
Twin pregnancy rate						20%	12.5%	9.6%
NPSU 2002 benchmark twin pregnancy rate				≤20%	≤20%	≤20%	≤20%	≤20%

Single embryo transfer policy

Since 2005, women under 36 years old who are having a first or second embryo transfer with at least one good quality embryo, are required to have only one embryo transferred. This was a Government initiative when public funding for a second cycle of treatment was introduced and was an attempt to decrease the twinning rate because of the risk multiple pregnancies carry to mothers, babies and relationships. There is also an increased cost to the Government because of the time babies from multiple pregnancies spend in NICU.

In 2005, this resulted in a decreased pregnancy rate in the younger women who were having a single embryo transfer on Day 3 post-egg collection. On Day 3, there are often several embryos to choose from. The embryos are cultured separately in drops, so we can record the progress of each embryo. We record normal fertilisation, time of first division, cleavage rate, number of cells and grade on Day 2. All of these things help us to choose the embryo to replace on Day 3 as they are markers of an embryo's viability. However, we were not always choosing the "best" embryo as evidenced by the drop in pregnancy rate for these good prognosis patients.
For this reason, in 2006, we decided to culture embryos from these younger women to Day 5 post collection when they become a blastocyst☹an embryo of approximately 100 cells which has a cavity). This enabled us to choose an embryo which has continued to develop and has higher implantation potential. We are delighted with the outcome, as in 2006 this resulted in a 56% clinical pregnancy rate in women <36 years having a single blastocyst transfer.

This has also resulting in a further decrease in our twinning rate. In 2006, 9.6% of our pregnancies resulted in a twin pregnancy.

Embryo Freezing Policy

As we are undertaking Day 5 transfers on these women with a good prognosis, there are often "spare" blastocysts, which can be frozen. The pregnancy rate per transfer of thawed blastocysts is currently 35% (an increase of 10%). This has led us to change our policy on freezing embryos. We no longer freeze spare embryos on Day 3 transfer and now culture them until Day 5 and freeze all embryos that have produced a viable blastocyst.
The pregnancy rate maybe higher for Day 5 thaws because we were previously freezing embryos on Day 3 that did not have the potential to become blastocysts. This has resulted in fewer embryos to freeze, but saves a woman going through the stress of a thaw and replacement cycle that may never have been going to achieve a pregnancy.

Chapter 11

GYNAECOLOGY

11 GYNAECOLOGY

11.1 Inpatient Gynaecology

Methods

In 2006, Ward 97, Gynaecology, worked hard to collect inpatient visit data. However, when audited against DSU coding data, the ward data were found to be incomplete. For this reason, the primary source of data for this section is coding data. Some reconciliation between DSU data and Healthware and PIMS Theatre data has occurred.

For the purposes of this report, "inpatient" has been defined as a stay in the ward of at least 3 hours.

Table 79: Admissions to Ward 97

	Number of visits n=2457	
	n	%
Age		
< 25	457	18.6
25-34	740	30.1
35-45	643	26.2
46-55	289	11.8
56-65	140	5.7
>65	188	7.7
Ethnicity		
NZ European	899	36.6
Māori	271	11.0
Pacific	487	19.8
Asian	271	11.0
Indian	166	6.8
Other European	187	7.6
Other	144	5.9
Not stated	32	1.3
District Health Board		
Auckland	1892	77.0
Counties Manukau	176	7.2
Waitemata	302	12.3
Other	87	3.5
Smoking		
Current	469	19.1
Past	262	10.7
Length of stay (days)		
0	1042	42.4
1-5	1237	50.4
6-10	152	6.2
>10	26	1.1

Table 78: Multiple admissions to Ward 97

	Number of visits n=2457	
	n	%
One visit only	1858	75.6
2 visits	458	18.6
3 visits	93	3.8
4 visits	20	0.8
5 visits	10	0.4
6 visits	6	0.2
12 visits	12	0.5

11.2 Hysterectomy

Methods

These data were sourced from inpatient coding data. They include all inpatient admissions to the gynaecology service during 2006 coded with hysterectomy as a procedure

The definition of malignant indication for hysterectomy is hysterectomy procedure in a woman with a diagnosis code of gynaecological cancer.

Findings

Table 80: Characteristics of women undergoing hysterectomy during 2006

	Malignant indication n=84		Non malignant n=131	
	n	%	n	%
Age				
<35	11	13.1	1	0.8
35-45	8	9.5	43	32.8
46-55	15	17.9	51	38.9
56-65	19	22.6	22	16.8
>65	31	36.9	14	10.7
Ethnicity				
NZ European	37	44.1	62	47.3
Māori	16	19.1	10	7.6
Pacific	10	11.9	26	19.9
Asian	4	4.8	10	7.6
Indian	4	4.8	9	6.9
Other European	7	8.3	8	6.1
Other	6	7.1	5	3.8
Not stated	0		1	1.0
District Health Board				
Auckland	25	29.8	111	84.7
Counties Manukau	19	22.6	5	3.8
Waitemata	20	23.8	1	0.8
Other	20	23.8	14	10.7
Smoking				
Current	9	10.7	31	23.7
Past	18	21.4	20	15.3

Table 81: Clinical details of women having a hysterectomy

	Malignant indication n=84		Non malignant n=131	
	n	%	n	%
Type of hysterectomy				
Total abdominal	84	100	81	61.8
Vaginal	0		36	27.5
Laparoscopic assisted vaginal (LAVH)	0		14	10.7
Length of stay (days)				
0-5	32	38.1	111	84.7
6-10	47	56.0	19	14.5
>10	5	6.0	1	0.8
Number of women having a transfusion	8	9.5	11	8.4

It is interesting to note that the transfusion rate following non-malignant hysterectomy is similar to that following malignant hysterectomy.

In view of this, the CRIS notes were reviewed to establish risk factors for transfusion among non-malignant cases. In some cases more than one risk factor was noted. Pre-operative anaemia was noted in three cases, large fibroids in four cases, and excessive bleeding at surgery or in the post-operative period in six cases. One case was complicated surgery on a woman with suspected malignancy, and one case was a hysterectomy combined with a gastrectomy.

Table 82: Route of hysterectomy among non-malignant hysterectomies (2000-2006)

	2000 n=197		2001 n=170		2002 n=208		2003 n=187		2005 n=161		2006 n=131	
	n	%	n	%	n	%	n	%	n	%	n	%
Abdominal	102	51.8	90	52.9	113	54.3	100	53.5	84	54	81	61.8
Vaginal	68	34.5	65	38.2	72	34.6	63	33.7	54	34	36	27.5
Laparoscopic assisted vaginal (LAVH)	27	13.7	15	8.8	23	11.1	24	12.8	21	13.0	14	10.7

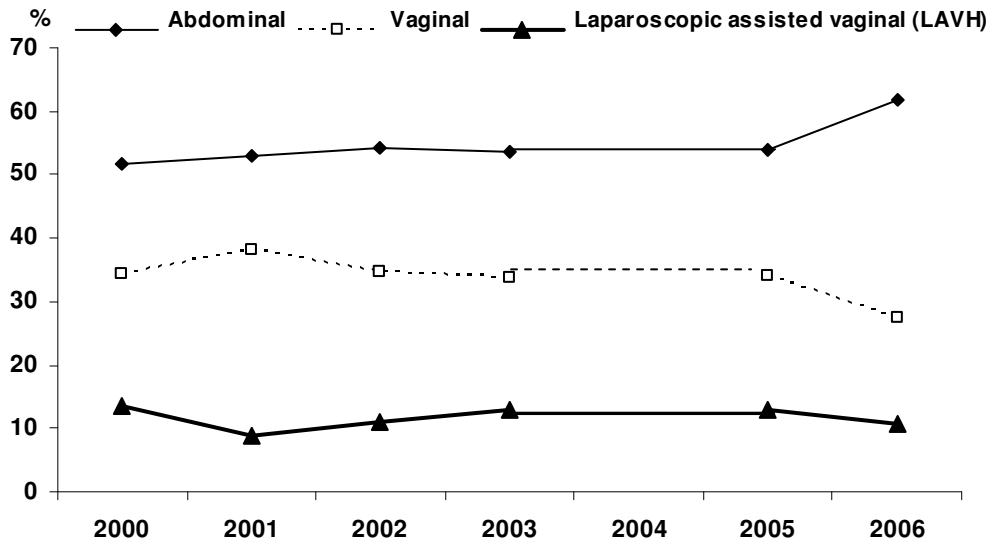

Figure 119: Route of hysterectomy among non malignant hysterectomies (2000-2006)

Table 83: Diagnoses associated with non-malignant hysterectomy*

	n=131	
	n	%
Endometriosis	18	14
Fibroids	66	50
CIN	3	2
Menorrhagia	52	40
PMB	8	6
Incontinence	15	11
Prolapse	36	27
Endometrial hyperplasia	10	8

*These diagnoses are derived from the diagnosis codes assigned by clinical coders following inpatient stay for the visit when hysterectomy was performed. They are not mutually exclusive and may not represent indication for hysterectomy. In some instances the diagnosis may be incidental to the true indication.

Summary / Implications

Previous reports have suggested that vaginal hysterectomy, as the safest and most cost effective option, should account for 50% of benign hysterectomies. The figures above show a trend in reduction in the rate of vaginal hysterectomy, with an associated increase in the rate of abdominal hysterectomy. This has implications not only for patient care, but also in training of the next generation of specialists. The rate of laparoscopic hysterectomy is unchanged.

The total number of hysterectomies for benign indications has reduced significantly since 2002 due to reduced demand on the service, contributed in some way by the

availability of other second and third generation treatment options for heavy menstrual bleeding e.g. Levonorgestrol containing intra–uterine system (Mirena) and endometrial ablation (MEA or EBT).

The transfusion rate following benign hysterectomy needs to be monitored. Pre-operative measures such as GnRH Analogues or Danazol for very large fibroids and iron supplementation may be of benefit.

The smoking rate among women undergoing hysterectomy is high. Smoke Free Education and support resources need to be allocated to Gynaecology services – inpatient and outpatient.

11.3 Ectopic pregnancy

Methods

These data were sourced from the Decision Support Unit coding data (DSU). They include all inpatient admissions to the gynaecology service during 2006 coded with a diagnosis of ectopic pregnancy

Each women's record was then searched on CRIS to identify those that had failed initial management prior to subsequent coded cytotoxic or surgical management. This search revealed four women who were found not to have an ectopic pregnancy. These women were not included in the analysis.

Four further women were identified from reviewing Early Pregnancy Assessment Unit (EPAU) records. These women are included in the table below.

Findings

There has been a small increase in the number of ectopic pregnancies at National Women's in 2006 compared to 2005. Just over 60% of women with ectopic pregnancy are now managed surgically and over 80% of these are managed laparoscopically. There is still considerable debate whether or not the fallopian tube should be removed at the time of the surgery as the risk of future ectopics may be increased. If future fertility is desired patients should be followed in the fertility clinic with an early resort to tubal patency testing. The remainder of the patients were managed either conservatively or with methotrexate. The current criteria for medical management are as follows: β-hCG ≤5000 IU/L, an adnexal mass ≤ 3.5 cm on ultrasound and no evidence of tubal rupture (a small amount of fluid in the pouch of Douglas is allowed on ultrasound) in a patient who is haemodynamically stable.

In 2006 the number of women receiving medical treatment increased compared to 2005. The number of women who were treated conservatively declined and the number of women with ectopic pregnancies who were treated surgically remained the same. As stated in the 2005 report, we need to continue to monitor the management of ectopic pregnancy to measure adherence to our protocols and to ensure that women are offered the choice of medical, surgical or conservative treatment when appropriate.

Table 84: Demography and clinical characteristics of inpatient admissions with ectopic pregnancy during 2006

	Women n=119	
	n	%
Maternal age		
≤ 20	7	6
21-25	16	13
26-30	32	27
31-35	37	31
≥35	27	23
Ethnicity		
NZ European	38	32
Māori	15	13
Pacific	20	17
Asian	18	15
Indian	9	8
Other European	14	12
Other	5	4
District Health Board		
Auckland	104	87
Counties Manukau	3	3
Waitemata	9	8
Northland	2	2
Overseas	1	1
Mode of treatment‡		
Expectant*	18	15
Medical‡	29	25
Surgical$^{\Psi}$	72	61
No of admissions		
1	88	74
2	20	17
3	5	4
4-9	2	2
Subsequent mode of treatment		
Failed conservative - medical	1	
Failed conservative - surgical$^{\Psi}$	3	
Failed medical - medical	7	
Failed medical - surgical$^{\Psi}$	8	

‡ The data given here denote management during inpatient stay.

*Expectant means that no medical or surgical treatment has been coded during an inpatient admission for this woman.

‡ Includes one live ectopic in previous caesarean scar –treated with intrasac Methotrexate (MTX) then 4x intramuscular MTX with folinic acid.

$^{\Psi}$ Of the 83 women who underwent surgical treatment 69 had laparoscopic management (83%) and only 3 had salpingostomy (conservation of the tube).

Table 85: Initial treatment of ectopic pregnancy at NW (2005-2006)

	2005 n=106		2006 n=119	
	n	%	n	%
Conservative	23	33	18	15
Medical	11	10	29	25
Surgical	60	57	72	61

11.4 Early Pregnancy Assessment Unit

EPAU was commenced in 2003 in preparation for the co-location of NW at Auckland City Hospital (ACH) and Greenlane Clinical Centre (GLCC) in 2004.

EPAU is an outpatient nurse-led service, with Social worker, RMO and SMO support on level 6 at the Greenlane Clinical Centre. Patients are referred from GPs, Specialists, midwives or from WAU.

If surgical evacuation of the uterus for a miscarriage is agreed with the patient, the necessary arrangements are made for this to be done at the Short Stay Surgical Unit at GLCC. This helps to reduce the need for inpatient services and acute major theatre utilisation at ACH.

1369 patient visits were recorded at Early Pregnancy Assessment Unit (EPAU) in 2006.

Many women were encouraged to allow their miscarriage to complete spontaneously without medical intervention. For those women who do not want expectant management, 32 chose medical management and 185 had evacuations of the uterus in 2006. Improved education and support for women should reduce the number of patients requesting surgical evacuation.

EPAU has in the last year also provided support for and follow up of patients who have a diagnosis of Molar Pregnancy. It is envisaged that this role will eventually return to Gynaecological Oncology services.

EPAU is the point of referral for second trimester requests for termination of pregnancy for women from ADHB area. EPAU will arrange counselling, specialist support and appropriate referral for ongoing care.

Table 86: Reasons for visits to EPAU

	Total n=1369	
	n	**%**
Miscarriage-Missed/non-viable/Incomplete/Complete	780	57.0
Follow-up of medical treatment of miscarriage	26	1.9
Ectopic and medical treatment of miscarriage		
Post treatment follow-up	85	6.2
BHCG review following pregnancy loss	307	22.4
Molar pregnancy	27	2.0
2nd Trimester TOP consultation	103	7.5
Not categorised	41	3.0

11.5 Recurrent Pregnancy Loss

The Recurrent Pregnancy Loss & Early Pregnancy Support Service is provided by the Reproductive Endocrinology & Infertility (REI) unit located in *fertility* PLUS at the Greenlane Clinical Centre.

