

# Antenatal Care in Counties Manukau DHB

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*A focus on primary antenatal care*

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## Abbreviations

BDM	Births, Deaths, and Marriages registry
BRD	Birth Registration Dataset
CMDHB	Counties Manukau District Health Board
DHB	District Health Board
EDD	Estimated Delivery Date
GP	General Practitioner
ICD-10	International Statistical Classification of Diseases and Related Health Problems, 10th Revision
LMC	Lead Maternity Carer
LMP	Last Menstrual Period
NMDS	National Minimum Dataset
NZHIS	New Zealand Health Information Service
PDC	Perinatal Death Classification PDC
PHO	Primary Healthcare Organisation
PMMRC	Perinatal and Maternal Mortality Review Committee
RCT(s)	Randomised Controlled Trial(s)
TFR	Total Fertility Rate
USS	Ultrasound Scan
WHO	World Health Organization

## Glossary of Terms

Birth Rate	Births per 1,000 women aged 15-49 years
Parity	Parity indicates the number of previous births at more than 20 weeks gestation
Private LMC	Includes lead maternity carers who are independent midwives, GP obstetricians, or private obstetricians
Resident	In this report a resident refers to a woman who lives in Counties Manukau DHB rather than being an official resident of New Zealand. Residency status and eligibility for free care was not an available data variable. When identified, women who usually resided outside of New Zealand were excluded
Total Fertility Rate	The average number of children a woman is likely to have during their lifetime based on age-specific birth rates



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## Executive Summary

Counties Manukau District Health Board (CMDHB) has a significantly higher perinatal mortality rate than the national rate (Figure 1).<sup>1-3</sup> This finding stimulated the development of a CMDHB perinatal mortality project to describe the epidemiology of perinatal mortality in CMDHB and review the CMDHB model of antenatal care in order to inform initiatives to improve perinatal mortality in CMDHB.

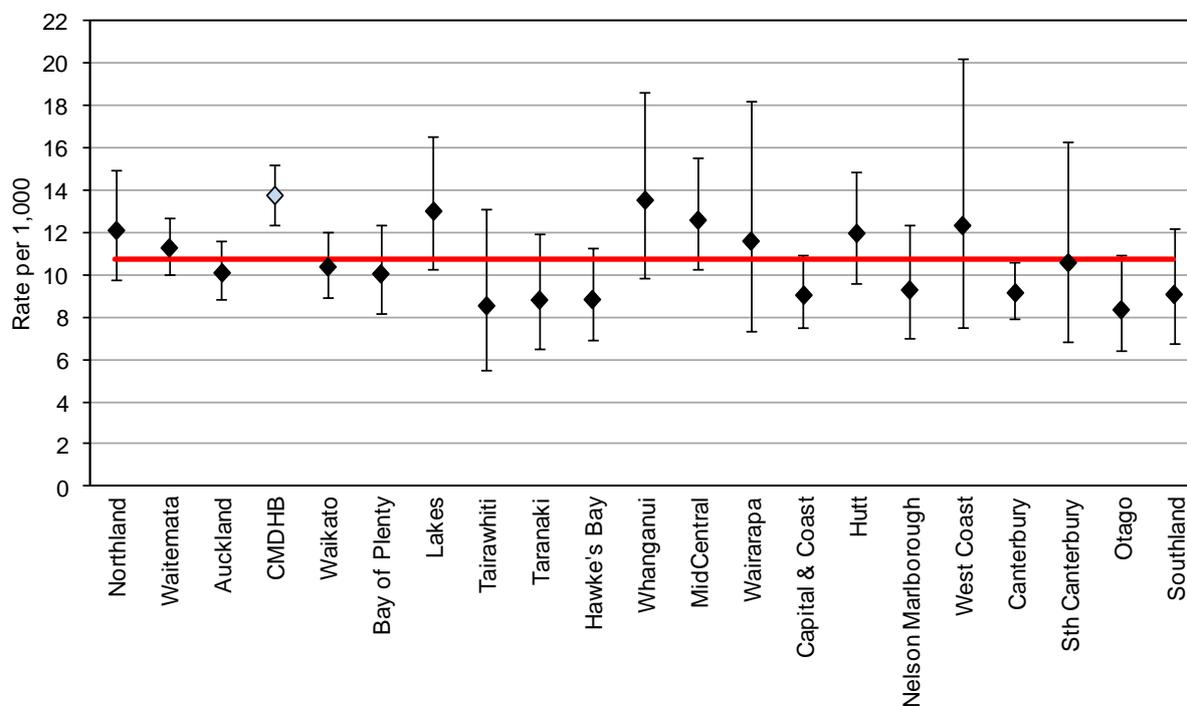
The decision to review antenatal care in CMDHB was made with the rationale that initiatives aimed at reducing perinatal mortality are likely to occur within the context of antenatal care. The objectives for this aspect of the perinatal mortality project were to:

1. Describe the population who need antenatal care in Counties Manukau
2. Describe the existing antenatal service and models of care provided by CMDHB, including utilisation and timing of care
3. Outline the best practice in antenatal care for such a population from the literature
4. Undertake a gap analysis including any information shortcomings
5. Recommend any changes to the models of care indicated by this analysis including a monitoring framework to assess the success of any changes.

This reports focuses on the CMDHB antenatal care review and provides an overview of primary maternity services in New Zealand, describes the CMDHB maternity population, examines the provision and use of CMDHB maternity services with an emphasis on antenatal care, and reviews the literature on antenatal models of care.

A companion report, *Perinatal Mortality in Counties Manukau DHB*, examines perinatal mortality in CMDHB resident women in detail, identifying the key drivers in this population.<sup>4</sup>

**Figure 1: Perinatal related mortality rates by DHB of residence, 2007-2009**



Source: PMMRC<sup>3</sup>. Note: Red line shows national perinatal mortality rate. Error bars indicate 95% confidence interval.

## Main Findings

The main findings of this report on antenatal care in CMDHB are summarised in brief here, and discussed in more detail in Chapter 7.

### 1. Maternity data need to be improved at both a national and local level.

Currently available maternity data at a national and local CMDHB level are inadequate and make examining antenatal care and antenatal outcomes in a robust method challenging (see Chapter 2). As a consequence, the capacity to make evidence based recommendations and to undertake high quality evaluations of services or new initiatives is limited.

**IMPORTANT CAUTION:** CMDHB maternity data are captured in an information system called Healthware; however, the accuracy of these data are unknown. Therefore the analyses presented in this report should be considered exploratory, and were performed in order to stimulate discussion, hypothesis generation, further research, and to inform the strengthening of data collection in CMDHB.

### 2. The CMDHB maternity population differs from elsewhere in New Zealand.

The population make-up of CMDHB's childbearing age and maternity population is significantly different from elsewhere in New Zealand. CMDHB mothers are younger on average than mothers across New Zealand and a greater proportion are Maaori, Pacific and Asian, and live in areas of high socioeconomic deprivation (see Chapter 3 and section 7.1.2). At least four out of five CMDHB women (6,075 women) that deliver each year are at increased risk of experiencing a perinatal death using PMMRC defined flags (see 7.1.5).