Prior to pregnancy, the clinic provides investigation and information regarding management options for couples. The clinic provides appropriate support during early pregnancy, including the following services:

- Pregnancy clinic, supported by a specialist & nurse
- Access to a pregnancy counsellor on an individual or group basis
- Weekly relaxation and support & education sessions
- A seven day per week telephone advisory service between the hours of 8.30-15.30
- Acute medical assessment, seven days per week for clinical emergencies

The referral criteria are as follows:

- 3 **consecutive** first trimester pregnancy losses*
- 2 **consecutive** second trimester pregnancy losses*
- Maternal age under 40yrs
- Resident in Auckland, Waitemata, Counties Manukau DHB area.

(* pregnancy loss includes miscarriage, ectopic pregnancy, molar pregnancy but not termination of pregnancy)

The data provided before have been extracted from the current manual data collection.

Table 87: Demographic and clinical characteristics of pregnant women attending RMC clinic (October 2004 –December 2006)

	Total n=168		Primipara n=64		Multipara n=104	
	n	%	n	%	n	%
Age (mean years (range))	35 (21-40)					
Ethnicity						
NZ European	94	56				
Maori	15	9				
Pacific	9	5				
Asian	30	18				
Other European	17	10				
Other	3	2				
Number of previous losses						
3	90	54	42	66	48	46
4	47	28	15	23	32	31
5	15	9	4	6	11	11
6	8	5	1	2	7	7
≥7	6	4	2	3	6	6

Table 88: Outcome of pregnancies among women attending RMC (October 2004 – December 2006)

	Total n=168		Nullipara n=64		Multipara n=104	
	n	%	n	%	n	%
Pregnancy loss						
Miscarriage before fetal heart detected	36	21				
Miscarriage after fetal heart detected	10	6	23	36	30	29
Termination of pregnancy	7	4				
Ongoing pregnancy at 12 weeks	115	68	41	64	74	71
Bleeding in ongoing pregnancy	38	23				

In 2007, the Recurrent Pregnancy Loss & Early Pregnancy Support Service plan to complete earlier work on an electronic database.

Chapter 12

TERMINATION of PREGNANCY

12 TERMINATION OF PREGNANCY

Epsom Day Unit is the Auckland Regional Service for first trimester terminations of pregnancy. It is a multi-disciplinary service incorporating Staff Nurses, Health Care Assistants, Social Workers, Surgeons from NW, Community Doctors with a particular interest in family planning, and a small administration support team.

Epsom Day Unit provides a two-day service. On day one, assessment is undertaken - psychosocial, medical, legal certification, contraceptive prescription and education. The women will meet with a social worker, community doctor and staff nurse. On day two a second certifying assessment is undertaken and, if certified, the surgical termination of pregnancy occurs.

Approximately one-third of the women reside in Central Auckland, one-third in South Auckland and the final third in North and West Auckland. The percentage of interpreters required for women accessing the service was 10%.

The service also offers pregnancy option counselling and post operative termination counselling.

Table 89: Number of terminations

	2000	2001	2002	2003	2004	2005	2006
Total number of terminations	5835	5557	5775	5960	5809	5598	5548

Table 90: Number of counselling sessions

	2001	2002	2003	2004	2005	2006
	n	n	n	n	n	n
Post op counselling	51	36	10	22	35	33
Pregnancy option counseling	78	90	70	92	89	87
Declines %	2.0	1.4	1.8	2.6	2.7	3.0

Pregnancy Option Counselling refers to an appointment a woman had with a social worker prior to her assessing appointment.

Declines refer to the number of women who do not meet the legal criteria of abortion as agreed by two certifying consultants.

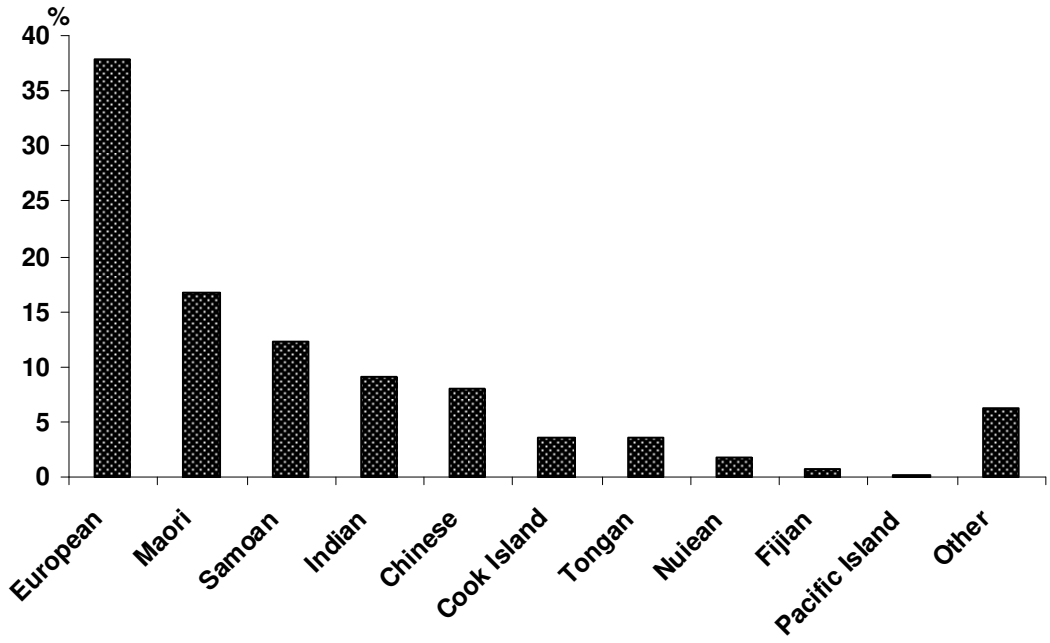

Figure 120: Ethnicity of women having a termination in 2006

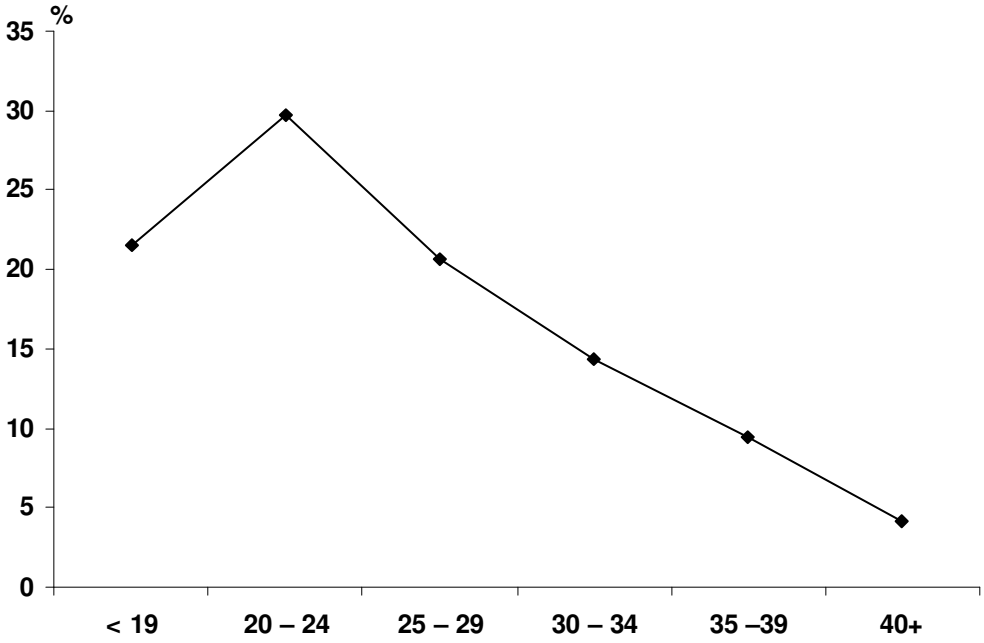

Figure 121: Age of women having a termination in 2006

Chapter 13

APPENDICES

APPENDIX 1 METHODOLOGY

1.1 Data cleaning queries

The following is a list of the data cleaning and validation queries which were carried out for the production of this report. This list is not exhaustive and some further ad hoc cleaning was carried out during analysis.

Antenatal

Ethnicity is Not Stated or Other

Check parity if parity is less than parity at previous live birth (although previously parity was defined as 2 for twins). Check that obstetric history has been completed for women with a gravidity >1.

Previous Caesarean; If indication for caesarean section=repeat caesarean, previous Caesar=yes and parity is > 0.

LMC is Other Please Specify, Null, NW Obstetrician or charge midwives.

BMI (Body Mass Index) Calculated from earliest weight recorded, as weight (kg)/height(m)^2. If BMI <17 or >40, check height and weight

Antenatal Complications

Medical Conditions: If delivered at NW HDU (High Dependency Unit), any DCC (Department of Critical Care) or ICU (Intensive Care Unit), then antenatal summary medical conditions is not = missing.

If Antenatal Admission for Hypertension, APH or Diabetes, check AN Summary screen medical conditions is not = missing &/or check data is consistent.

If Induction Indication is Hypertension, APH or Diabetes, check AN Summary screen medical conditions is not = missing &/or check data is consistent.

If Reason for Operative Delivery is Hypertension, APH or Diabetes, check AN Summary screen medical conditions is not = missing &/or check data is consistent.

If HDU Admission for Hypertension, APH or Diabetes, check AN or PN screen medical conditions & blood loss/ transfusion is not = missing &/or data is consistent.

Medical History Screen; Previous Medical Conditions = Chronic Hypertension, Diabetes Type 1 or Diabetes Type 2 & AN Summary screen medical conditions is not = missing &/or check data is consistent.

Antenatal Summary - Hypertension Fields can not be Null (Eclampsia, Gestational Hypertension, Pre eclampsia, Other Current Med Surg Cond).

Antenatal Summmary; Current Medications (prior to labour or elective cs) = Antihypertensives then check Hypertension Fields are not be Null &/or data is consistent. (Eclampsia, Gestational Hypertension, Pre eclampsia, Other Current Med Surg Cond).

Antenatal Diabetes Screen fields - Hypertension, Chronic HT pre preg or Antihypertensive Treatment pre preg indicate Hypertension, check Antenatal Summary Hypertension fields are not null &/or data is consistent.

Eclampsia = Yes (Boolean in Antenatal Summary).

Diastolic greater than or equal to 90, but no Hypertension entered in AN Summary fields.

Antenatal Summary screen; Reason for Specialist Consultation = Diabetes, check Sugar Tolerance = is not null.
If Antenatal Summary Sugar Tolerance indicates Diabetes check Diabetic Screens AN or PN = missing.

Antenatal Diabetes screen without a PN Diabetes Screen & vice versa.

Newborn Diabetes; Newborn Discharge Summary, check for missing diabetic data.

Induction of Labour

If time at ARM is earlier than onset of contraction time, assume this is an induction.

If time at start of Syntocinon is earlier than onset of contraction time, then check this is an induction.

If indication for ARM is induction and time of ARM is before onset of contractions, then induction data are entered.

If indication for ARM is induction and time of ARM is after onset of contractions, then indication for ARM is labour augmentation.

If an induction occurred, there is an Induction Indication entered.

Indication for Induction Is Other Please Specify and Comment fields for checking.

Pregnancy/Birth

Homebirths & BBA's (babies born before arrival at hospital when intended birth in hospital) All checked as appropriately classified.

Check 'Delivered by' is not missing.

Check that admission to Labour & Birth Suite/Operating Theatre/WAU is before birth time (unless is recorded as BBA).

If birth location is BBA, then birth time is before admission.

Onset of contraction time is before full dilatation which is in turn before Birth time (sometimes there is no onset of contraction time because of pre-labour caesarean).

There should be NO onset of contraction time if method of Birth is Elective Caesarean not in labour or Emergency Caesarean not in labour.

Onset of contraction time should **not** be missing if method of Birth is Caesarean (elective or emergency) in labour.

Full Dilatation Time should not be null if Delivery Method is a vaginal delivery.

If indication for induction is SRM then rupture of membrane time should be before induction start time which in turn is before onset of contraction time.

Syntocinon time is before birth time.

Membranes ruptured time is not null.

Membranes ruptured time is before birth time.

Time of epidural insertion is before birth time.

Full dilatation time is before birth time.

Birth time is always before delivery of placenta time.

Placenta delivery time is not null.

Check Birth Methods fields 1, 2 & 3 are consistent.

Check all Classical Caesareans to ensure they are authentic.
A Caesarean Section (CS) must have an option from the expanded tree to describe what type of CS. Cannot be just Lower Segment Caesarean Section or Classical Caesarean Section.

If Delivery Method is anything other than SVD or Spontaneous Breech Delivery, check there is a reason for Operative Delivery.

If Delivery Method is a SVD or Spontaneous Breech Delivery, check there is NO reason for operative delivery.

If indication for operative delivery is fetal distress, then fetal distress variable (in Labour & Birth Baby) is yes or meconium was present.

Check if failure to progress is the primary indication for operative delivery & mode of delivery is elective caesarean.

Indication for Operative Delivery Is Other Please Specify + Comment fields - for checking.

If Delivery Presentation is Breech, should not be a Spontaneous Vertex Delivery.

If Birth method is breech, then presentation is breech.

If indication for caesarean is breech or malpresentation, then presentation is NOT cephalic.

If Birth method is 'Elective CS' then Dilatation at Syntocinon should be null.

Membrane method is SRM but has indication for ARM, check.

If ARM check there is an indication for ARM.

If vaginal delivery, membranes method should not be At time of C/S.

Delivery Presentation is null.

If Dilatation at Epidural is not Null then Anaesthesia should show Epidural Lumbar or Epidural Spinal.

If Time of Epidural is not Null then Anaesthesia should show Epidural Lumbar or Epidural Spinal.

If caesarean is mode of birth, anaesthesia is not missing.

If had an epidural, then dilatation at last VE is not missing and time of epidural is not missing.

If there is postpartum transfusion and blood loss is < 1000 mls, check blood loss.

Blood Loss is not out of range ie: <50, >1500 or is null.

Blood Loss >=1500 & Blood Transfusion = No.

Blood Loss <1500 & Blood Transfusion =Yes.

Vaginal Delivery & Lacerations is Null.

Sutured by Is Not Null, Lacerations Is Null.

If Instrumental Delivery (Forceps) then check for Episiotomy.

Mothers Destination to Ward is somewhere within Auckland City Hospital but PN screen does not reflect this.

Breast Feeding Baby Unknown or missing fields from Immediate Newborn Assessment & Newborn Discharge Summary Screen.

Baby

Birth weight – check if <400g or >5kg.

If gestation <35 weeks, check birth weight if >2500g.
If gestation >35 weeks, check birth weight if <2500g.

Gestation: check if < 20wks or > 44 wks.

If indication for induction is post term, check gestation if gestation is < 40 weeks.

Derived Gestation to Neonatal Gestation (Immediate Newborn Assessment screen) >2 weeks difference.

Gestational Age (Immediate Newborn Assessment) Is Null.

Days in NICU/PIN/Paed care on Ward are not null or check if >30.

Missing Apgars.

Live birth with Apgars 1min or Apgars 5 min of 0.

Admissions

HDU (High Dependency Unit) Admission (i.e. Admission Time &/or Admission from) but reason for Admission Is Null.

Data Checks with Other Sources

CMS/ Coding data to ensure correct birth numbers.

Neonatology database; fields checked include Birthweight, Gestation, Apgars & Days in NICU.

Perinatal database fields cross-referenced with Healthware include; ethnicity, gestation – LMP/EDD, LMC, Gravida/Parity, Height/Weight/BMI, Outcome, Apgars, Sex, Gestation, Birth Weight, PSANZ-PDC & PSANZ-NDC classifications, customised centile.

PIMs theatre data checked against Healthware for epidural and GA

1.2 Derived definitions – maternity

Ethnicity

Table 91: Level 2 prioritisation of ethnicity as outlined in 'Ministry of Health. 2004. Ethnicity Data Protocols for the Health and Disability Sector.'

Priority order	Ethnic Group Code Description
1	Māori
2	Tokelauan
3	Fijian
4	Niuean
5	Tongan
6	Cook Island Maori
7	Samoan
8	Other Pacific Island
9	Pacific Island NFD (Not Further Defined)
10	South East Asian
11	Indian
12	Chinese
13	Other Asian
14	Asian NFD
15	Latin American / Hispanic
16	African
17	Middle Eastern
18	Other
19	Other European
20	European NFD
21	NZ European

APPENDIX 2 SUMMARY STATISTICS

Table 92: Mode of birth (1998-2006)

	1998 n=7531		1999 n=7501		2000 n=7827		2002 n=7775		2003 n=7611		2004 n=7491		2005 n=7194		2006 n=7212	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Spontaneous vertex birth	4670	62	4635	61.8	4650	59.4	4327	55.7	4269	56.1	4073	54.4	3845	53.4	3815	52.9
Vaginal breech	75	1	83	1.1	87	1.1	66	0.8	58	0.8	54	0.7	54	0.7	51	0.7
Operative vaginal	926	12.3	945	12.6	1010	12.9	1081	13.9	1065	14.0	1171	15.6	1022	14.2	956	13.3
Caesarean	1860	24.7	1838	24.5	2080	26.6	2301	29.6	2219	29.1	2193	29.3	2273	31.6	2390	33.1

Data for mode of birth in 2001 are not available

APPENDIX 3 MATERNAL DEMOGRAPHY

Table 93: Domicile of women giving birth at National Women's (2002-2006)

	2002 n=7775		2003 n=7611		2004 n=7491		2005 n=7194		2006 n=7212	
	n	%	n	%	n	%	n	%	n	%
Auckland Central	5085	65.4	5007	65.8	5055	67.5	4985	69.3	5100	70.7
Auckland Waitemata	1180	15.2	1138	15	1068	14.3	982	13.7	994	13.8
Auckland South	1408	18.1	1368	18	1240	16.6	1089	15.1	994	13.8
North of Auckland	29	0.4	38	0.5	37	0.5	31	0.4	40	0.6
North Island Other	68	0.9	42	0.6	72	1.0	93	1.3	69	1.0
South Island	5	0.1	13	0.2	12	0.2	9	0.1	13	0.2
Overseas			5	0.1	7	0.1	5	0.1	2	0.03

Table 94: Maternal age distribution (2000-2006)

		<21 yrs		21-25 yrs		26-30 yrs		31-35 yrs		36-40 yrs		>40 yrs	
	N	n	%	n	%	n	%	n	%	n	%	n	%
2000	7827	431	5.5	1091	13.9	2204	28.2	2670	34.1	1232	15.7	199	2.5
2002	7775	376	4.8	998	12.8	2018	26.0	2816	36.2	1335	17.2	232	3.0
2003	7611	372	4.9	959	12.6	1933	25.4	2738	36.0	1380	18.1	229	3.0
2004	7491	357	4.8	913	12.2	1809	24.1	2781	37.1	1384	18.5	247	3.3
2005	7194	330	4.6	828	11.5	1685	23.4	2702	37.6	1395	19.4	254	3.5
2006	7212	323	4.5	869	12.0	1735	24.1	2619	36.3	1421	19.7	245	3.4

Table 95: Maternal age and parity

	Total	<21 yrs		21-25 yrs		26-30 yrs		31-35 yrs		36-40 yrs		>40 yrs	
	N	n	%	n	%	n	%	n	%	n	%	n	%
Nullipara	3499	260	7.4	533	15.2	1011	28.9	1187	33.9	450	12.9	58	1.7
Multipara	3713	63	1.7	336	9.1	724	19.5	1432	38.6	971	26.2	187	5.0

Table 96: Time trends in nulliparity and multiparity (Data for 2001-2003 not available)

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2004	2005	2006
Number of births	8315	8690	8812	9125	9157	8055	7492*	7501	7827	7491	7194	7212
Nullipara	3700	3649	3814	4037	4018	3591	3263	3262	3455	3597	3522	3499
%	44.5	42.0	43.3	44.2	43.9	44.6	43.6	43.5	44.1	48.0	49.0	48.5
Multipara	4615	5041	4998	5088	5139	4464	4229	4239	4372	3894	3672	3713
%	55.5	58.0	56.7	55.8	56.1	55.4	56.4	56.5	55.9	52.0	51.0	51.5

*Does not include 39 BBA's

Table 97: Prioritised ethnicity of women giving birth at National Women's
(for information on assigning ethnicity and prioritising ethnicity, see Appendix 1

	2006 n=7212	
	n	%
NZ European	3034	42.1
Chinese	707	9.8
Maori	597	8.3
Indian	520	7.2
Other European	546	7.6
Samoan	384	5.3
Tongan	346	4.8
Other Asian	286	4.0
European NFD	136	1.9
Middle Eastern	121	1.7
Cook Island Maori	113	1.6
South East Asian	81	1.1
Niuean	81	1.1
African	74	1.0
Fijian	60	0.8
Asian NFD	41	0.6
Latin American/ Hispanic	45	0.6
Other Pacific Island	31	0.4
Tokelauan	3	0.04
Pacific Island NFD	3	0.04
Other	3	0.04

Table 98: Maternal ethnicity and age

	Total	NZ European		Maori		Pacific		Asian		Indian		Other European		Other	
	N	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Total	7212	3034	42.1	597	8.3	1021	14.2	1115	15.5	520	7.2	682	9.5	243	3.4
<21	323	78	24.1	109	33.7	92	28.5	16	5.0	15	4.6	7	2.2	6	1.9
21-25	869	158	18.1	144	16.6	264	30.4	138	15.9	75	8.6	41	4.8	49	5.6
26-30	1735	582	33.5	135	7.8	280	16.1	310	17.9	214	12.3	138	8.0	76	4.4
31-35	2619	1346	51.4	130	5.0	220	8.4	400	15.3	164	6.3	298	11.4	61	2.3
36-40	1421	748	52.6	68	4.8	136	9.6	208	14.6	46	3.2	176	12.4	39	2.7
41+	245	122	49.8	11	4.5	29	11.8	43	17.6	6	2.4	22	9.0	12	4.9

Table 99: Ethnicity of women birthing at NW

	2000 n=7827		2002 n=7775		2003 n=7611		2004 n=7491		2005 n=7194		2006 n=7212	
	n	%	n	%	n	%	n	%	n	%	n	%
NZ European	3988	51.0	3362	43.2	3224	42.4	2911	38.9	2802	39.0	3034	42.1
Other European	*		642	8.3	608	8.0	548	7.3	674	9.4	682	9.5
Maori	629	8.0	547	7.0	486	6.4	509	6.8	545	7.6	597	8.3
Niuean	138	1.8	108	1.4	108	1.4	106	1.4	111	1.5	81	1.1
Cook Islander	176	2.2	160	2.1	159	2.1	140	1.9	106	1.5	113	1.6
Samoan	546	7.0	531	6.8	439	5.8	425	5.7	339	4.7	384	5.3
Tongan	498	6.4	432	5.6	406	5.3	355	4.7	315	4.4	346	4.8
Fijian	55	0.7	50	0.6	42	0.6	47	0.6	62	0.9	60	0.8
Other Pacific Islands	33	0.4	40	0.5	36	0.5	37	0.5	47	0.7	37	0.5
Chinese	763	9.7	780	10.0	811	10.7	871	11.6	769	10.7	707	9.8
Indian	347	4.4	467	6.0	548	7.2	540	7.2	545	7.6	520	7.2
Other Asian	386	4.9	422	5.4	438	5.8	404	5.4	354	4.9	408	5.7
Other	268	3.4	229	2.9	298	3.9	471	6.3	521	7.2	243	3.4
Not Stated			5	0.1	8	0.1	127	1.7	3		0	

* All women with ethnicity of Other European are included in the European ethnicity

Table 100: Maternal ethnicity and parity

		NZ European n=3034		Maori n=597		Pacific n=1021		Asian n=1115		Indian n=520		Other European n=682		Other n=243	
	N	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Nullipara	3499	1522	43.5	233	6.7	328	9.4	635	18.1	275	7.9	405	11.6	101	2.9
Multipara	3713	1511	40.7	364	9.8	693	18.7	480	12.9	245	6.6	277	7.5	142	3.8

3.1 Body mass index

Table 101: BMI and age categories

		<21 yrs n=323		21-25 yrs n=869		26-30 yrs n=1735		31-35 yrs n=2619		36-40 yrs n=1421		>40 yrs n=245	
	N	n	%	n	%	n	%	n	%	n	%	n	%
<19	304	10	3.1	43	4.9	88	5.1	113	4.3	44	3.1	6	2.4
19-25	3329	123	38.1	318	36.6	755	43.5	1315	50.2	690	48.6	128	52.2
26-35	1625	83	25.7	225	25.9	410	23.6	532	20.3	324	22.8	51	20.8
>35	402	18	5.6	74	8.5	91	5.2	114	4.4	82	5.8	23	9.4
Missing data	1552	89	27.6	209	24.1	391	22.5	545	20.8	281	19.8	37	15.1

Table 102: BMI and parity

	Total	<19		19-25		26-35		>35		Missing	
	N	n	%	n	%	n	%	n	%	n	%
Nullipara	3499	195	5.6	1804	51.6	678	19.4	121	3.5	701	20.0
Multipara	3713	109	2.9	1525	41.1	947	25.5	281	7.6	851	22.9

Table 103: Maternal ethnicity and BMI

	Total	NZ European n=3034		Maori n=597		Pacific n=1021		Asian n=1115		Indian n=520		Other European n=682		Other n=243	
	N	n	%	n	%	n	%	n	%	n	%	n	%	n	%
<19	304	102	3.4	8	1.3	5	0.5	122	10.9	28	5.4	29	4.3	10	4.1
19-25	3329	1632	53.8	154	25.8	145	14.2	614	55.1	275	52.9	401	58.8	108	44.4
26-35	1625	573	18.9	190	31.8	423	41.4	119	10.7	130	25.0	110	16.1	80	32.9
>35	402	76	2.5	58	9.7	231	22.6	5	0.4	11	2.1	13	1.9	8	3.3
Missing data	1552	651	21.4	187	31.3	217	21.3	255	22.9	76	14.6	129	18.9	37	15.2

3.2 Smoking

Table 104: Smoking status among NZ European women

		<21 yrs n=62		21-25 yrs n=120		26-30 yrs n=4479		31-35 yrs n=1053		36-40 yrs n=587		>40 yrs n=93	
	N	n	%	n	%	n	%	n	%	n	%	n	%
Not smoking	2239	40	64.5	100	83.3	418	93.5	1020	96.9	569	96.9	92	98.9
Stopped in Pregnancy	30	5	8.1	5	4.2	10	2.2	6	0.6	3	0.5	1	1.1
Currently smoking	93	17	27.4	15	12.5	19	4.3	27	2.6	15	2.6	0	

Table 105: Smoking status among Maori women

		<21 yrs n=78		21-25 yrs n=104		26-30 yrs n=91		31-35 yrs n=88		36-40 yrs n=49		>40 yrs n=5	
	N	n	%	n	%	n	%	n	%	n	%	n	%
Not smoking	267	35	44.9	59	56.7	65	71.4	70	79.6	34	69.4	4	80.0
Stopped in Pregnancy	15	3	3.8	6	5.8	1	1.1	4	4.6	1	2.0	0	
Currently smoking	133	40	51.3	39	37.5	25	27.5	14	15.9	14	28.6	1	20.0

Table 106: Smoking status among Pacific women

		<21 yrs n=69		21-25 yrs n=184		26-30 yrs n=200		31-35 yrs n=172		36-40 yrs n=103		>40 yrs n=18	
	N	n	%	n	%	n	%	n	%	n	%	n	%
Not smoking	593	46	66.7	140	76.1	157	78.5	146	84.9	89	86.4	15	83.3
Stopped in Pregnancy	44	5	7.3	11	6.0	18	9.0	5	2.9	4	3.9	1	5.6
Currently smoking	109	18	26.1	33	17.9	25	12.5	21	12.2	10	9.7	2	11.1

3.3 Lead Maternity Carer (LMC) and maternal demographic characteristics

Table 107: LMC at birth

	n=7212	
	n	%
Independent Midwife	2850	39.5
Private Obstetrician	1710	23.7
General Practitioner	152	2.1
NW Domino	429	5.9
NW Community	1379	19.1
NW Diabetic	230	3.2
NW Medical	319	4.4
Other DHB	93	1.3
Unbooked	50	0.7

Table 108: LMC at birth and maternal age

	Total	<21		21-25		26-30		31-35		36-40		41+	
	N	n	%	n	%	n	%	n	%	n	%	n	%
Total	7212	323	4.5	869	12.0	1735	24.1	2619	36.3	1421	19.7	245	3.4
Independent Midwife	2850	121	4.2	348	12.2	749	26.3	1129	39.6	445	15.6	58	2.0
Private Obstetrician	1710	5	0.3	30	1.8	251	14.7	756	44.2	563	32.9	105	6.1
General Practitioner	152	1	0.7	20	13.2	41	27.0	70	46.1	19	12.5	1	0.7
NW Domino	429	40	9.3	70	16.3	138	32.2	116	27.0	58	13.5	7	1.6
NW Community	1379	108	7.8	298	21.6	413	29.9	333	24.1	194	14.1	33	2.4
NW Diabetes	230	2	0.9	19	8.3	50	21.7	81	35.2	56	24.3	22	9.6
NW Medical	319	21	6.6	49	15.4	65	20.4	97	30.4	70	21.9	17	5.3
Other DHB	93	13	14.0	22	23.7	18	19.4	26	28.0	12	12.9	2	2.2
Unbooked	50	12	24.0	13	26.0	10	20.0	11	22.0	4	8.0	0	0.0

Table 109: LMC at birth and maternal ethnicity

	Total	NZ European		Maori		Pacific		Asian		Indian		Other European		Other	
	N	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Total	7212	3034	42.1	597	8.3	1021	14.2	1115	15.5	520	7.2	6823	9.5	243	3.4
Independent Midwife	2850	1246	43.7	221	7.8	322	11.3	614	21.5	124	4.4	273	9.6	50	1.8
Private Obstetrician	1710	1183	69.2	35	2.0	11	0.6	146	8.5	71	4.2	243	14.2	21	1.2
General Practitioner	152	65	42.8	6	3.9	18	11.8	35	23.0	8	5.3	15	9.9	5	3.3
NW Domino	429	119	27.7	49	11.4	99	23.1	44	10.3	48	11.2	38	8.9	32	7.5
NW Community	1379	192	13.9	173	12.5	415	30.1	212	15.4	210	15.2	65	4.7	112	8.1
NW Diabetes	230	44	19.1	20	8.7	73	31.7	36	15.7	37	16.1	13	5.7	7	3.0
NW Medical	319	142	44.5	43	13.5	50	15.7	21	6.6	20	6.3	27	8.5	16	5.0
Other DHB	93	35	37.6	32	34.4	12	12.9	5	5.4	2	2.2	7	7.5	0	
Unbooked	50	8	16	18	36.0	21	42.0	2	4.0	0		1	2.0	0	