### 3. The CMDHB model of antenatal care has aspects that differ from elsewhere in New Zealand.

CMDHB provides a range of maternity services that are for the most part the same as those provided elsewhere in New Zealand (see Chapter 4 and section 7.1.3). In addition to primary maternity services available from a private lead maternity carer (LMC) or hospital midwife, CMDHB women can also chose to have Shared Care led by their GP which includes three antenatal visits with a DHB employed community midwife and delivery by a CMDHB employed midwife. GPs that offer Shared Care enter into a contractual relationship with CMDHB; this option was developed in response to a private LMC shortage.

### 4. The CMDHB model of antenatal care is consistent with guidelines in key areas.

For the most part, the CMDHB model of antenatal care is in line with international guidelines (see Chapter 6 and section 7.1.4). The implementation of two addition recommendations made by the National Institute of Health and Clinical Excellence (NICE) should be considered; namely early initiation of antenatal care before 10 weeks gestation and an early antenatal scan at 10-13 weeks (in addition to the 18 week anatomy scan). The rationale for these recommendations are discussed in sections 6.2 and 7.1.4.

### 5. The capacity for antenatal care to further improve perinatal outcomes is limited.

Antenatal care is necessary, but not sufficient, for optimising outcomes for mothers and infants, and is the vehicle via which components of antenatal care with proven effectiveness are delivered to pregnant women (see sections 6.1, 6.2.3, and 7.1.5). Antenatal care is not an appropriate vehicle for interventions that are best implemented prior to pregnancy occurring including prevention of unwanted pregnancy, pre-pregnancy folic acid, smoking cessation, weight loss, and glucose control in women with diabetes. These risk factors, and others, are making a significant contribution to excess perinatal mortality in CMDHB.<sup>4</sup>

### 6. Engagement of CMDHB women with antenatal care could be improved.

During 2007-09, an average of 190 CMDHB women who delivered in CMDHB had no evidence of antenatal care and were Unbooked (Chapter 5 and 7.1.6). In addition, just over

a third booked very late in pregnancy (after 18 weeks) limiting the capacity to offer screening or health promoting interventions. Data to evaluate utilisation of CMDHB maternity care once care had been initiated were limited; however Healthware data suggests that 48% of women with Shared Care, and 30% of women with CMDHB community midwife led care (Closed Unit), did not attend their expected number of CMDHB midwife visits.

Taking these findings in conjunction with those presented in the companion report, *Perinatal Mortality in Counties Manukau DHB*, three important additional conclusions were drawn.

**1. The current CMDHB model of care is not contributing negatively to the perinatal mortality rate**

Analyses presented in a companion report entitled *Perinatal Mortality in Counties Manukau DHB*, did not find evidence to suggest that the current model of care in CMDHB is contributing to higher perinatal mortality.<sup>4</sup> Perinatal mortality rates did not differ significantly by primary maternity provider in CMDHB (i.e. CMDHB midwife, private LMC or Shared Care led care). Higher rates were observed for women under Secondary Care; however this was expected as these women are under specialist care because they are deemed high risk.

**2. Improving appropriate engagement with antenatal care may result in modest improvements in pregnancy outcomes for CMDHB women and their infants**

There was some evidence from the analysis of CMDHB perinatal mortality data that having no antenatal care was independently associated with stillbirth in very low birth weight infants (<1,500g: adjusted odds ratio 5.1 (95% CI: 1.7-16.1) p=0.0048) after controlling for the effects of ethnicity, maternity provider, being small for gestational age, and gestation at delivery. In contrast, the same association was not found for stillborn infants weighing 1,500g or more at birth, or for neonatal mortality. Few women (17%) met the NICE recommendation for early initiation of antenatal care (<10 weeks). While this recommendation has been made, it is unknown how widely this is known by the child-bearing population or by maternity providers in CMDHB.

Increasing appropriate engagement, early initiation and an appropriate number of visits, in conjunction with early ultrasound scan at 10-13 weeks may result in improvements in pregnancy outcomes; however the gains are likely to be modest.

**3. The capacity for antenatal care to improve perinatal outcomes is limited by the significant contribution of risk factors best addressed prior to pregnancy**

The changes required for improving perinatal mortality in CMDHB are primarily behavioural and include planning pregnancy, weight management, improving nutrition, smoking cessation, engagement in antenatal care. These changes are best made in the childbearing population and not during pregnancy, emphasising the need for a life course approach to women's health. Among the risk factors contributing to increased odds of perinatal mortality in CMDHB women, smoking during pregnancy (most prevalent in CMDHB Maaori women) and obesity (most prevalent in CMDHB Pacific women) remain independently associated.

Careful consideration of initiatives to improve women's health during their child bearing years to improve pregnancy outcomes need to be considered so as not to increase disparities. Growing Up in New Zealand recently reported that 40% of pregnancies are unplanned, and the prevalence increases with decreasing education suggesting that implementing pre-pregnancy counselling and medical advice via primary care may not target women at high risk of a poor pregnancy outcome.<sup>8</sup> Population level approaches delivered to all women of child bearing age would be more appropriate in CMDHB.

## Recommendations

### Regarding Maternity Information Systems

CMDHB is well placed to contribute to the improvement of maternity data collection at a local and national level. The analysis of maternity data for this project was challenging and has informed the following recommendations:

#### Recommendations for the Ministry of Health

- 1) That CMDHB support the development of a national maternity information system.
- 2) That CMDHB support the following recommendations made by the PMMRC in 2010 regarding the collection of birth registration data<sup>2</sup>:
  - a) The current birth registration dataset should be required to henceforth include maternity data (e.g. parity, major complications, mode of birth, history of smoking, and previous obstetric history).
  - b) New legislation should enable Births, Deaths and Marriages to accept National Health Index data for the mother and infant.

#### Recommendations for Counties Manukau District Health Board

- 1) That CMDHB make the following recommendations to the Ministry of Health:
  - a) That submission of maternity data to a national maternity information system be mandatory for all practitioners providing publically funded maternity services.
  - b) That the current birth registration dataset be required to henceforth include antenatal care data, including as a minimum LMC at first registration, LMC at delivery, date of first antenatal scan, gestation as measured by the first antenatal scan, gestation at first antenatal visit, and number of antenatal visits.
- 2) That the development of a web-based maternity information system for CMDHB include the following features:
  - a) Database documentation including a data dictionary to inform staff training, standardise definitions, standardise data entry, and facilitate research.
  - b) The collection of essential information for action only – to inform clinical decision making and quality improvement activities.
  - c) The capacity for Shared Care providers and private LMCs to enter data. Consideration could be given to how this activity could be incentivised, for example via CME recognition, the capacity to self-generate performance reports by provider or provider group.
  - d) Improved inbuilt logic checks to improve data accuracy.
- 3) That the process for collecting ethnicity data in CMDHB be reviewed and that the Maternity Registration Form be amended to include the ethnicity standard question developed for use in the health sector<sup>56</sup>.