Table 110: LMC at birth and parity

	Total	Nullipara		Multipara	
	N	n	%	n	%
Total	7212	3499	48.5	3713	51.5
Independent Midwife	2850	1468	51.5	1382	48.5
Private Obstetrician	1710	863	50.5	847	49.5
General Practitioner	152	74	48.7	78	51.3
NW Domino	429	219	51.0	210	49.0
NW Community	1379	603	43.7	776	56.3
NW Diabetes	230	74	32.2	156	67.8
NW Medical	319	114	35.7	205	64.3
Other DHB	93	66	71.0	27	29.0
Unbooked	50	18	36.0	32	64.0

3.4 Standard primipara

Table 111: Demographic characteristics of standard and non-standard primipara

	Total	Standard primipara		Non-standard primipara	
	N	n	%	n	%
Total	**3499**	**1194**	**16.6**	**2305**	**65.9**
Age					
< 21	260	32	12.3	228	87.7
21-25	533	248	46.5	285	53.5
26-30	1011	498	49.3	513	50.7
31-35	1187	416	35.1	771	65.0
36-40	450	0		450	100
41+	58	0		58	100
Ethnicity					
NZ European	1522	436	28.6	1086	71.4
Maori	233	61	26.2	172	73.8
Pacific	328	113	34.5	215	65.6
Asian	635	290	45.7	345	54.3
Indian	275	115	41.8	160	58.2
Other European	405	138	34.1	267	65.9
Other	101	41	40.6	60	59.4
LMC at Birth					
Independent Midwife	1468	581	39.6	887	60.4
Private Obstetrician	863	261	30.2	602	69.8
General Practitioner	74	39	52.7	35	47.3
NW Domino	219	78	35.6	141	64.4
NW Community	603	215	35.7	388	64.3
NW Diabetic	74	0		74	100
NW - Medical	114	15	13.2	99	86.8
Other DHB	66	1	1.5	65	98.5
Unbooked	18	4	22.2	14	77.8
Smoking					
Currently smoking	128	18	14.1	110	85.9
Stopped in pregnancy	65	19	29.2	46	70.8
Not currently smoking	2519	921	36.6	1598	63.4
Missing	787	236	30.0	551	70.0

APPENDIX 4 ANTENATAL COMPLICATIONS

4.1 Preterm birth

Table 112: Preterm birth rate and maternal demographic characteristics

	Total	Total preterm birth		Iatrogenic preterm		Spontaneous preterm	
	N	n	%	n	%	n	%
Age							
≤20	323	51	15.8	13	4.0	38	11.8
21-25	869	82	9.4	36	4.1	46	5.3
26-30	1735	156	9.0	89	5.1	67	3.9
31-35	2619	257	9.8	136	5.2	121	4.6
36-40	1421	135	9.5	87	6.1	48	3.4
41+	245	35	14.3	20	8.2	15	6.1
Ethnicity							
NZ European	3034	303	10.0	173	5.7	130	4.3
Maori	597	95	15.9	43	7.2	52	8.7
Pacific	1021	95	9.3	44	4.3	51	5.0
Asian	1115	87	7.8	43	3.9	44	3.9
Indian	520	49	9.4	24	4.6	25	4.8
Other European	682	68	10.0	39	5.7	29	4.3
Other	243	19	7.8	15	6.2	4	1.6
Parity							
Nulliparous	3499	371	10.6	201	5.7	170	4.9
Multiparous	3713	345	9.3	180	4.8	165	4.4
Plurality							
Singleton	7050	601	8.5	308	4.4	293	4.2
Twins	157	110	70.1	69	43.9	41	26.1
Triplets	5	5	100	4	80.0	1	20.0
Smoking							
Currently smoking	358	50	14.0	22	6.1	28	7.8
Stopped in Pregnancy	111	12	10.8	7	6.3	5	4.5
Not currently smoking	5005	377	7.5	186	3.7	191	3.8
Unknown	1738	277	15.9	166	9.6	111	6.4
BMI							
<19	304	24	7.9	11	3.6	13	4.3
19-25	3329	27.7	8.3	145	4.4	132	4.0
26-35	1625	139	8.6	88	5.4	51	3.1
>35	402	40	10.0	26	6.5	14	3.5
Missing	1552	236	15.2	111	7.2	125	8.1

4.2 Small for Gestational Age Babies

Table 113: Demography of mothers of SGA babies as defined by Customised Birth Centiles (this table includes mothers of twins twice)

	Total Babies	Customised SGA <10th%		Customised Birthweight ≥ 10th%		RR(95% CI)
	N	n	%	n	%	
Total	7379	889	12.0	6490	88.0	
Maternal Age						
≤ 20	326	47	14.4	279	85.6	1.3 (0.96-1.74)
21-25	888	127	14.3	761	85.7	1.29 (1.04-1.58)
26-30	1763	196	11.1	1567	88.9	ref
31-35	2679	294	11.0	2385	89.0	0.99 (0.83-1.17)
36-40	1474	194	13.2	1280	86.8	1.19 (0.98-1.43)
>40	249	31	12.4	218	87.6	1.12 (0.79-1.60)
Ethnicity						
NZ European	3124	336	10.8	2788	89.2	ref
Maori	612	107	17.5	505	82.5	1.63 (1.33-1.98)
Pacific	1037	142	13.7	895	86.3	1.27 (1.06-1.53)
Chinese	719	86	12.0	633	88.0	1.11 (0.89-1.39)
Other Asian	410	71	17.3	339	82.7	1.61 (1.27-2.03)
Indian	525	56	10.7	469	89.3	0.99 (0.76- 1.30)
Other European	707	68	9.6	639	90.4	0.89 (0.7-1.14)
Other	245	23	9.4	222	90.6	0.87 (0.58-1.30)
Parity						
Multipara	3791	409	10.8	3382	89.2	ref
Primipara	3588	480	13.4	3108	86.6	1.24 (1.10-1.40)
Smoker						
Currently smoking	364	79	21.7	285	78.3	2.14 (1.73-2.65)
Stopped in pregnancy	113	21	18.6	92	81.4	1.83 (1.24-2.72)
Not currently smoking	5090	516	10.1	4574	89.6	ref
Unknown	1812	273	15.1	1539	84.9	1.49 (1.30-1.70)
BMI						
<19	306	40	13.1	266	86.9	1.30 (0.96-1.76)
19-25	3395	342	10.1	3053	89.9	ref
26-35	1670	217	13.0	1453	87.0	1.29 (1.10-1.51)
>35	409	55	13.5	354	86.6	1.33 (1.02-1.74)
Missing data	1599	235	14.7	1364	85.3	1.46 (1.25-1.70)
Plurality Singleton	7050	785	11.1	6265	88.9	ref
Twins	314	102	32.5	212	67.5	2.92 (2.45-3.47)
Triplets	15	2	13.3	13	86.7	not calculated

4.3 Diabetes

Table 114: Women with diabetes attending diabetes clinic and delivering ≥ 20 weeks gestation

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Type I	23	29	19	12	19	15	14	21	26	22	26	21	20	25	31	33
Type 2	26	19	21	26	32	35	22	23	28	32	37	49	40	47	52	57
GDM	125	140	197	160	221	245	247	221	181	186	161	251	352	343	304	286
Total	174	188	237	198	272	295	283	265	235	240	224	321	412	415	387	376

Table 115: Perinatal deaths (1993 – 2006) among babies of women with diabetes

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Total number of perinatal related losses	3	1	3	6	3	6	1	2	2	3	6	0	2	8
Perinatal related loss rate /1000 births	13	5	11	20	11	21	4	8	9	9	9	0	5	21

Table 116: Maternal outcomes among women with diabetes

	Type I n=33		Type 2 n=57		GDM n=277		Postnatally Diagnosed Type 2 n=9		No diabetes n=6836	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Induction of labour	16	48.5	36	63.2	141	50.9	6	66.7	1578	23.1
Mode of birth										
SVB	14	42.4	25	43.9	132	47.7	5	55.6	3690	54.0
Ventouse	1	3.0	1	1.8	21	7.6	0		616	9.0
Forceps	0		2	3.5	15	5.4	0		300	4.4
CS emergency	13	39.4	20	35.1	66	23.8	2	22.2	1365	20.0
CS elective	5	15.2	9	15.8	43	15.5	2	22.2	865	12.7
Gestation at birth										
<32 weeks	8	24.2	3	5.3	4	1.4	0		197	2.9
<37 weeks	16	48.5	10	17.5	42	15.2	1	11.1	647	9.5
PPH ≥500 mls	17	51.5	32	56.1	111	40.1	7	77.8	2345	34.3
PPH ≥1000 mls	5	15.2	5	8.8	15	5.4	1	11.1	528	7.7
Postpartum transfusion	0		0		4	1.4	1	11.1	165	2.4

Table 117: Demographic characteristics of women with diabetes

	Type I n=32		Type 2 n=57		GDM n=286		No diabetes n=6837	
	n	%	n	%	n	%	n	%
Age								
≤ 20	0	0	0	0	3	1.0	320	4.7
21-25	5	15.2	3	5.3	20	7.0	841	12.3
26-30	11	33.3	10	17.5	62	21.7	1652	24.2
31-35	10	30.3	13	22.8	113	39.5	2483	36.3
36-40	6	18.2	23	40.4	69	24.1	1323	19.4
41+	1	3.0	8	14.0	19	6.6	217	3.2
Ethnicity								
NZ European	22	66.7	4	7.0	59	20.6	2949	43.1
Maori	3	9.1	8	14.0	16	5.6	570	8.3
Pacific	2	6.1	29	50.9	58	20.3	932	13.6
Asian	1	3.0	4	7.0	70	24.5	1040	15.2
Indian	0		7	12.3	57	19.9	456	6.7
Other European	5	15.2	3	5.3	17	5.9	657	9.6
Other	0		2	3.5	9	3.1	232	3.4
BMI								
<19	0		0		6	2.1	298	4.4
19-25	14	42.4	7	12.3	82	28.7	3226	47.2
26-35	14	42.4	21	36.8	111	38.8	1479	21.6
>35	0		23	40.4	59	20.6	320	4.7
Missing	5	15.2	6	10.5	28	9.8	1513	22.1
Smoking								
Not smoking	17	51.5	24	42.1	176	61.5	4794	70.1
Currently smoking	4	12.1	7	12.3	20	7.0	327	4.8
Stopped in Pregnancy	1	3.0	3	5.3	8	2.8	99	1.4
Missing	11	33.3	23	40.4	82	28.7	1616	23.6
Body weight at booking (kg)								
Median (IQR)	72.5 (67.5-78.5)		92.8(79-111.6)		80.6 (68-102.4)			

4.4 Antepartum haemorrhage

Table 118: Characteristics of pregnancies complicated by antepartum haemorrhage

	Placenta praevia n=68		Placental abruption n=44		APH unknown origin n=299		No APH n=6801	
	n	%	n	%	n	%	n	%
Maternal age								
≤20	1	1.5	3	6.8	17	5.7	302	4.4
21-25	3	4.4	8	18.2	43	14.4	815	12.0
26-30	12	17.6	8	18.2	73	24.4	1642	24.1
31-35	26	38.2	18	40.9	105	35.1	2470	36.3
36-40	24	35.3	6	13.6	48	16.1	1343	19.7
41+	2	2.9	1	2.3	13	4.3	229	3.4
Parity								
Nulliparous	37	54.4	18	40.9	146	48.8	3298	48.5
Multiparous	31	45.6	26	59.1	153	51.2	3503	51.5
Previous CS	14	20.6	15	34.1	45	15.1	1035	15.2
Smoker								
Current	3	4.4	5	11.4	32	10.7	318	4.7
Stopped in pregnancy	0	0.0	0	0.0	11	3.7	100	1.5
Not currently smoking	36	52.9	23	52.3	177	59.2	4769	70.1
Unknown	29	42.6	16	36.4	79	26.4	1614	23.7
Hypertensive disease								
Gestational hypertension	2	2.9	0		15	5.0	305	4.5
Preeclampsia	1	1.5	5	11.4	13	4.3	226	3.3
Chronic hypertension	0		2	4.5	8	2.7	153	2.2

Table 119: Maternal outcomes of pregnancies complicated by antepartum haemorrhage

	Placenta praevia n=68		Placental abruption n=44		APH unknown origin n=299		No APH n=6801	
	n	%	n	%	n	%	n	%
Mode of birth								
Normal vaginal	4	5.9	8	18.2	176	58.9	3678	54.1
Operative vaginal	3	4.4	0	0.0	34	11.4	919	13.5
CS elective	37	54.4	4	9.1	21	7.0	862	12.7
CS emergency	27	39.7	29	65.9	68	22.7	1342	19.7
Maternal transfusion	19	27.9	5	11.4	13	4.3	133	2.0

Table 120: Fetal/neonatal outcomes of pregnancies complicated by antepartum haemorrhage (n=babies)

	Placenta praevia n=69		Placental abruption n=44		APH unknown origin n=313		No APH n=6953	
	n	%	n	%	n	%	n	%
Gestation at birth								
<37 weeks	24	34.8	24	54.5	99	31.6	569	8.2
<32 weeks	5	7.2	13	29.5	51	16.3	143	2.1
Birthweight								
Mean (sd)	2895 (696)		2466 (1021)		2757 (1023)		3343 (656)	
<2500g	16	23.2	20	45.5	99	31.6	552	7.9
<1500g	3	4.3	10	22.7	43	13.7	154	2.2
Small for gestational age	12	17.4	10	22.7	53	16.9	814	11.7
Perinatal deaths	2	2.9	3	6.8	24	7.7	70	1.0
Admission to NICU	20	29.0	19	43.2	82	26.2	650	9.4
≥2 days in NICU	20	29.0	18	40.9	78	24.9	591	8.5

4.5 Hypertensive disease

Table 121: Demographic characteristics of women with hypertensive disease

		Gestational hypertension		Preeclampsia		Chronic hypertension		Normotensive	
	Total	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Ethnicity									
NZ European	3034	158	5.2	101	3.3	87	2.9	2688	88.6
Maori	597	23	3.9	24	4.0	17	2.9	533	89.3
Pacific	1021	41	4.0	49	4.8	17	1.7	914	89.5
Asian	1115	26	2.3	28	2.5	13	1.2	1048	94.0
Indian	520	30	5.8	18	3.5	8	1.5	464	89.2
Other European	682	38	5.6	19	2.8	18	2.6	607	89.0
Other	243	6	2.5	6	2.5	3	1.2	228	93.8
Maternal age (nullipara)									
≤20	260	9	3.5	17	6.5	0	0	234	90.0
21-25	533	25	4.7	23	4.3	5	0.9	480	90.1
26-30	1011	60	5.9	42	4.2	9	0.9	900	89.0
31-35	1187	74	6.2	52	4.4	28	2.4	1033	87.0
36-40	450	43	9.6	28	6.2	12	2.7	367	81.6
41+	59	1	1.7	5	8.5	4	6.8	49	83.1
Maternal age (multiparous)									
≤20	63	2	3.2	2	3.2	0	0	59	93.7
21-25	336	6	1.8	5	1.5	2	0.6	323	96.1
26-30	724	19	2.6	18	2.5	12	1.7	675	93.2
31-35	1432	41	2.9	28	2.0	40	2.8	1323	92.4
36-40	971	36	3.7	21	2.2	40	4.1	874	90.0
41+	186	6	3.2	4	2.2	11	5.9	165	88.7
Smoker									
Currently smoking	358	12	3.4	11	3.1	10	2.8	325	90.8
Stopped in pregnancy	111	7	6.3	5	4.5	1	0.9	98	88.3
Not currently smoking	5005	215	4.3	161	3.2	114	2.3	4515	90.2
Unknown	1738	88	5.1	68	3.9	38	2.2	1544	88.8
BMI									
<19	304	6	2.0	6	2.0	5	1.6	287	94.4
19-25	3329	127	3.8	87	2.6	62	1.9	3053	91.7
26-35	1625	101	6.2	70	4.3	52	3.2	1402	86.3
>35	4.2	33	8.2	24	6.0	18	4.5	327	81.3
Unknown	1552	55	3.5	58	3.7	26	1.7	1413	91.0