## Regarding the CMDHB Model of Antenatal Care

- 1) That CMDHB implement the PMMRC recommendation for the early initiation of antenatal care before 10 weeks gestation.<sup>2</sup> A recommended schedule of activities is as follows:

### *Phase I - Pre-implementation*

- i) Engagement with maternity providers indicating the intention to implement this recommendation, including the rationale, and to provide an opportunity for consultation.
- ii) Local research to identify barriers to early initiation of antenatal care for CMDHB women and maternity providers, some of which is currently in process. This should include maternity service funding related barriers.
- iii) Development of a monitoring framework. This could be achieved by adding the date of the first antenatal visit, and the provider type (e.g. Private, Shared Care GP, other GP, community midwife etc.), to the CMDHB Booking Form and to Healthware, and by developing a Healthware report to enable monitoring. This could be implemented prior to the development of a web-based system, and data collection should commence well in advance of implementation in order to establish an accurate baseline rate of early initiation of care.
- iv) Review of the current schedule of antenatal visits offered to women using Shared Care or Closed unit care.

### *Phase II - Programme Design and Implementation*

- v) Informed by the activities of Phase I and the findings of this project, a strategy specific to CMDHB can be designed with the aim of increasing the number of women who initiate antenatal care by 10 weeks gestation.
  - vi) Development of a communication strategy targeting those with the lowest odds of early initiation of antenatal care, Maaori and Pacific women, women aged <25 years old, and women with a parity of three or more.
  - vii) Evaluation of this strategy using the monitoring framework developed in the pre-implementation phase, with a process of reporting back to key stakeholders and maternity provider groups.
- 2) That CMDHB implement the NICE guidelines recommendation for an early dating ultrasound scan between 10 and 13 weeks, in addition to the 18 week anatomy scan.<sup>21</sup> To monitor implementation the date of the first antenatal scan, and EDD by this scan, could be added to the Booking Form.
  - 3) That CMDHB pilot group antenatal care targeting women who have high odds of inadequate utilisation of antenatal care including Maaori, Pacific, women aged <25 years, and women of high parity. An evaluation framework should be devised to include measures of engagement (date of first visit, screening uptake, date of first antenatal scan, attendance) as well of measures of service quality (e.g. felt I could contribute to group discussions, made to feel included, discussion topics were appropriate, felt listened to and taken seriously, venue was easy to get to etc).
  - 4) That CMDHB consider a focus on programmes for preventing unintended teenage pregnancy<sup>171</sup>, and preventing rapid repeat pregnancy in teenage mothers e.g. via long-term contraception<sup>172, 173</sup> or motivational interventions<sup>174</sup>.

Additional recommendations are made in the companion report, Perinatal Mortality in CMDHB.<sup>4</sup> These include recommendations for community engagement and pre-conception care.



# Chapter 1. Maternity Care in New Zealand

New Zealand has a unique maternity care model, driven by the premise of a woman's right to choose, with significant changes made to the funding framework over the last two decades, and marked changes in the maternity workforce. This Chapter provides an overview of the maternity model in New Zealand, and briefly describes some of the concerns that have been prominent in recent years.

There have been two major legislative milestones. In 1990, the *Nurses Amendment Act* was passed enabling midwives to practice independently, access hospital beds, prescribe medications, and claim from the Maternity Benefit Schedule on a fee-for-service basis.<sup>29</sup> The Act also provided for direct entry midwifery training removing the prerequisite for training as a registered nurse.<sup>30</sup> In 1996, the lead maternity care model was introduced and defined under *Section 51* of the *Health and Disability Services Act 1993* (later *Section 88*).<sup>29, 31-33</sup>

## 1.1 Lead Maternity Care Model

The intention of the lead maternity care model is that one practitioner, the Lead Maternity Carer (LMC), will take responsibility for assessing the needs and planning the care of a woman and baby through her pregnancy, labour and birth, and post-partum period, ensuring that all applicable primary maternity and well child services are provided.<sup>33</sup> A woman is required to register with a single LMC who may be a midwife, general practitioner obstetrician (GPO), specialist obstetrician, maternity provider, or an employee or contractor of a maternity provider, who then holds the budget for her primary maternity care.<sup>33</sup> While a woman can change LMC at any time, she can only be registered with one LMC at any one time.

Most women delivering in New Zealand should only require primary maternity services and referral guidelines have been developed for LMCs to guide appropriate access to specialist services and transfer to secondary and tertiary services (Appendix 1). These guidelines specify maternal or infant conditions that may place mother or infants at risk of a poor outcome and define three levels of referral and consequent action:

1. Level 1: Referral optional;
2. Level 2: LMC must recommend specialist consultation; and
3. Level 3: LMC must recommend transfer to secondary or tertiary services.

The lead maternity carer model allows the LMC to continue to caring for a woman following a Level 1 or Level 2 referral if care is not transferred. If transfer to secondary or tertiary services occurs prior to the onset of established labour, the funding model does not support the ongoing provision of primary midwifery maternity services by a midwife LMC. However, if the transfer to secondary or tertiary maternity services occurs after labour has been established, midwife LMCs are still able to claim for primary maternity midwifery services provided. In this situation, if the midwife LMC feels that the woman's care is outside of her scope of practice, she is able to transfer her care to a hospital midwife.<sup>29</sup> Generally care is transferred back to the midwife LMC once the need for additional secondary or tertiary services has passed.

## 1.2 Primary Maternity Services

Primary maternity services are provided by LMCs and legislated for under *Section 88* of the *New Zealand Public Health and Disability Act 2000 Primary Maternity Services Notice* (Table 1).<sup>33</sup> This legislation defines primary maternity services and sets out the terms and

conditions for payment for providing such services. In 2007, LMC payments were made to 1126 midwives, 63 GPOs, and 47 obstetricians across New Zealand.<sup>34</sup>

**Table 1: Primary Maternity Services Defined in Section 88**

<b>Services Included</b>	
<b>Service</b>	<b>Description</b>
Lead maternity care	Continuity of care throughout pregnancy, labour and birth, and the post-natal period provided by a LMC
Maternity non-LMC services	Services that are in addition to lead maternity care or sought on a casual basis outside lead maternity care including: <ul style="list-style-type: none"> <li>• Non-LMC first trimester services <ul style="list-style-type: none"> <li>○ Confirmation of pregnancy and pregnancy advice</li> <li>○ Miscarriage services</li> <li>○ Termination of pregnancy services</li> </ul> </li> <li>• Non-LMC urgent pregnancy care</li> <li>• Non-LMC rural labour and birth support</li> <li>• Non-LMC urgent post-natal care</li> </ul>
Specialist medical maternity services	May only be provided on written referral and includes: <ul style="list-style-type: none"> <li>• USS for approved clinical indications</li> <li>• Consulting obstetrician services in accordance with the Referral Guidelines</li> <li>• Consulting paediatrician services in accordance with the Referral Guidelines</li> </ul>
<b>Services Excluded</b>	
<ul style="list-style-type: none"> <li>• Negative pregnancy test</li> <li>• Consultations for medical conditions not related to pregnancy, including medical conditions exacerbated by pregnancy except where included in lead maternity care</li> <li>• A service given more than 6 weeks after the birth</li> <li>• A services given more than 2 weeks after a miscarriage or termination of pregnancy</li> <li>• Caesarean section</li> <li>• Dilation and curettage</li> <li>• Circumcision</li> <li>• Termination of pregnancy</li> <li>• Radiological imaging other than USS</li> <li>• USS that are not for listed approved clinical indications</li> <li>• The following services: <ul style="list-style-type: none"> <li>○ Maternity facility services</li> <li>○ Birthing unit services</li> <li>○ Secondary maternity services</li> <li>○ Tertiary maternity services</li> <li>○ Specialist neonatal services</li> </ul> </li> <li>• Cost of vaccines provided</li> <li>• Consultation in the second or third trimester with a non-LMC GP for a second opinion</li> <li>• Other non-specified services</li> </ul>	

Source: New Zealand Government<sup>33</sup>. Note: USS: Ultrasound Scan

Section 88 defines the objectives of primary maternity services as to:

- a) give each woman, her partner, and her whānau or family, every opportunity to have a fulfilling outcome to the woman's pregnancy and childbirth by facilitating the provision of primary maternity services that are safe, informed by evidence and that are based on partnership, information, and choice; and

- b) recognise that pregnancy and childbirth are a normal life-stage for most women; and
- c) provide the woman with continuity of care through her LMC who is responsible for assessment of her needs, planning of her care with her and the care of her baby; and
- d) facilitate the provision of appropriate additional care for those women and babies who need it.<sup>33</sup>

Primary maternity services are funded by the Crown. LMC services provided by a midwife or general practitioner must be provided free, however specialists may charge additional fees. Provider payments are sectioned into modules for first, second and third trimester services, labour and birth, and post-natal services (Appendix 2). Additional payments for non-LMC and specialist single service episodes, covering selected components of care that do not fit well into the modules, can be claimed by the service provider on a fee-for-service basis. The number of fee-for-service components has decreased since the 1990s.

In 1998, Section 88 was changed to allow maternity providers (e.g. District Health Boards (DHBs) and primary health organisations (PHOs) to act as LMCs and claim primary maternity funding. In 2007, Section 88 was further amended so that DHBs could no longer claim for providing primary maternity care via this route.<sup>33</sup> Instead, DHB provided primary maternity services became bulk-funded based on the level of primary maternity services were provided in recent years.

### **1.3 Other Maternity Services**

Publically bulk-funded hospital-based secondary and tertiary maternity services and specialist neonatal services are provided free of charge to women and their infants. These services are defined in national Service Specifications by the Ministry of Health.

#### **1.3.1 Secondary Maternity Services<sup>35</sup>**

Secondary maternity services are available from 20 weeks gestation to six weeks following the birth for women and babies who experience complications and who have a clinical need for referral or transfer on a planned or emergency basis in accordance with the referral guidelines. With the exception of emergency situations, access is via written referral following a three way discussion between the LMC, specialist, and the woman. Women who present to a secondary maternity service in labour without an LMC must be accepted for care.

Eligible women and babies are entitled to receive DHB provided secondary maternity services free of charge. Referral to a private specialist for secondary maternity services may incur a cost. DHBs must provide secondary maternity services that include obstetrics, anaesthetics, paediatrics, radiology, midwifery, nursing, and operating theatre staff. Service components that must be provided include inpatient and outpatient assessment and care, amniocentesis, chorionic villus sampling, lactation advice, induction of labour advice, epidurals, and operative vaginal deliveries.

#### **1.3.2 Tertiary Maternity Services<sup>36</sup>**

Tertiary maternity services are supplied on a regional basis for women with complex needs requiring a multi-disciplinary approach. These services must be provided free of charge to eligible women and babies. The multi-disciplinary teams must include obstetricians, anaesthetists, medical specialists, midwives, and ancillary staff and includes the provision of both outpatient and inpatient services. The service specifications describe situations that indicate that a woman may require tertiary maternity services and these include:

- major fetal disorders and maternal disorders requiring prenatal diagnostic and fetal therapy services;

- preterm labour prior to 32 weeks gestation;
- women with an obstetric history that increases their risk of a poor outcome;
- women with high risk medical histories;
- women with major problems in their current pregnancy.

## 1.4 Maternity Facilities

Maternity facilities provides inpatient services during labour, birth, and the immediate post-natal period in conjunction with LMCs. Women can chose to birth at any maternity facility that has a contract with a DHB. Maternity facilities can provide different levels of services including primary, secondary and tertiary maternity services. In New Zealand most are public facilities, although a few are privately owned.

Primary maternity facilities provide inpatient services during labour and birth and in the immediate post-partum period but have no on-site access to medical or obstetric facilities. There are also a small number of birthing units which are used during labour and delivery only, with no post-partum inpatient facility. In 2008, there were 52 primary maternity facilities in New Zealand (including 4 birthing units) that were either stand-alone facilities or attached to community hospitals.<sup>29</sup> LMCs must be given access to the use of primary maternity services facilitated via an access agreement.<sup>37</sup> Secondary and tertiary maternity facilities are situated in public hospitals and provide specialist services.

## 1.5 Reviews of the New Zealand Model of Care

Maternity services in New Zealand have been the focus of a number of reviews since the introduction of the lead maternity carer model.<sup>29, 38, 39</sup> While several concerns have been raised, those that feature prominently and still appear to be relevant, are described here.