Table 122: Onset of birth among women with hypertensive disease

	Gestational hypertension n=322		Preeclampsia n=245		Chronic hypertension n=163		Normotensive n=6482	
	n	%	n	%	n	%	n	%
Spontaneous onset of labour	112	34.8	44	18.0	46	28.2	4054	62.5
Induced labour	156	48.5	117	47.8	74	45.4	1429	22.0
CS emergency before onset of labour	30	9.3	32	13.1	27	16.6	828	12.8
CS elective	24	7.5	52	21.2	16	9.8	171	2.6

APPENDIX 5 LABOUR AND BIRTH

5.1 Induction of labour

Table 123: Induction of labour rates (1992-2006) No data available on induction rates for 2001-2003

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2004	2005	2006
Total Births	8315	8690	8812	9125	9157	8055	7531*	7501	7827	7491	7194	7212
Women Induced	1734	2049	2033	2366	2225	2135	2053	1910	2106	1922	1894	1776
Incidence (%)	**20.9**	**23.6**	**23.1**	**25.9**	**24.3**	**26.5**	**27.4**	**27.2**	**26.9**	**25.7**	**26.3**	**24.6**
Total Nullipara	3700	3649	3814	4037	4018	3591	3263	3262	3455	3597	3522	3499
Nullipara Induced	914	931	1046	1191	1112	1104	992	923	1049	1064	1042	940
Incidence (%)	**24.7**	**25.5**	**27.4**	**29.5**	**27.7**	**30.7**	**30.4**	**28.3**	**30.4**	**29.6**	**29.5**	**26.9**
Total Multipara	4615	5041	4998	5088	5139	4464	4229	4239	4372	3894	3672	3713
Multipara Induced	820	1118	987	1175	1113	1031	1061	987	1057	858	852	836
Incidence (%)	**17.8**	**22.2**	**19.7**	**28.7**	**21.7**	**23.1**	**25.1**	**23.3**	**24.2**	**22.0**	**23.2**	**22.5**

*Does not include 39 BBA's

Table 124: Indication for induction (all births)

	Preterm n= 716		Term n=6496	
	n	**%**	**n**	**%**
Total	162	22.6	1614	24.8
Post dates	0		429	6.6
Hypertension	17	2.4	185	2.9
Term PROM	10	1.4	156	2.4
Diabetes	8	1.1	148	2.3
Maternal request	1	0.1	46	0.7
SGA	8	1.1	120	1.8
Maternal medical complications	8	1.1	109	1.7
Decreased liquor	3	0.4	79	1.2
PPROM	34	4.7	24	0.4
IUD/Fetal anomaly	50	7.0	17	0.3
Fetal distress	2	0.3	34	0.5
Not in established labour	8	1.1	82	1.3
Poor obstetric history	0		28	0.4
Large for gestational age	0		14	0.2
Maternal age	1	0.1	91	1.4
Other	12	1.7	52	0.8

Table 125: Rates of indication for induction by parity (term births)

	Multipara n=3368		Nullipara n=3128	
	n	%	n	%
Total	758	22.5	856	27.4
Post dates	160	4.8	269	8.6
Diabetes	92	2.7	56	1.8
Hypertension	60	1.8	125	4.0
Maternal age	67	2.0	24	0.8
Maternal medical complications	57	1.7	52	1.7
Term PROM	57	1.7	99	3.2
SGA	47	1.4	73	2.3
Not in established labour	46	1.4	36	1.2
Maternal request	35	1.0	11	0.4
Decreased liquor volume	33	1.0	46	1.5
Poor obstetric history	25	0.7	3	0.1
Fetal Distress	16	0.5	18	0.6
IUD/Fetal anomaly	11	0.3	6	0.2
PPROM	7	0.2	17	0.5
Pelvic arthropathy	7	0.2	3	0.1
Large for gestational age	6	0.2	8	0.3
Multiple pregnancy	4	0.1	1	
Other	28	0.8	9	0.3

Table 126: Rates of indication for induction by age among nulliparous women (all gestations)

	≤25 n=793		26-30 n=1011		31-35 n=1187		>35 n=508	
	n	%	n	%	n	%	n	%
Total	180	22.7	271	26.8	330	27.8	159	31.3
Post dates	51	6.4	70	6.9	109	9.2	39	7.7
Hypertension	29	3.7	40	4.0	44	3.7	20	3.9
Term PROM	17	2.1	38	3.8	41	3.5	9	1.8
SGA	19	2.4	21	2.1	24	2.0	14	2.8
Diabetes	7	0.9	20	2.0	19	1.6	12	2.4
Maternal medical complication	9	1.1	16	1.6	20	1.7	10	2.0
Other	48	6.1	66	6.5	73	6.2	55	10.8

Table 127: Rates of indication for induction by age among multiparous women (all gestations)

	≤25 n=399		26-30 n=724		31-35 n=1432		>35 n=1158	
	n	%	n	%	n	%	n	%
Total	62	15.5	153	21.1	317	22.1	304	26.3
Post dates	15	3.8	28	3.9	61	4.3	56	4.8
Hypertension	7	1.8	17	2.3	25	1.7	20	1.7
Term PROM	5	1.3	15	2.1	28	2.0	13	1.1
SGA	0		10	1.4	25	1.7	15	1.3
Diabetes	9	2.3	14	1.9	42	2.9	33	2.8
Maternal medical complication	6	1.5	12	1.7	27	1.9	17	1.5
Other	20	5.0	57	7.9	109	7.6	150	13.0

Table 128: Induction rate by indication and ethnicity among nulliparous women (all gestations)

	NZ European n=1522		Maori n=233		Pacific n=328		Asian n=635		Indian n=275		Other European n=405		Other n=101	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Total	445	29.2	57	24.5	91	27.7	135	21.3	82	29.8	109	26.9	21	20.8
Post dates	150	9.9	15	6.4	25	7.6	33	5.2	13	4.7	29	7.2	4	4.0
Hypertension	69	4.5	9	3.9	17	5.2	11	1.7	11	4.0	14	3.5	2	2.0
Term PROM	42	2.8	6	2.6	8	2.4	22	3.5	14	5.1	8	2.0	5	5.0
SGA	37	2.4	4	1.7	9	2.7	13	2.0	7	2.5	7	1.7	1	1.0
Diabetes	15	1.0	2	0.9	9	2.7	12	1.9	12	4.4	7	1.7	1	1.0
Maternal medical complications	26	1.7	4	1.7	2	0.6	5	0.8	6	2.2	12	3.0	0	
Other	106	7.0	17	7.3	21	6.4	39	6.1	19	6.9	32	7.9	8	7.9

Table 129: Induction rate by indication and ethnicity among multiparous women (all gestations)

	NZ European n=1512		Maori n=364		Pacific n=693		Asian n=480		Indian n=245		Other European n=277		Other n=142	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Total	378	25.0	87	23.9	162	23.4	70	14.6	47	19.2	68	24.5	24	16.9
Post dates	83	5.5	10	2.7	29	4.2	11	2.3	6	2.4	14	5.1	7	4.9
Hypertension	29	1.9	10	2.7	17	2.5	4	0.8	3	1.2	6	2.2	0	
Term PROM	21	1.4	10	2.7	13	1.9	6	1.3	3	1.2	6	2.2	2	1.4
SGA	25	1.7	9	2.5	5	0.7	6	1.3	3	1.2	2	0.7	0	
Diabetes	18	1.2	6	1.6	41	5.9	14	2.9	12	4.9	4	1.4	3	2.1
Maternal medical complications	34	2.2	9	2.5	4	0.6	3	0.6	4	1.6	6	2.2	2	1.4
Other	168	11.1	33	9.1	53	7.6	26	5.4	16	6.5	30	10.8	10	7.0

5.2 Outcomes following induction

Table 130: Mode of birth at term by onset of birth and parity

	Nullipara				Multipara			
	Spontaneous labour n=1955		Induced labour n=856		Spontaneous labour n=1966		Induced labour n=758	
	n	%	n	%	n	%	n	%
Mode of birth								
SVB	1045	53.5	316	36.9	1587	80.7	587	77.4
Forceps	157	8.0	67	7.8	37	1.9	22	2.9
Ventouse	325	16.6	149	17.4	103	5.2	45	5.9
CS emergency	428	21.9	319	37.3	239	12.2	102	13.5
CS elective	0		5	0.6	0		0	
Epidural	1283	65.6	733	85.6	721	36.7	455	60.0

Table 131: Mode of birth at term among nulliparous women by most common indications for induction

	Post dates n=269		Diabetes n=58		SGA n=78		Maternal request n=55		Term PROM n=105		Hypertension n=133		Other n= 242	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Mode of birth														
SVB	102	37.9	11	19.0	37	47.4	21	38.2	44	41.9	43	32.3	113	46.7
Operative vaginal	61	22.7	15	25.9	18	23.1	19	34.5	33	31.4	30	22.6	49	20.2
CS elective	2	0.7	0		1	1.3	0		0		0		2	0.8
CS emergency	104	38.7	32	55.2	22	28.2	15	27.3	28	26.7	60	45.1	78	32.2
Epidural	243	90.3	51	87.9	60	76.9	45	81.8	90	85.7	111	83.5	177	73.1

Table 132: Mode of birth at term among multiparous women by most common indications for induction

	Post dates n=160		Diabetes n=98		SGA n=50		Maternal request n=62		Term PROM n=61		Hypertension n=69		Other n= 336	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Mode of birth														
SVB	121	75.6	73	74.5	39	78.0	48	77.4	48	78.7	53	76.8	274	81.5
Operative vaginal	16	10.0	7	7.1	5	10.0	10	16.1	7	11.5	4	5.8	23	6.8
CS elective	0		0		0		0		0		0		2	0.6
CS emergency	23	14.4	18	18.4	6	12.0	4	6.5	6	9.8	12	17.4	37	11.0
Epidural	87	54.4	54	55.1	26	52.0	32	51.6	40	65.6	42	60.9	211	62.8

Table 133: Gestation at birth among women whose primary indication for induction was 'post dates'

Gestation at birth	Induction for post dates n=429		Induction for post dates and age <35 n=307		Induction for post dates and age ≥35 n=122	
	n	%	n	%	n	%
38 – 38^{6}	2	0.5	1	0.3	1	0.8
39 – 39^{6}	4	0.9	3	1.0	1	0.8
40 – 40^{6}	83	19.4	51	16.6	32	26.2
41 – 41^{6}	260	60.6	193	62.9	67	54.9
42 – 42^{6}	78	18.2	58	18.9	20	16.4
43 – 43^{6}	2	0.5	1	0.3	1	0.8

5.3 Use of Syntocinon

Table 134: Dilatation at start of syntocinon by onset of birth

	Induced n=1195		Spontaneous onset n=1325	
	n	%	n	%
0	61	5.1	25	1.9
1	162	13.6	68	5.1
2	375	31.4	148	11.2
3	297	24.9	246	18.6
4	83	6.9	212	16.0
5	40	3.3	135	10.2
6	17	1.4	83	6.3
7	18	1.5	60	4.5
8	13	1.1	50	3.8
9	13	1.1	54	4.1
10	32	2.7	106	8.0
Missing	84	7.0	138	10.4

5.4 Mode of birth

Table 135: Mode of birth by parity and previous caesarean section status

	Nullipara preterm n=371		Nullipara term n=3128		Multipara no prev CS preterm n=226		Multipara no prev CS term n=2378		Multipara prev CS preterm n=119		Multipara prev CS term n=990	
	n	%	n	%	n	%	n	%	n	%	n	%
Spontaneous vertex	125	33.7	1359	43.4	137	60.6	1975	83.1	26	21.8	193	19.5
Vaginal breech	23	6.2	2	0.1	18	8.0	6	0.3	2	1.7	0	
Operative vaginal birth												
Ventouse	14	3.8	474	15.2	2	0.9	100	4.2	1	0.8	48	4.8
Forceps	25	6.7	224	7.2	4	1.8	41	1.7	5	4.2	18	1.8
Caesarean section												
Emergency	148	39.9	809	25.9	55	24.3	174	7.3	54	45.4	226	22.8
Elective	36	9.7	260	8.3	10	4.4	82	3.5	31	26.1	505	51.0

Table 136: Mode of birth by ethnicity

	NZ European n=3034		Maori n=597		Pacific n=1021		Asian n=1115		Indian n=520		Other European n=682		Other n=243	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Spontaneous vertex	1425	47.0	396	66.3	718	70.3	569	51.0	257	49.4	315	46.2	135	55.6
Vaginal breech	20	0.7	10	1.7	7	0.7	3	0.3	4	0.8	5	0.7	2	0.8
Forceps	168	5.5	15	2.5	10	1.0	51	4.6	30	5.8	38	5.6	5	2.1
Ventouse	294	9.7	23	3.9	30	2.9	135	12.1	58	11.2	81	11.9	18	7.4
CS elective	513	16.9	49	8.2	75	7.3	105	9.4	49	9.4	107	15.7	26	10.7
CS emergency	614	20.2	104	17.4	181	17.7	252	22.6	122	23.5	136	19.9	57	23.5

Table 137: Mode of birth by maternal age

	≤20 n=323		21-25 n=869		26-30 n=1735		31-35 n=2619		36-40 n=1421		41+ n=245	
	n	%	n	%	n	%	n	%	n	%	n	%
Spontaneous vertex	232	71.8	593	68.2	972	56.0	1316	50.2	609	42.9	93	38.0
Vaginal breech	7	2.2	9	1.0	11	0.6	14	0.5	8	0.6	2	0.8
Forceps	9	2.8	27	3.1	81	4.7	141	5.4	50	3.5	9	3.7
Ventouse	23	7.1	71	8.2	187	10.8	231	8.8	110	7.7	17	6.9
CS elective	4	1.2	31	3.6	135	7.8	360	13.7	324	22.8	70	28.6
CS emergency	48	14.9	138	15.9	349	20.1	557	21.3	320	22.5	54	22.0