### a. The System is Confusing for Providers and Women

A review of maternity services in the Wellington region in 2008 identified confusion in the use and understanding of the terms primary, secondary, and tertiary in relation to maternity services and their funding.<sup>29</sup> Contributing to this is a lack of consistency across key documents including the Section 88 legislation and maternity services specifications.<sup>33, 35, 36</sup>

For example, the primary maternity notice states *“there can be no claim for lead maternity care if a woman has transferred to secondary maternity or tertiary maternity for an entire module”* and *“if responsibility for a woman’s care transfers to a secondary maternity service or tertiary maternity service after established labour, the woman’s LMC may continue to support the woman”*.<sup>33</sup> However, the tertiary service specifications state *“women accessing Tertiary Maternity Services will continue to have access to LMC services”*.<sup>36</sup> In addition, both the secondary and tertiary service specifications state *“if the woman does not consent to a transfer of clinical responsibility, the Secondary/Tertiary Maternity Service will offer to provide specialist consultations in conjunction with the LMC and all decisions are to be documented”*.<sup>35, 36</sup>

Two surveys of women who had recently used maternity services suggest that women do not fully understand the maternity system.<sup>7</sup> In 2002, 23% of women surveyed did not know they needed to chose and register with a LMC, and by 2007 after a decade of the LMC model this had only declined to 20%.<sup>7</sup>

## **b. Maternity Care is Not Always Easy to Access**

Maternity workforce issues have existed since the LMC model was instituted. Workforce shortages have made it difficult for women to access maternity care, and changes in the make-up of the workforce have restricted choice of carer for some. In 2007, a survey of women who had recently used maternity services reported that 19% experienced difficulty finding a LMC to provide their care, an increase from 11% in 2002.<sup>7</sup> More recently, the Growing Up in New Zealand Study including women living in Auckland, Counties Manukau, and Waikato DHBs, reported that 11% of women living in urban areas were not able to get their first choice of LMC<sup>8</sup>. In these women, the preferred provider was an independent midwife in 50%, while others would have preferred obstetrician (17%), GP (11%) or shared care (9%) between their GP and a midwife.<sup>8</sup>

That some New Zealand women have no or little antenatal care has been reported in local studies and surveys<sup>7, 8, 20, 40</sup>, however the current prevalence of women having no or little antenatal care in New Zealand remains unreported or unknown. While two local studies from 1992<sup>41</sup> and 2005<sup>42</sup> report demographic characteristics associated with antenatal care non-attendance, no research studies examined the barriers to accessing antenatal care for New Zealand women were identified.

## **c. Maternity Care is not Entirely Free**

Primary maternity services are supposed to be free for eligible women. However, in a 2007 survey, 72% of women reported having to pay for services that they considered were related to their pregnancy, childbirth and post-natal needs, an increase from 50% in 2002.<sup>7</sup> While this finding may suggest that women's expectations of their entitlements are too high, or that women do not completely understand the NZ system and how to access free services, cost is frequently cited as a barrier to accessing healthcare, including maternity care.<sup>24, 25, 43, 44</sup>

Of concern, 10.2% of the women surveyed reported having to pay for a positive pregnancy tests (average cost \$28). This could pose a barrier to the timely initiation of antenatal care in some populations. In addition, 62.3% of women surveyed reported having to pay for an antenatal ultrasound scans (average cost \$78). As antenatal scans can only be accessed via referral, with strict referral criteria, the possibility of women forgoing a scan due to the cost is concerning and should be examined further.

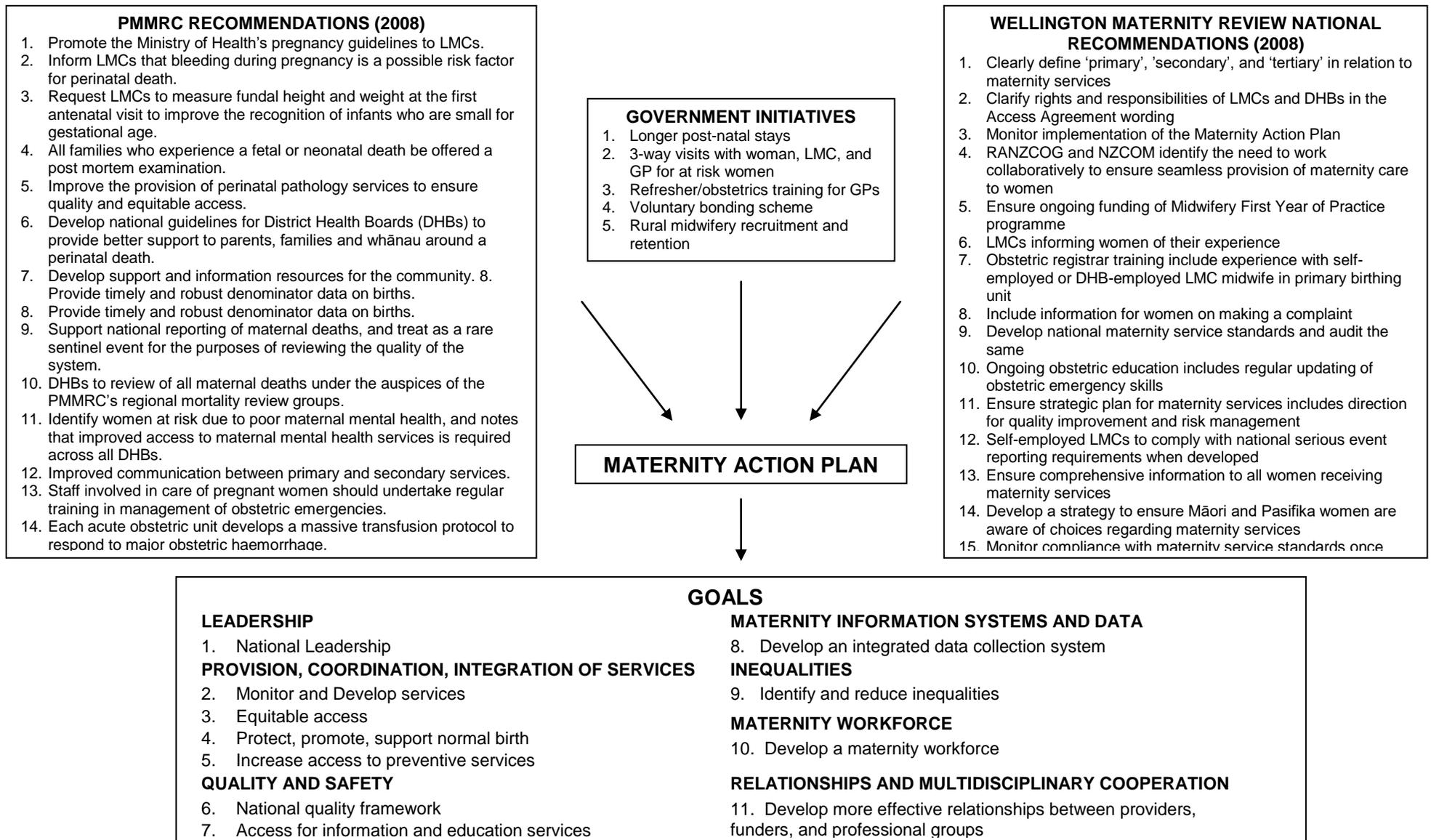
## **d. There are no National Standards for the Provision of Maternity Care**

There is currently no single source of national guidelines or standards for the provision of maternity care in New Zealand. A list showing the range of publically available documents that provide guidelines for care during pregnancy, delivery, and the early post-natal period for providers of maternity services can be found in Appendix 3. These are produced by a large number of organisations, some are out dated with no set revision process, are non-standardised, and not all provide a systematic review of the literature in support of recommendations made. However, in mid 2010, the Minister of Health announced that a set of national maternity standards are to be developed and that the revision of the Maternity Referral Guidelines had been initiated.<sup>45</sup>

## **e. Maternity and Newborn Data are Inadequate**

There is currently no national maternity and newborn data collection which hampers the development and evaluation of evidenced based strategies to improve maternity outcomes for New Zealand women and children. In particular, data on antenatal care use and risk factors for poor outcomes, including smoking, obesity, and diabetes in pregnancy, is lacking.