Table 138: Mode of birth by BMI

	<19 n=304		19-25 n=3329		26-35 n=1625		>35 n=402		Missing n=1552	
	n	%	n	%	n	%	n	%	n	%
Spontaneous vertex	172	56.6	1684	50.6	878	54.0	239	59.5	842	54.3
Vaginal breech	1	0.3	21	0.6	13	0.8	2	0.5	14	0.9
Forceps	11	3.6	169	5.1	56	3.4	5	1.2	76	4.9
Ventouse	41	13.5	380	11.4	97	6.0	7	1.7	114	7.3
CS elective	28	9.2	458	13.8	223	13.7	49	12.2	166	10.7
CS emergency	51	16.8	617	18.5	358	22.0	100	24.9	340	21.9

Table 139: Mode of birth by LMC at time of birth-primipara

	Total	Spontaneous vertex		Vaginal breech		Operative vaginal		CS elective		CS emergency	
	n	n	%	n	%	n	%	n	%	n	%
Total	3499	1484	42.3	25	0.7	737	21.1	296	8.5	957	27.4
IMW	1468	694	47.3	7	0.5	318	21.7	48	3.3	401	27.3
Pvt Obstetrician	863	232	26.9	1	0.1	197	22.8	189	21.9	244	28.3
GP	74	28	37.8	0		23	31.1	2	2.7	21	28.4
NW Domino	219	107	48.9	2	0.9	44	20.0	8	3.7	58	26.5
NW Community	603	332	55.1	5	0.8	115	19.1	26	4.3	125	20.7
NW Diabetes	74	20	27.0	4	5.4	13	17.6	6	8.1	31	41.9
NW Medical	114	41	36.0	3	2.6	18	15.8	15	13.2	37	32.5
Other DHB	66	18	27.3	3	4.5	7	10.6	2	3.0	36	54.5
Unbooked	18	12	66.7	0		2	11.1	0		4	22.2

Table 140: Mode of birth by LMC at time of birth – standard primipara (Definition of standard primipara is given in Chapter 1)

	Total	Spontaneous vertex		Operative vaginal		CS elective		CS emergency	
	n	n	%	n	%	n	%	n	%
Total	1194	639	53.5	293	24.5	40	3.4	222	18.6
IMW	581	348	59.9	125	21.5	5	0.9	103	17.7
Pvt Obstetrician	261	86	33.0	80	30.7	31	11.9	64	24.5
GP	39	19	48.7	13	33.3	0		7	17.9
NW Domino	78	43	55.1	18	23.1	0		17	21.8
NW Community	215	136	63.3	49	22.8	3	1.4	27	12.6
NW Diabetes	0								
NW Medical	15	4	26.7	7	46.7	1	6.7	3	20.0
Other DHB	1	0		0		0		1	100
Unbooked	4	3	75.0	1	25.0	0		0	

Table 141: Mode of birth by LMC at time of birth among multipara –no previous caesarean

	Total	Spontaneous vertex		Operative vaginal		CS elective		CS emergency	
	n	n	%	n	%	n	%	n	%
Total	2604	2136	82.0	147	5.6	92	3.5	229	8.8
IMW	1128	964	85.5	66	5.9	17	1.5	81	7.2
Pvt Obstetrician	450	322	71.6	48	10.7	45	10.0	35	7.8
GP	60	54	90.0	4	6.7	0		2	3.3
NW Domino	171	157	91.8	4	2.3	1	0.6	9	5.3
NW Community	513	424	82.7	16	3.1	17	3.3	56	10.9
NW Diabetes	98	73	74.5	2	2.0	5	5.1	18	18.4
NW Medical	136	101	74.3	7	5.1	6	4.4	22	16.2
Other DHB	21	14	66.7	0		1	4.8	6	28.6
Unbooked	27	27	100	0		0		0	

5.5 Operative births

Table 142: Indication for caesarean section by parity and gestation

	Nullipara preterm n=184		Nullipara term n=1069		Multipara preterm n=150		Multipara term n=987		Total n=2390	
	n	%	n	%	n	%	n	%	n	%
Failure to progress	15	8.2	428	40.0	5	3.3	168	17.0	616	25.8
Repeat caesarean	0		0		39	26.0	479	48.5	518	21.7
Fetal distress	44	23.9	246	23.0	24	16.0	76	7.7	390	16.3
Malpresentation	29	15.8	158	14.8	17	11.3	62	6.3	266	11.1
Obstetric history	10	5.4	22	2.1	11	7.3	85	8.6	128	5.4
Maternal request	2	1.1	66	6.2	0		39	4.0	107	4.5
APH / abruption	12	6.5	5	0.5	16	10.7	11	1.1	44	1.8
Hypertension	33	17.9	10	0.9	10	6.7	7	0.7	60	2.5
Disproportion	0		29	2.7	0		8	0.8	37	1.5
Diabetes	2	1.1	4	0.4	4	2.7	6	0.6	16	0.7
Failed induction	3	1.6	19	1.8	0		12	1.2	34	1.4
Maternal distress	0		6	0.6	1	0.7	1	0.1	8	0.3
Cord prolapse/presentation	0		4	0.4	1	0.7	4	0.4	9	0.4
Other	34	18.5	72	6.7	22	14.7	29	2.9	157	6.6

Table 143: Indication for caesarean section at term by parity and type of caesarean section

	Nullipara CS elective n=260		Nullipara CS emergency n=809		Multipara CS elective n=587		Multipara CS emergency n=400		Total n=2056	
	n	%	n	%	n	%	n	%	n	%
Failure to progress	2	0.8	426	52.7	0		168	42.0	596	29.0
Repeat caesarean	0		0		416	70.9	63	15.8	479	23.3
Fetal distress	1	0.4	245	30.3	0		76	19.0	322	15.7
Malpresentation	95	36.5	63	7.8	30	5.1	32	8.0	220	10.7
Obstetric history	19	7.3	3	0.4	70	11.9	15	3.8	107	5.2
Maternal request	58	22.3	8	1.0	31	5.3	8	2.0	105	5.1
APH / abruption	1	0.4	4	0.5	4	0.7	7	1.8	16	0.8
Disproportion	17	6.5	12	1.5	2	0.3	6	1.5	37	1.8
Hypertension	4	1.5	6	0.7	4	0.7	3	0.8	17	0.8
Failed Induction	5	1.9	14	1.7	2	0.3	10	2.5	31	1.5
Diabetes	3	1.2	1	0.1	4	0.7	2	0.5	10	0.5
Cord prolapse	0		4	0.5	2	0.3	2	0.5	8	0.4
Maternal distress	2	0.8	4	0.5	1	0.2	0		7	0.3
Maternal age	7	2.7	1	0.1	2	0.3	0		10	0.5
Other	46	17.7	18	2.2	19	3.2	8	2.0	91	4.4

Table 144: Operative vaginal birth rates

	1992	1993	1994	1995	1996	1997	1998*	1999	2000	2001	2002	2003	2004	2005	2006
Total births (mothers)	**8315**	**8690**	**8812**	**9125**	**9157**	**8055**	**7492**	**7501**	**7827**	**7471**	**7775**	**7611**	**7491**	**7194**	**7212**
Total operative vaginal births	1039	1070	1190	1120	1156	1051	925	949	1006		1081	1065	1171	1022	956
Incidence %	12.5	12.3	13.5	12.3	12.6	13.0	12.3	12.7	12.9		13.9	14.0	15.6	14.2	13.3
Total nullipara	**3700**	**3649**	**3814**	**4037**	**4018**	**3591**	**3263**	**3262**	**3455**				**3597**	**3522**	**3499**
Operative vaginal births	820	700	893	850	895	776	704	722	733				875	809	737
Nulliparous operative vaginal birth rate (%)	22.2	19.2	23.4	21.1	22.3	21.6	21.6	22.1	21.2				24.3	23.0	21.1
Total multipara	**4615**	**5041**	**4998**	**5088**	**5139**	**4464**	**4229**	**4239**	**4372**				**3894**	**3672**	**3713**
Operative vaginal births	219	370	297	270	261	275	221	227	273				296	213	219
Multiparous operative vaginal birth rate (%)	4.7	7.3	5.9	5.3	5.1	6.2	5.2	5.4	6.2				7.6	5.8	5.9

Table 145: Type of operative vaginal birth: (1992-2006)

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Total births	**8315**	**8690**	**8812**	**9125**	**9157**	**8055**	**7492**	**7501**	**7827**	**7471**	**7755**	**7611**	**7491**	**7194**	**7212**
Total operative vaginal births	1039	1070	1190	1120	1156	1051	925	949	1006		1081	1065	1171	1022	956
% of all births	12.5	12.3	13.5	12.3	12.6	13.0	12.3	12.7	12.9		13.9	14.0	15.6	14.2	13.3
Total forceps alone	854	883		795	739	590	464	439	435		391	352	323	234	256
% of all births	10.3	10.2		8.7	8.1	7.3	6.2	5.9	5.6		5.0	4.6	4.3	3.3	3.5
Kiellands forceps	131	123		112	83	73	41	33	21				36	22	33
% of all births	1.6	1.4		1.2	0.9	0.9	0.5	0.4	0.3				0.5	0.3	0.5
Other forceps	723	760		683	656	517	423	406	414				287	212	223
% of all births	8.7	8.7		7.5	7.2	6.4	5.6	5.4	5.3				3.8	2.9	3.1
Ventouse or forceps /ventouse	185	185		325	417	461	461	510	571		690	713	848	788	700
% of all births	2.2	2.1		3.6	4.6	5.7	6.1	6.8	7.3		8.9	9.4	11.3	11.0	9.7
Ventouse alone								436	516				771	728	639
% of all births								5.8	6.6				10.3	10.1	8.9
Forceps/ ventouse								74	55				77	60	61
% of all births								1.0	0.7				1.0	0.8	0.8

Table 146: Mode of birth by ethnicity – nullipara

		Spontaneous vertex		Vaginal breech		Operative forceps		Operative ventouse		CS elective		CS emergency	
	N	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
NZ European	1522	566	37.2	10	0.7	134	8.8	215	14.1	179	11.8	418	27.5
Maori	233	139	59.7	5	2.1	12	5.2	15	6.4	9	3.9	53	22.7
Pacific	328	201	61.3	3	0.9	6	1.8	24	7.3	12	3.7	82	25.0
Asian	635	262	41.3	2	0.3	38	6.0	106	16.7	39	6.1	188	29.6
Indian	275	108	39.3	3	1.1	24	8.7	40	14.5	14	5.1	86	31.3
Other European	405	163	40.2	0		31	7.7	73	18.0	37	9.1	101	24.9
Other	101	45	44.6	2	2.0	4	4.0	15	14.9	6	5.9	29	28.7

Table 147: Mode of birth by ethnicity - multipara

		Spontaneous vertex		Vaginal breech		Operative forceps		Operative ventouse		CS elective		CS emergency	
	N	n	%	n	%	n	%	n	%	n	%	n	%
NZ European	1512	859	56.8	10	0.7	34	2.2	79	5.2	334	22.1	196	13.0
Maori	364	257	70.6	5	1.4	3	0.8	8	2.2	40	11.0	51	14.0
Pacific	693	517	74.6	4	0.6	4	0.6	6	0.9	63	9.1	99	14.3
Asian	480	307	64.0	1	0.2	13	2.7	29	6.0	66	13.8	64	13.3
Indian	245	149	60.8	1	0.4	6	2.4	18	7.3	35	14.3	35	14.7
Other European	277	152	54.9	5	1.8	7	2.5	8	2.9	70	25.3	36	12.6
Other	142	90	63.4	0		1	0.7	3	2.1	20	14.1	28	19.7

Table 148: Breech birth (1995-2006)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Total nos of babies born	9516	9612	8270	7721	7679	8054	7654	7988	7804	7679	7384	7379
Total breech births	535	479	434	400	440	484				421	432	419
Percent of total births	5.6	5.0	5.2	5.2	5.7	6.0				5.5	5.9	5.7
Total singleton babies					7329	7609				7303	7007	7050
Total singleton breech births					341	363				318	328	328
Percent of singleton births					4.7	4.8				4.4	4.7	4.7
Total multiple birth babies					350	445				376	377	329
Total multiple breech births					99	121				103	104	91
Percent of multiple birth babies					28.3	27.2				27.4	27.6	27.7

Table 149: Mode of birth by type of breech (singletons only)

	Extended leg n=170		Flexed leg n=92		Unspecified n=66		Total breech n= 328	
	n	%	n	%	n	%	n	%
Vaginal breech	19	11.2	11	12.0	5	7.6	35	10.7
Caesarean section	151	88.8	81	88.0	61	92.4	293	89.3
CS emergency	64	37.6	43	46.7	32	48.5	139	42.4
CS elective	87	51.2	38	41.3	29	43.9	154	47.0

Table 150: Mode of birth by type of breech (multiples only)

	Extended leg n=35		Flexed leg n=27		Unspecified n=29		Total breech n= 91	
	n	%	n	%	n	%	n	%
Spontaneous breech birth	9	25.7	9	33.3	5	17.2	23	25.3
Caesarean section	26	74.3	18	66.7	24	82.8	68	74.7
CS emergency	9	25.7	12	44.4	19	65.5	40	44.0
CS elective	17	48.6	6	22.2	5	17.2	28	30.8

5.6 Analgesia/anaesthesia

Table 151: Epidural use among women with spontaneous and induced labour (2000-2006)

	2000	2001	2002	2003	2004	2005	2006
Number of births	7827				7491	7194	7212
Number women with spontaneous labour	4820				4817	4246	4256
Spontaneous labour and epidural	2143				2434	2138	2168
%	44.5				50.5	50.4	50.9
Number of women with induced labour	2002				1922	1894	1776
Induced labour and epidural	1313				1412	1373	1269
%	65.6				73.5	72.5	71.5

Table 152: Analgesic use and maternal age (among nulliparous spontaneous and induced labours)

Maternal age (years)	Total	Epidural		Entonox		Pethidine		TENS		Water	
	N	n	%	n	%	n	%	n	%	n	%
≤20	252	128	50.8	138	54.8	81	32.1	0		27	10.7
21-25	507	298	58.8	267	52.7	160	31.6	3	0.6	53	10.5
26-30	921	649	70.5	421	45.7	238	25.8	18	2.0	92	10.0
31-35	1025	786	76.7	446	43.5	213	20.8	23	2.2	134	13.1
36-40	328	262	79.9	121	36.9	62	18.9	8	2.4	36	11.0
41+	32	27	84.4	11	34.4	8	25.0	0		4	12.5

Table 153: Analgesic use and LMC type among nulliparous spontaneous and induced labours

LMC type	Total	Epidural		Entonox		Pethidine		TENS		Water	
	n	n	%	n	%	n	%	n	%	n	%
IMW	1396	993	71.1	618	44.3	339	24.3	34	2.4	191	13.7
Pvt Obstetrician	625	531	85.0	231	37.0	91	14.6	11	1.8	50	8.0
GP	70	55	78.6	38	54.3	15	21.4	1	1.4	6	8.6
NW Domino	204	119	58.3	103	50.5	48	23.5	3	1.5	44	21.6
NW Community	563	320	56.8	326	57.9	210	37.3	2	0.4	46	8.2
NW Diabetes	63	48	76.2	20	31.7	26	41.3	0		2	3.2
NW Medical	85	61	71.8	39	45.9	25	29.4	1	1.2	7	8.2
Other DHB	44	22	50.0	18	40.9	5	11.4	0		0	
Unbooked	15	1	6.7	11	73.3	3	20.0	0		0	

Table 154: Analgesic use and ethnicity (among nulliparous spontaneous and induced labours)

	Total	Epidural		Entonox		Pethidine		TENS		Water	
	N	n	%	n	%	n	%	n	%	n	%
NZ European	1275	994	78.0	558	43.8	239	18.7	33	2.6	189	14.8
Maori	214	117	54.7	119	55.6	48	22.4	0		30	14.0
Pacific	309	165	53.4	157	50.8	88	28.5	1	0.3	31	10.0
Asian	574	374	65.2	249	43.4	202	35.2	4	0.7	16	2.8
Indian	250	185	74.0	115	46.0	84	33.6	0		13	5.2
Other European	354	256	72.3	157	44.4	68	19.2	13	3.7	57	16.1
Other	89	59	66.3	49	55.1	33	37.1	1	1.1	10	11.2

5.7 Labour interventions and birth outcomes for low risk women birthing at NW

Table 155: Demographic characteristics of low risk women

	Total N=7212	Spontaneous labour				Induced or prelabour CS	
		Low risk		High risk			
	n	n	%	n	%	n	%
Parity							
Nullipara	3499	1566	44.8	559	16.0	1374	39.3
Multipara	3713	1301	35.0	830	22.4	1582	42.6
Age							
<21	323	171	52.9	79	24.5	73	22.6
21-25	869	441	50.7	197	22.7	231	26.6
26-30	1735	616	35.5	301	17.4	818	47.2
31-35	2619	1002	38.3	517	19.7	1100	42.0
36-40	1421	393	27.7	251	17.7	777	54.7
>40	245	42	17.1	44	18.0	159	64.9
Ethnicity							
NZ European	3034	1018	33.6	563	18.6	1453	47.9
Maori	597	228	38.2	152	25.5	217	36.4
Pacific	1021	444	43.5	223	21.8	354	34.7
Asian	1115	586	52.6	186	16.7	343	30.8
Indian	520	217	41.7	100	19.2	203	39.0
Other European	682	261	38.3	116	17.0	305	44.7
Other	243	113	46.5	49	20.2	81	33.3
LMC							
IMW	2850	1518	53.3	517	18.1	815	28.6
Pvt Obstetrician	1710	436	25.5	246	14.4	1028	60.1
GP	152	89	58.6	22	14.5	41	27.0
NW Domino	429	239	55.7	65	15.2	125	29.1
NW Community	1379	585	42.4	280	20.3	514	37.3
NW Diabetes	230	0		50	21.7	180	78.3
NW Medical	319	0		116	36.4	203	63.6
Other DHB	93	0		50	53.8	43	46.2
Unbooked	50	0		43	86.0	7	14.0
BMI							
<19	304	161	53.0	47	15.5	96	31.6
19-25	3329	1402	42.1	596	17.9	1331	40.0
26-35	1625	591	36.4	303	18.7	731	45.0
>35	402	109	27.1	77	19.2	216	53.7
Missing	1552	604	38.9	366	23.6	582	37.5
Smoking							
Not smoking	5011	2189	43.7	936	18.7	1886	37.6
Currently smoking	358	119	33.2	108	30.2	131	36.6
Stopped in Pregnancy	111	43	38.7	19	17.1	49	44.1
Missing	1732	516	29.8	326	18.8	890	51.4

APPENDIX 6 LABOUR and BIRTH OUTCOMES

6.1 Perineal trauma

Table 156: Perineal trauma by mode of birth, parity and LMC

	Total	Episiotomy		3rd/4th tear		Vaginal wall tear	
	N	n	%	n	%	n	%
Total vaginal births	4822	1103	22.9	103	2.1	210	4.4
Mode of birth							
Normal vaginal	3866	545	14.1	50	1.3	167	4.3
Ventouse	639	308	48.2	13	2.0	25	3.9
Forceps	317	250	78.9	40	12.6	18	5.7
Parity							
Nulliparous	2246	802	35.7	78	3.5	157	7.0
Multiparous	2576	301	11.7	25	1.0	53	2.1
LMC							
Independent Midwife	2151	515	23.9	39	1.8	92	4.3
Private Obstetrician	853	267	31.3	19	2.2	21	2.5
General Practitioner	112	34	30.4	4	3.6	2	1.8
NW Domino	330	59	17.9	10	3.0	19	5.8
NW Community	963	180	18.7	25	2.6	65	6.7
NW Diabetes	129	21	16.3	3	2.3	5	3.9
NW Medical	195	22	11.3	3	1.5	4	2.1
Other DHB	44	3	6.9	0		1	2.3
Unbooked	45	2	4.4	0		1	2.2

Table 157: Episiotomy rates in spontaneous (non operative) vertex birth(not breech)

		Nullipara			Multipara	
	Total	n	%	Total	n	%
Total	1484	327	22.0	2331	212	9.1
Independent Midwife	694	167	24.1	1035	109	10.5
Private Obstetrician	232	62	26.7	353	53	15.0
General Practitioner	28	12	42.9	55	4	7.3
NW Domino	107	19	17.8	170	9	5.3
NW Community	332	54	16.3	470	25	5.3
NW Diabetes	20	7	35.0	88	6	6.8
NW Medical	41	5	12.2	115	6	5.2
Other DHB	18	0		16	0	
Unbooked	12	1	8.3	29	0	

Table 158: 3rd and 4th degree tears in spontaneous (non operative) vaginal birth by LMC at birth and parity (Diabetic, GP, Other DHB and unbooked LMC groups are not included as values =0)

		Nullipara			Multipara	
	Total	n	%	Total	n	%
Total	1434	35	2.4	2198	15	0.6
Independent Midwife	694	15	2.2	1035	5	0.5
Private Obstetrician	232	6	2.6	353	1	0.3
NW Domino	107	4	3.7	170	3	1.8
NW Community	332	10	3.0	470	5	1.1
NW Medical	41	0		115	1	0.9

Table 159: Postpartum transfusion rates by recorded blood loss at birth

		Postpartum transfusion	
		n=153	
	Total	n	%
Blood loss <500mls	4651	14	0.3
PPH ≥500- <1000	1958	37	1.9
PPH ≥1000mls	554	102	18.4
Blood loss unknown	49	0	
Manual removal placenta	92	12	13.0

APPENDIX 7 POSTNATAL CARE

7.1 Infant Feeding

Table 160: Method of Infant Feeding at Discharge from NW

	2003 n = 5177		2004 n = 5938		2005 n = 5765		2006 n = 6158	
	n	%	n	%	n	%	n	%
Exclusive Breastfeeding	2789	53.9	3673	61.9	3686	63.9	4546	73.8
Fully Breastfeeding	562	10.9	464	7.8	485	8.4	441	7.2
Partial Breastfeeding	1521	29.4	1497	25.2	1375	23.9	958	15.6
Artificial Feeding	305	5.9	304	5.1	219	3.8	213	3.5

Table 161: Demography of infant feeding on discharge from NW

	Total	Exclusive BF		Fully BF		Partial BF		Artificial	
	N	n	%	n	%	n	%	n	%
Total	6158	4546	73.8	441	7.2	958	15.6	213	3.5
Mode of Birth									
Spontaneous Vaginal	3295	2831	85.9	89	2.7	262	8.0	113	3.4
Operative Vaginal	807	632	78.3	40	5.0	113	14.0	22	2.7
Elective CS	872	508	58.3	118	13.5	202	23.2	44	5.0
Emergency CS	1184	575	48.6	194	16.4	381	32.2	34	2.9
LMC at birth									
IMW	2495	2011	80.3	134	5.	289	11.6	61	2.4
Private Obstetrician	1508	1126	74.7	113	7.5	225	14.9	44	2.9
GP	132	99	75.0	7	5.3	19	14.4	7	5.3
NW Community	1203	801	66.6	90	7.5	253	21.0	59	4.9
NW Domino	383	309	80.7	19	5.0	46	12.0	9	2.3
NW Medical	187	66	35.3	45	24.1	65	34.8	11	5.9
NW Diabetes	202	103	51.0	30	14.9	54	26.7	15	7.4
Unbooked	32	19	59.4	2	6.3	6	18.8	5	15.6
Other DHB	16	12	75.0	1	6.3	1	6.3	2	12.5
Maternal age									
≤20	265	215	81.1	8	3.0	28	10.6	14	5.3
21-25	730	534	73.2	46	6.3	115	15.8	35	4.8
26-30	1445	1088	75.3	104	7.2	207	14.3	46	3.2
31-35	2262	1693	74.8	158	7.0	363	16.0	48	2.1
36-40	1248	883	70.8	108	8.7	198	15.9	59	4.7
41+	208	133	63.9	17	8.2	47	22.6	11	5.3

Table 162: Demography of infant feeding on discharge from NW (continued)

	Total	Exclusive BF		Fully BF		Partial BF		Artificial	
	N	n	%	n	%	n	%	n	%
Ethnicity									
NZ European	2573	2053	79.8	172	6.7	267	10.4	81	3.1
Maori	484	362	74.8	29	6.0	59	12.2	34	7.0
Pacific	866	602	69.5	69	8.0	154	17.8	41	4.7
Asian	989	611	61.8	69	7.0	279	28.2	30	3.0
Indian	436	303	69.5	36	8.3	91	20.9	6	1.4
Other European	598	472	78.9	41	6.9	68	11.4	17	2.8
Other	212	143	67.5	25	11.8	40	18.9	4	1.9
Gestation									
<37 weeks	250	109	43.6	47	18.8	78	31.2	16	6.4
37 - 40 weeks	4906	3677	74.9	330	6.7	737	15.0	162	3.3
41+ weeks	1002	760	75.8	64	6.4	143	14.3	35	3.5
Weight									
<2.5 kgs	152	51	33.6	35	23.0	55	36.2	11	7.2
2.5 - 2.9 kgs	915	622	68.0	83	9.1	181	19.8	29	3.2
3.0 - 4.4 kgs	4977	3805	76.5	312	6.3	692	13.9	168	3.4
≥4.5 kgs	114	68	59.6	11	9.6	30	26.3	5	4.4
Standard / Non standard Primipara									
Standard	858	631	73.5	66	7.7	148	17.2	13	1.5
Non standard	2074	1063	51.3	232	11.2	747	36.0	32	1.5
Breastfeeding at discharge from Homecare									
Community	1073	540	50.3	138	12.9	271	25.3	124	11.6
Domino	388	269	69.3	46	11.9	40	10.3	33	8.5
Medical	153	48	31.4	38	24.8	46	30.1	21	13.7
Diabetes	94	35	37.2	17	18.1	27	28.7	15	16.0

7.2 Postnatal Admissions

Table 163: Maternal destination following birth by mode of birth

	NW Wards n=4384		Birthcare n=2322		Home n=483		Other Units n=23	
	n	%	n	%	n	%	n	%
Spontaneous vaginal	1393	31.8	1939	83.5	463	95.9	20	87
Breech vaginal	47	1.1	3	0.1	1	0.2	0	0
Operative vaginal	554	12.6	380	16.4	19	3.9	3	13
CS elective	924	21.1	0	0	0	0	0	0
CS emergency	1466	33.4	0	0	0	0	0	0

Table 164: Maternal destination following birth by LMC

	Total	NW Wards		Birthcare		Home		Other Units	
	N	n	%	n	%	n	%	n	%
Independent Midwife	2850	1346	47.2	1216	42.7	272	9.5	16	0.6
Private Obstetrician	1710	1153	67.4	535	31.3	16	0.9	6	0.4
General Practitioner	151	77	51	63	41.7	11	7.3	0	0
NW Domino	429	231	53.8	146	34	51	11.9	1	0.2
NW Community	1385	905	65.3	358	25.8	122	8.8	0	0
NW High Risk	547	542	99.1	3	0.5	2	0.4	0	0
Other DHB	91	88	96.7	1	1.1	2	2.2	0	0
Unbooked	49	42	85.7	0	0	7	14.3	0	0

Table 165: Maternal destination following birth by ethnicity

	Total	NW Wards		Birthcare		Home		Other Units	
	N	n	%	n	%	n	%	n	%
NZ European	3034	1806	59.5	1120	36.9	91	3.0	17	0.6
Maori	597	378	63.3	147	24.6	70	11.7	2	0.3
Pacific	1021	634	62.1	253	24.8	134	13.1	0	0.0
Asian	1115	651	58.4	348	31.2	115	10.3	1	0.1
Indian	520	355	68.3	141	27.1	24	4.6	0	0.0
Other European	682	414	60.7	245	35.9	21	3.1	2	0.3
Other	243	146	60.1	68	28.0	28	11.5	1	0.4

Table 166: Postnatal readmission reason by maternal destination following birth

	NW Wards n=4384		Birthcare n=2322		Home n=483	
	n	%	n	%	n	%
Neonatal Admission	37	0.8	29	1.2	5	1
Infection	54	1.2	6	0.3	1	0.2
Breast	41	0.9	18	0.8	2	0.4
Wound	19	0.4	1	0	0	0

Table 167: Postnatal readmission by LMC at birth

	Total	Neonatal Admission		Infection		Breast		Wound	
	N	n	%	n	%	n	%	n	%
Independent Midwife	2850	17	0.6	20	0.7	21	0.7	5	0.2
Private Obstetrician	1710	18	1.1	9	0.5	12	0.7	2	0.1
NW Domino	429	6	1.4	3	0.7	6	1.4	1	0.2
NW Community	1385	22	1.6	20	1.4	15	1.1	7	0.5
NW High Risk	547	7	1.3	4	0.7	5	0.9	3	0.5

APPENDIX 8 NEWBORN SERVICES

8.1 Admissions to NICU

Table 168: Admissions to NICU by gestational age of babies born in National Women's

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

Table 169: Admissions to NICU by birth weight of babies born in National Women's

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

Table 170: Admissions to NICU by gestational age of babies transferred postpartum to National Women's

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

Table 171: Admissions by birth weight of babies transferred postpartum to National Women's

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

Table 172: Domicile of mother of all babies admitted to NICU

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

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

Table 173: Ethnicity of mothers of babies admitted to NICU

	Preterm	Term	Total
European	313	170	483
Maori	87	31	118
Indian	29	36	65
Chinese	35	17	52
Samoan	29	21	50
Tongan	11	23	34
Other Asian	15	16	31

	Preterm	Term	Total
Other	11	15	26
Cook Island	13	4	17
Niue	2	5	7
Other Pacific	2	1	3
Fiji	2	1	3
Korean	0	1	1

Table 174: Occupancy (baby days) for NICU by gestational age

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

Table 175: Occupancy (baby-days) for NICU by birth weight

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

Table 176: Reason for admission to NICU

Reason	n
Prematurity	427
Respiratory distress	182
Congenital abnormality	70
Hypoglycaemia	33
Depression at birth	30
IU growth restriction	27
Other	25
Cyanotic episode	24
Suspected infection	19

Reason	n
Jaundice	17
Haemolytic disease	8
Feeding difficulty	8
Bile stained vomiting	6
Neurological problem	6
Neonatal abstinence syndrome	4
Vomiting	2
Maternal diabetes mellitus	1

8.2 Infection

Table 177: Organisms causing serious infection

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

Table 178: Late onset serious infection (septicaemia)

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

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

8.3 Infant feeding in babies discharged from NICU

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

Table 179: Infant feeding in babies discharged either directly home or to a post-natal ward by gestational age

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

Table 180: Infant feeding in babies discharged either directly home or to a post-natal ward by birth weight