**Figure 2: Wider Context for the Maternity Action Plan**



Source: Ministry of Health<sup>46</sup>

## 1.6 National Maternity Strategy

In 2009, a draft national Maternity Action Plan with 11 goals was distributed for consultation but never finalised, therefore there is no current national plan or strategy for maternity.<sup>47</sup> In crafting the Maternity Action Plan, current Government initiatives and recommendations from the PMMRC and the Wellington Maternity Services Review were taken into consideration and an overview of the wider context for the Maternity Action Plan developed (Figure 2).

In early 2010, the Ministry of Health announced 4 priority action areas for maternity:

- Developing a quality and safety programme for maternity services;
- Reviewing and updating the Guidelines for Consultation with Obstetric and Related Specialist Medical Services;
- Developing a national standard set of maternity notes that can be transferred electronically;
- Improving maternity and newborn information to better monitor quality and safety.<sup>48</sup>

## 1.7 Chapter Summary

New Zealand has a unique system of maternity care. Despite the LMC model being in place for more than a decade, confusion regarding how the systems works, and how it should be accessed appears to be an ongoing issue for New Zealand women. In addition, although the model of care aimed to increase a woman's choice, it appears that choice is constrained by the knowledge of the system and the availability of maternity providers, suggesting that the opportunity to chose may not be equitably distributed.

Encouragingly, recent Ministry of Health initiatives include the development of maternity standards, a quality framework, and the development of a maternity and newborn information system.<sup>48</sup> These tools should allow better monitoring of the provision and quality of maternity care in New Zealand, and inform the development and evaluation of appropriate and evidenced based strategies to improve maternity outcomes and reduce disparities.



## Chapter 2. Examining Maternity Care

There is currently no comprehensive national maternity data collection in New Zealand. Data has been unavailable from the Maternity and Newborn Information System (MNIS) for several years. The MNIS was started 1998 and collated and reported on perinatal data from Section 88 claims; however coverage was incomplete and in 2004 only 77% of registered births were captured in the MNIS.<sup>49</sup> The last publication from this dataset was in 2007, reporting on births that occurred in 2004 using a combination of MNIS and data from the National Minimum Dataset (NMDS). Since this time Ministry of Health reports on maternity have used NMDS data only, which do not contain any information on antenatal care.<sup>5, 6</sup> Improving maternity and newborn information to better monitor quality and safety is a current priority for the Ministry of Health, and the development of a national maternity information system is a current work stream to which CMDHB is contributing.

This Chapter describes the data sources used in this report, including the Birth Registration Dataset, the National Minimum Dataset, and Healthware. The strengths and limitations of each are discussed. In addition, a literature review was undertaken and the methodology used is described.

### 2.1 Birth Registration Dataset

The Birth Registration Dataset (BRDS) is a register of all births in New Zealand and is maintained by the Department of Internal Affairs. The *Births, Deaths, Marriages, and Relationships Registration Act 1995* requires registration and of all live and stillborn infants that weigh 400g or more at birth or that were born after 20 weeks of pregnancy, including those resulting from a termination of pregnancy.<sup>50</sup> Hospitals and LMCs are required to notify Internal Affairs of births that require registration under the act within 5 days of the birth occurring by submitting the mother's contact details and the infant's gestation and birth weight.<sup>51</sup> In addition, parents are required to complete a Notification of Birth for Registration form as soon as is reasonably practical after birth, and within 2 years.<sup>52</sup> Once both notifications are received by Internal Affairs they are merged into one record.

#### 2.1.1 Strengths

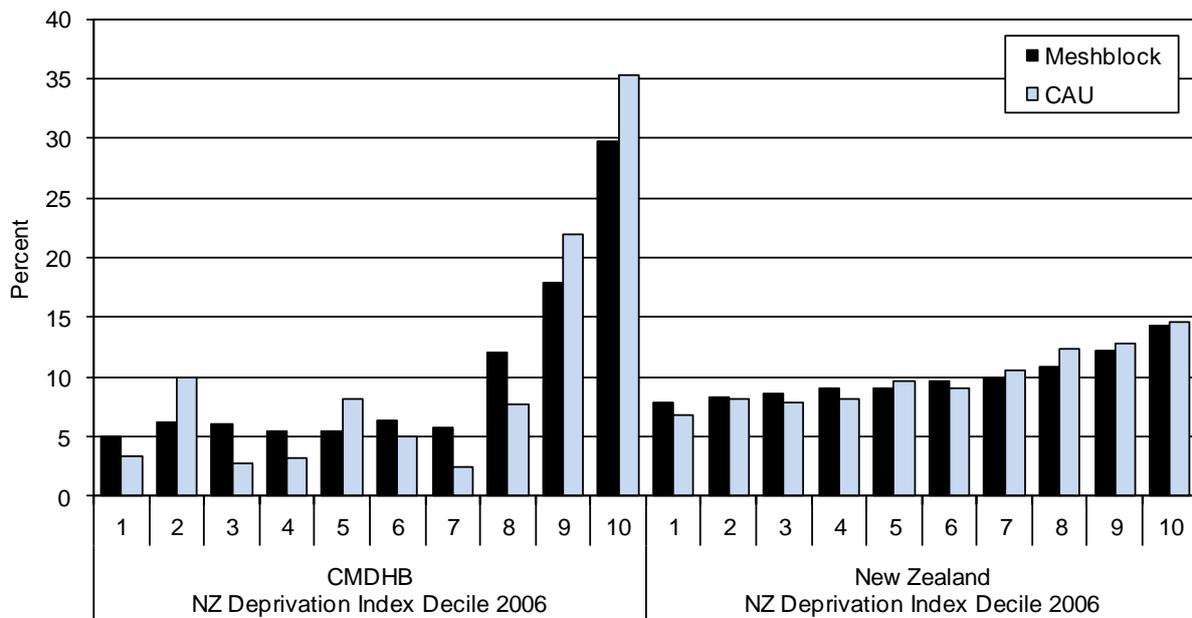
The BRD is the most complete measure of the number of births in New Zealand and it is estimated that 99.9% of births in New Zealand are captured, including both hospital and home births. The BRD captures demographic data for the mother, father, and infant. In addition, occupation, citizenship, the number of children from the current relationship, and the nature of the parent's relationship are recorded, as are birth weight, gestation, and birth order in the case of multiples, and the outcome of the birth (live or stillborn).

The recording of ethnicity in the BRD is considered to be of exceptionally high quality, as it is self-reported from the birth registration form that the parents complete, and is thought to be more accurate than ethnicity recorded in the NMDS. The PMMRC have recommended that ethnicity recorded in the NHI dataset be updated from the BRD.

The BRD codes the mothers address at meshblock level, unlike the NMDS in which captures area of residence at the census area unit (CAU) level. The New Zealand Deprivation Index (NZDep) is determined at the meshblock level (based on 90-100 people), and a weighted average is provided at CAU level (based on 3,000-5,000 people). It is an area based measure of deprivation, with decile 1 representing the least deprived 10% of small areas and decile 10 representing the most deprived 10% of small areas. Therefore, while the decile is for the area a woman lives in and not for her personally, it is likely to be a better reflection of her socio-economic status the smaller the area is. When comparing the distribution of women who delivered in 2007-09 across the NZDep deciles at a national level, CAU deciles

tend to over-estimate the proportion living in the most deprived areas and underestimate the proportion living in the least deprived area (Figure 3). For CMDHB, the difference between meshblock level and CAU level deciles is more marked due to way in which affluent and deprived meshblocks are distributed around the DHB, with pockets of affluence within deprived area and vice versa. When undertaking analyses by NZDep it is essential that the numerator and denominator deciles were assigned in the same way (i.e. both at CAU level, or both at meshblock level).

**Figure 3: Mothers by NZ Deprivation Index Decile 2006 at Meshblock vs Census Area Unit level, 2007-2009**



Source: Birth registration dataset

### 2.1.2 Limitations

Parents have up to two years to register a birth, and a birth will not appear in the BRD until this has been done. When using the BRD as a denominator, year of registration and not year of birth is usually used, even though this means that some births will be included that occurred in earlier years.<sup>2</sup> This maintains a consistent methodology over time, and avoids underestimating the total number of births for the current year which would occur if late registrations were excluded because a number of births in the current year will not yet have been registered. During 2007-09, 98% of births were registered within a year of occurring, and <1% were late registrations (registered more than two years after the birth).

Some important maternity data are not available in the BRD that would be extremely useful at a national level for investigating maternity outcomes, including information on the location of birth, maternal risk factors (e.g. smoking, body mass index), and antenatal care (e.g. LMC, gestation at the first antenatal visit, and number of antenatal visits). This level of detail is collected in the United States and has enabled sophisticated analyses of maternity outcomes and antenatal care use, identification of disparities, and informed strategies to improve maternity outcomes.<sup>53-55</sup>

The BRD does not record the National Health Index (NHI) for mothers of infants; therefore the BRD can't be linked to other datasets that contain relevant perinatal data, for example the National Mortality Collection which records fetal and neonatal deaths, or the NMDS which may capture co-morbidity data.

### **2.1.3 Use in Maternity Related Analyses**

Because of the completeness of births recorded in the BRD compared with other data sources, the BRD is the most appropriate source of denominator data for analyses involving infants under the age of one year. In particular, the BRD is used to provide denominator data for analyses of perinatal mortality by the PMMRC.<sup>1</sup>

The PMMRC have made several recommendations for the BRD to increase its utility in informing the development of strategies to improve maternity outcomes including:<sup>2</sup>

- Expansion of the dataset to include key maternity data such as parity, major complications, mode of birth, history of smoking, BMI, and previous obstetric history
- Inclusion of maternal and infant NHI's

The addition of extra data to the BRD could be accomplished ahead of the implementation of a national maternity information system, providing essential information for developing maternity strategies. This could be accomplished by adding to the required data submitted by the hospital or LMC. In addition to those data suggested by the PMMRC, consideration should be given to collecting LMC and antenatal care data.

## **2.2 National Minimum Dataset**

The National Minimum Dataset (NMDS) is maintained by the Ministry of Health and is a national collection of publically funded hospital discharge information, including clinical information, for inpatients and day patients. All hospital admissions during pregnancy are captured in this dataset, and birth events are recorded for both mothers and infants.

### **2.2.1 Strengths**

In-hospital birth events are recorded for both mothers and infant's allowing analyses of either the maternal or the infant's data. NMDS data are readily available, and include maternity data not currently captured in other datasets including location of birth, type of birth (forceps, caesarean, etc), hospital admissions that occurred during pregnancy, and clinical data in addition to demographic data.

Patients in the NMDS are assigned a code that identifies their DHB of usual residence, so hospital data are available for CMDHB resident women, irrespective of where they were admitted during their pregnancy, or which hospital facility they delivered in.

### **2.2.2 Limitations**

The NMDS only captures births that occur in hospital; therefore homebirths and births that occur before arrival at hospital (e.g. in a car or ambulance) are not captured. In addition, very limited antenatal care data are recorded, and the completeness and quality of these data are unknown. The event of a stillbirth is recorded in maternal records, but an infant record is not created.

Data from the NMDS are not a good source of delivery facility prior to 2009 because only one birth event was captured for each delivery. Therefore, if a woman birthed in one facility and had her postnatal care at a different facility, it was the latter facility that was captured at discharge. Since 2009, in-hospital postnatal care has been recorded as a separate event; so the facility for the birth event is a better reflection of birth location.

The NMDS captures a domicile code at birth for each woman and infant based on their residential address at that time. Domicile codes map to Census Area Units, and therefore do

not provide as good an indication of socio-economic status compared to meshblock data (see section 2.1.1).

### **2.2.3 Use in Maternity Related Analyses**

A comparison of births captured by the NMDS and the Birth Registration dataset shows that during 2005-2009 95.2% of registered live births were recorded on the NMDS (97.5% for CMDHB). Because not all births are captured, NMDS data should only be used for analyses of hospital events only.

Only live born infants have a birth record in the NMDS, so the NMDS is not a good source of data for stillborn infants and underestimates stillbirth rates. In addition, neonatal deaths in the first 27 days of life are only recorded in the NMDS if the death occurred in hospital, therefore the NMDS under-estimates neonatal mortality. Therefore perinatal mortality based on NMDS data is also underestimated.

## **2.3 Healthware**

Healthware is a software package used at CMDHB since October 2004 to capture maternity data, replacing Terranova which was implemented in the late 1990's. A local database for maternity data was necessary to enable claiming for the provision of primary maternity services under Section 88; however this function is no longer needed as DHBs are now bulk-funded for these services.

Healthware has undergone various upgrades since its introduction but remains clumsy and difficult to use. Recently, the requirements of a web-based maternity data system for the DHB has been scoped, and CMDHB has had input into the development of a national system. It is likely to be several years before a national maternity data system is in place.

Healthware is used to record antenatal, labour and delivery, and postnatal data for the women and their infants that use CMDHB maternity services. Data are generally entered by CMDHB employed midwives and CMDHB administrative staff. Private LMCs and Shared Care GPs do not currently enter data directly into the system.

### **2.3.1 Strengths**

Healthware provides a rich source of data not available from other sources including maternity service provider, booking date, estimated delivery date (EDD), antenatal visit data, body mass index, smoking, alcohol use, and parity. In Healthware mothers can be linked to their infant's, allowing more in depth analyses to be performed.