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

8.4 Assisted ventilation

Table 181: Proportion of babies needing assisted ventilation (excluding for surgery or a congenital anomaly) 2003-2006

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

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

Table 182: High Frequency Oscillatory Ventilation

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

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

Table 183: Inhaled Nitric Oxide (iNO)

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

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

Table 184: iNO plus HFOV

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

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

Table 185: Reason for ventilation and CPAP in term and post-term infants

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

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

8.5 Very low birth weight infants

Table 186: Number of VLBW who were born elsewhere and admitted to NICU, or were born in ACH and alive at birth

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

Table 187: Numbers and survival by gestational age of babies <32 weeks gestation in 2006

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

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

Table 188: Intraventricular haemorrhage by birth weight

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

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

Table 189: Intraventricular haemorrhage by gestation

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

Table 190: Retinopathy of prematurity by birth weight in babies surviving to 36 weeks' gestation

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

Table 191: Retinopathy of prematurity by gestational age in babies surviving to 36 weeks' gestation

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

Table 192: Chronic lung disease by birth weight

Birth Weight (gms)	n	Dead by 36 wks	Alive at 36 wks	In O_2	CPAP/ IPPV	CLD	CLD in All	CLD if Alive
Total	134	4	130	18	10	21	16%	16%
500-749	19	2	17	7	5	7	37%	41%
750-999	24	1	23	5	2	5	21%	22%
1000-1249	34	1	33	3	3	6	18%	18%
1250-1499	57	0	57	3	0	3	5%	5%

Table 193: Chronic lung disease by gestational age

Gestation (weeks)	n	Dead by 36 wks	Alive at 36 wks	In O_2	CPAP/ IPPV	CLD	%CLD in All	%CLD if Alive
Total	163	5	158	17	10	20	12%	13%
<24	1	0	1	1	1	1	100%	100%
24-25	18	2	16	6	3	6	33%	38%
26-27	25	2	23	7	5	10	40%	43%
28-29	41	1	40	3	1	3	7%	8%
30-31	78	0	78	0	0	0	0%	0%

Table 194: Necrotising enterocolitis (NEC) by birth weight

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

Table 195: Necrotising enterocolitis by gestational age

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

Table 196: Patent Ductus Arteriosus by birth weight

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

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

Table 197: Patent Ductus Arteriosus by gestational age

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

Table 198: Pneumothorax by birth weight

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

Table 199: Pneumothorax by gestational age

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

Table 200: Percentage receiving antenatal corticosteroids by birth weight

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

Table 201: Percentage receiving antenatal corticosteroids by gestational age

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

8.7 Details of babies who died

Table 202: Extremely preterm neonatal and post-neonatal deaths (n = 19)

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

Table 203: Premature neonatal and post-neonatal deaths (n = 1)

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

Table 204: Term/post-term neonatal and post-neonatal deaths (n = 2)

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

Table 205: Babies with significant anomalies (n = 14)

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

APPENDIX 9 PERINATAL MORTALITY

Table 206: Postnatal transfer deaths (these are babies born elsewhere who transferred to NW for postnatal care)

		2000	2001	2002	2003	2004	2005	2006
Early neonatal deaths	≤ 7 days	6	1	3	3	3	3	3
Late neonatal deaths	8 – 28 days	0	1	0	0	0	3	3
Total deaths		6	2	3	3	3	6	6

Table 207: Perinatal and perinatal- related losses (1992 – 2006)

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Total number of perinatal related losses	168	133	147	131	165	128	133	105	136	94	116	105	124	111	99
Fetal death	86	61	80	84	86	74	73	65	84	57	69	64	82	68	74
Early neonatal death	65	60	49	39	63	45	50	31	43	32	40	34	33	38	23
Late neonatal death	9	6	15	7	10	6	6	9	9	5	7	7	9	5	2
Perinatal mortality rate /1000	11.6	9.4	9.3	7.6	10.1	9.4	9.8	12.5	15.8	11.6	13.6	12.6	15.0	14.4	13.1
Perinatal related loss rate /1000	19.7	14.3	15.6	13.7	16.5	14.7	16.1	13.7	16.9	12.3	14.5	13.5	16.1	16.1	13.4

Table 208: Perinatal mortality rate (per 1000 births) and perinatal-related loss rate (per 1000 births) adjusted for termination for fetal abnormalities

	2000	2001	2002	2003	2004	2005	2006	
	Rate	Rate	Rate	Rate	Rate	Rate	n	Rate/ 1000
Perinatal mortality rate	15.8	11.6	13.6	12.6	15.0	14.4	97 / 7379	13.1
Perinatal mortality rate (excluding lethal & terminated fetal abnormalities)	11.5	8.0	8.9	8.2	11.4	9.7	(97-35) / (7379-35)	8.4
Perinatal related loss rate	16.9	12.3	14.5	13.5	16.2	15.0	99 / 7379	13.4
Perinatal related loss rate (excluding lethal & terminated fetal abnormalities)	12	8.4	9.4	8.9	12.4	9.9	(99-37) / (7379-37)	8.4

Table 209: Cause of death (2000-2006)

Classification*	2000		2001		2002		2003		2004		2005		2006	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Congenital abnormality	37	25	28	30	42	36	36	34	36	34	38	34	37	37
Perinatal infection	11	8	5	5	7	6	6	6	6	6	11	10	9	9
Hypertension	5	4	3	3	3	3	4	4	4	4	3	3	3	3
Antepartum haemorrhage	10	8	10	11	3	3	5	5	5	5	6	5	4	4
Maternal conditions	5	4	3	3	8	7	8	7	8	7	8	7	6	6
Specific perinatal conditions	22	17	16	17	18	16	5	5	5	5	10	9	7	7
Hypoxic peripartum death	2	2	2	2	1	1	3	3	3	3	4	4	0	
Fetal growth restriction	10	8	6	6	4	3	6	6	6	6	1	1	8	8
Spontaneous preterm	23	17	12	13	17	15	23	22	23	22	20	18	13	13
Unexplained antepartum death	11	8	9	10	13	11	9	8	9	8	10	9	12	12
Total	136	100	94	100	116	100	105	100	124	100	111	100	99	100

* 2000-2004 ANZACPM 2005-2006 PSANZ-PDC

Table 210: Termination of pregnancy among causes of death 2006

Classification	Termination of pregnancy n=36	
	n	%
Congenital abnormality	**28**	**77.8**
Maternal conditions	**1**	**2.8**
Hypertension	**1**	**2.8**
Specific perinatal conditions	**4**	**11.1**
Fetal growth restriction	**2**	**5.6**

Table 211: Perinatal deaths by cause (PSANZ-PDC) and gestational age

Classification	Total n=99		< 37 weeks n=86		≥ 37 weeks n=13	
	n	%	n	%	n	%
Congenital abnormality	37	37.4	34	39.5	3	23.1
Perinatal infection	9	9.1	7	8.1	2	15.4
Hypertension	3	3.0	3	3.5	0	
Antepartum haemorrhage	4	4.0	4	4.7	0	
Maternal conditions	6	6.1	5	5.8	1	7.7
Specific perinatal conditions	7	6.1	5	5.8	2	15.4
Hypoxic peripartum death	0		0		0	
Fetal growth restriction	8	8.1	7	8.1	1	7.7
Spontaneous preterm	13	13.1	13	15.1	0	
Unexplained antepartum death	12	12.1	8	9.3	4	3.1

Table 212: Perinatal full necropsy rates (%)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Perinatal necropsy rates (%)	58	56	65	68	57	48	50	38	50	40	40	41	43	52	48	50

APPENDIX 10 TERMINATION OF PREGNANCY

Table 213: Demography and characteristics of women attending E.D.U

	2000	2001	2002	2003	2004	2005	2006
Ethnicity	%	%	%	%	%	%	%
Chinese	7	7	6.5	8	7.4	8.5	8.0
Cook Island	4	3.5	3.5	3	3.2	3.5	3.6
European	41	39.5	38.5	40	39.2	38.1	37.9
Fijian	1	1	1	1	0.5	1.0	0.7
Indian	6	6	6.5	7.6	8.7	8.6	9.0
Maori	17	17.5	18.5	16.7	16.4	15.9	16.7
Nuiean	1	1.5	1.5	2	1.4	1.6	1.8
Other	7	7.5	7	8	7.7	7.4	6.2
Pacific Island	0	0.5	0.5	0	0.2	0.1	0.1
Samoan	13	13	13	11	12.6	11.9	12.3
Tongan	3	3	3.5	2.7	2.7	3.4	3.5
Age							
$\leq$ 19	18	19	18	18	19.3	16.3	21.5
20 – 24	29	29	29	31	28.9	41	29.7
25 – 29	21	21	23	21	20.9	19.9	20.7
30 – 34	17	17	16	17	16.1	13.1	14.4
35 –39	11	11	10	10	10.9	6.6	9.5
40+	4	3	4	3	3.9	3.3	3.9
Gestation (weeks) at termination							
7	4	2.5	1	0.8	1.0	0.4	0.3
8	15	14	9	6.8	17.3	10.5	11.1
9	21	19.5	20	18	23.9	20.9	22.2
10	22	21.5	23	24	21.4	22.7	24.2
11	20	21	22.5	25	20.8	24.0	23.6
12	15	18.5	21	22.4	14.5	20.2	17.6
$\geq$13	3	3	3.5	3	1.2	1.3	0.8

APPENDIX 11 GLOSSARY OF ABBREVIATIONS

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

APPENDIX 12 DEFINITIONS

Antepartum Haemorrhage (APH)
Vaginal bleeding from any cause at or beyond 20 weeks during pregnancy and labour, and includes placenta praevia without bleeding.

Augmentation
Describes use of oxytocin or ARM to accelerate spontaneous labour.

Breastfeeding (BF) Definitions
The format of data collection was changed during 2001/02 to fit the Ministry of Health definitions as adopted by the New Zealand Breastfeeding Authority.

Exclusive breastfeeding: The infant has never, to the mother's knowledge, had any water, formula or other liquid or solid food. Only breastmilk, from the breast or expressed, and prescribed* medicines have been given from birth.
* Prescribed as per Medicines Act 1981

Fully breastfeeding: The infant has taken breastmilk only, no other liquids or solids except a minimal amount of water or prescribed medicines, in the past 48 hours.

Partial breastfeeding: The infant has taken some breastmilk and some infant formula or other solid food in the past 48 hours.

Artificial feeding: The infant has had no breastmilk but has had alternative liquid such as infant formula with or without solid food in the past 48 hours.

Chronic Hypertension (CH)
Diastolic BP≥90mmHg at booking or a medical history of essential hypertension.

Early Neonatal Death (ENND)
Death of a baby between birth and completion of 7 days of life.

Elective Caesarean Section:
An elective caesarean is defined as a caesarean which was scheduled in advance and scheduled prior to the onset of labour. Therefore, caesarean sections performed after the onset of labour but booked electively prior to labour are included with elective caesarean.

Fetal Death
Stillbirth of a baby of at least 20 weeks gestation at issue or at least 400 grams birth weight if gestation is unknown.

Gestational Diabetes (GDM)
This diagnosis is based on either a fasting glucose > 5.5mmol/L or a 2 hour glucose > 9.0mmol/L after a 75 gram oral glucose tolerance test.

Gestational Hypertension (GH)
Diastolic BP ≥90mmHg without proteinuria, when diastolic BP < 90mmHg at booking.

Infant Death
Death of a baby after the 28th day and before completion of 1 year.

Large for Gestational Age (>90th percentile)
Birth weight greater than 90th percentile for gestation, gender, ethnicity, maternal height, weight, age and parity, calculated using a customised birth centile calculator (McCowan L et al, Aust N Z J Obstet Gynaecol 2004;44:428-31).

Late Neonatal Death (LNND)
Death of a baby after the 7th day and before completion of 28 days of life.

Lead Maternity Carer (LMC)
The Lead Maternity Carer is the practitioner or caregiver service selected by the woman to have the legal professional and practical responsibility for ensuring the woman and her baby are given clinically appropriate care.

National Women's LMC services

Domino Midwives are the LMC for low risk women. Women self refer to this service. Domino midwives work in partnership with another midwife and provide continuity of antenatal, intrapartum and postnatal care.

Community Midwives are the LMC for women who either self refer or are referred to this service. The midwives provide continuity of antenatal and postnatal care to woman who live in NW geographical boundary. Labour and birth care is provided by NW core Labour and Birth Suite midwives.

Diabetic Midwives are the LMC for women who are referred to the Diabetic Service for secondary/tertiary care and LMC care. The midwives provide continuity of antenatal and postnatal care to woman who live in NW geographical boundary. The Diabetic Midwives are not the LMC for all women referred to this service as some women will have an Independent LMC.

Medical Midwives are the LMC for women who are referred to the Medical Service for secondary/tertiary care and LMC care. These women have complex medical needs. The midwives provide continuity of antenatal and postnatal care to woman who live in NW geographical boundary. The Medical Midwives are not the LMC for all women referred to this service as some women will have an Independent LMC.

Self-employed LMC Services

Independent midwife
General Practitioner (arranges private or hospital midwifery care)
Private Specialist (arranges private or hospital midwifery care)

Unbooked is assigned to those women who present at NW, usually in labour or pre-labour, and who do not have an LMC.

Other Unspecified. These women are usually transferred to NW in late pregnancy, and remain with their original LMC. This LMC might be another District Health Board LMC or a non-NW access holder (e.g. a private obstetrician or independent midwife without access rights at NW or a homebirth midwife without access rights at NW).

Neonatal Hypoglycaemia
Blood glucose < 2.3mmol/L.

Neonatal Death
Death of liveborn babies of any gestation or weight.

Neonatal Death Rate
Early and late neonatal deaths of liveborn babies of any gestation or weight per 1000 total births.

Parity
The number of times a woman has given birth to a liveborn baby of any weight or gestation or to a stillborn infant after 20 weeks gestation or where the infant weighed 400gms or more and gestation is unknown. Multiple birth adds only one to parity total.

Perinatal Mortality Rate (PMR)
Fetal and early neonatal deaths per 1000 total births.

Perinatal Related Loss Rate (PRLR)
Fetal and early and late neonatal deaths per 1000 total births.

Postnatally (or newly) Diagnosed Type 2 Diabetes
Type 2 diabetes diagnosed by postnatal glucose tolerance test (GTT) in a woman diagnosed as a gestational diabetic (GDM) during pregnancy.

Postpartum Haemorrhage (PPH)
Primary PPH is 500mls blood loss or more from the genital tract within the first 24 hours of delivery. Secondary PPH is excessive (>1000mls) blood loss from the genital tract 24 hours to 6 weeks postpartum.

Preeclampsia (PE or PET)
Diastolic BP $\geq$ 90mmHg with proteinuria > '+' or 0.3g/24h, when diastolic BP < 90mmHg at booking.

PSANZ-PDC (PSANZ Perinatal Death Classification) is to identify the single most important factor which led to the chain of events which resulted in the death.

PSANZ-NDC (PSANZ Neonatal Death Classification) is in addition to the PSANZ-PDC to identify the single most important factor in the neonatal period which caused the death.

Small for Gestational Age (SGA)
Birthweight less than 10th percentile for gestation, gender, ethnicity, maternal height, weight, age and parity, calculated using a customised birth centile calculator (McCowan L et al, Aust N Z J Obstet Gynaecol 2004;44:428-31)