### **2.3.2 Limitations**

Data are limited for women who do not received CMDHB provided care, i.e. those women with a private LMC with Shared Care, and generally limited to booking and delivery information. In addition, antenatal care data for women under Secondary Care are limited in Healthware.

During the course of this project the following observations regarding Healthware data were made:

1. *Data Access:* While several reports have been set up to extract data from Healthware, the capacity to create customised reports is limited, and therefore much of the data collected are seldom used. The lack of a Healthware data dictionary

describing data collection processes, defining variables and rules for recording data (e.g. defining Unbooked), identifying limitations and cautions, and providing a guide for data analysis is a weakness. For example, some fields allow the recording of several lines of data (e.g. Type of Antenatal Care); however in data extracts received only the first entry appeared.

2. *Data Quality*: The accuracy of Healthware data is unknown. Healthware appears to have few built in data validity checks. While several screens have a 'verification' process, it is not clear how well this functions as inaccuracies were found in data that had been 'verified'.
3. *Ethnicity Data*: The ethnicity data provided for this project came from the CMDHB Patient Information Management System (PIMS) was not prioritised ethnicity. Ethnicity data in Healthware come from PIMS. At CMDHB, ethnicity data are collected on admission to hospital by administrative staff who verbally enquires about ethnicity (personal communication: Dianne Wilson, Decision Support). If more than one ethnic group is specified, then the patient is asked to indicate which ethnic group they would like recorded first, and this is entered into the first of three fields. This is what was supplied and in accessing Healthware, this is the ethnic group displayed if more than one ethnic group was specified. This could be regarded as a preferred ethnicity. This process for collecting ethnicity data does not comply with national standards and neither does the ethnicity question on the Booking Form (see Appendix 4).<sup>56</sup>
4. *Domicile Codes*: Each woman in Healthware is assigned a domicile code based on where she lives. As it is a live database a woman's residential address is updated if she moves. Therefore, the domicile code extracted from Healthware may not coincide with where she lived at the time she delivered, if she subsequently moved residence. Domicile codes map to Census Area Units, and therefore do not provide as good an indication of socio-economic status compared to meshblock data (see section 2.1.1).

### 2.3.3 Use in This Report

While this project focused on the CMDHB resident population, Healthware captures data for CMDHB provided services therefore includes data for women who reside outside CMDHB if they use CMDHB maternity services. In addition, data collection for CMDHB resident women who delivered in a facility outside CMDHB, or that had a planned homebirth, are incomplete. Therefore, Healthware data used in this report are limited to data for CMDHB resident women who delivered in, or on route to, a CMDHB facility (Table 2). Any duplicate data were removed.

**Table 2: Healthware Data Use in This Report, 2007-2009**

Women Using CMDHB Maternity Services	25125
Excluded:	
Non-CMDHB resident women	1,900
CMDHB women delivered outside CMDHB	741
Women with deliveries <20 weeks gestation or <400g*	11
Planned home birth	6
<b>CMDHB Resident Women Delivering in CMDHB</b>	<b>22,467</b>

Source: Healthware. Note: Duplicate data were removed prior to exclusions being made. \*These births are not legally required to be registered and are not captured as births in the National Minimum Dataset or the Birth Registration Dataset.

### 2.3.3.1 Data Cleaning and Validation

Several weeks of data cleaning were undertaken in the course of this project prior to analyses being performed. The purpose of this was to increase the completeness and accuracy of the data presented here and in other reports arising from this project. Particular attention was given to the accuracy of data for perinatal deaths.

#### *Missing Data*

For key data elements, missing data were sought from other fields in Healthware or from Concerto. These included maternal date of birth, maternal ethnicity, infant and maternal domicile codes, booking date, estimated date of delivery, type of antenatal care, delivery location, delivery gestation, birth weight, height, weight, and smoking status.

#### *Inconsistent Data:*

Data inconsistencies were sought and data verified. These included verification of data in the case of date inconsistencies (e.g. date of death occurred before the date of birth, antenatal visit date after the date of birth or before the last menstrual period), a body mass index of <15 or >45, babies born with a gestation <20 weeks or >45 weeks, birth weight of <400g.

### 2.3.3.2 Comparison of Data Sourced Healthware with data from the NMDS

Data for CMDHB resident women delivering in CMDHB facilities used in this report are sourced from either the NMDS (n=22,215) or Healthware (n=22,467) as shown in Table 3. Healthware identified 252 additional deliveries. There are several potential reasons for this:

#### *1. Infants Born Before Arrival*

In Healthware, 57 infants were identified during data cleaning as being born before the mother arrived at hospital (BBA). None of these deliveries were identified as planned home births. Healthware does not have a consistent process for identifying infants that are BBA; therefore this number is likely to be an underestimate. In contrast, women's records in the NMDS do not capture births that occurred outside a hospital facility and so do not include women who delivered prior to admission to hospital.

#### *2. Assignment of Domicile Code*

Healthware is a live database and the woman's residential address is updated if she moves. The domicile code assigned during data extraction was the domicile for the infant where available, as these records are not updated again in Healthware. Where no infant domicile code was available, the woman's domicile code will be for her last known residence and this may not be the same address she lived at when she delivered in 2007-2009. In contrast, the NMDS records a woman's domicile code at the time of each birth event. Therefore, domicile code as recorded in Healthware may not be as good at determining CMDHB residency as that captured in the NMDS, and some women who did not reside in CMDHB during 2007-2009 may be included in the Healthware data.

#### *3. Non-resident Non-eligible Women*

Women who are both non-resident and eligible for free maternity care in New Zealand occasionally birth at CMDHB. It is possible that the NMDS better identifies these women and excludes them from the CMDHB population than Healthware.

In addition to 252 extra women being included in the Healthware data base, the demographic profile of the women in Healthware differed from that reported in the NMDS data (Table 3). The following observations were made:

- The ethnic profile of women in Healthware differed from the NMDS with Maori under-represented in Healthware. This difference is most likely a consequence of ethnicity data collection processes, with Healthware data being preferred ethnicity (see Section 2.3.2) and NMDS data being prioritised ethnicity.

- The age structures of these two data sources are similar, with a tendency for the additional women captured by Healthware to be older.
- The distribution by NZ Deprivation index decile and residential area differ between the two data sources. This may have occurred as a consequence of Healthware domicile coding in Healthware changing with a woman's moves. In Healthware a greater proportion of women are recorded as living in the most deprived areas (decile 9-10) whilst women living in decile 7-8 are under-represented. There is a tendency for the additional women captured in Healthware to reside in Papatoetoe or Otara.

**Table 3: CMDHB Mothers Delivering in a CMDHB Facility by Data Source, 2007-09**

	NMDS		Healthware		Difference	
	Number	Percent	Number	Percent	Number	Percent
<b>Ethnicity</b>						
Maaori	5,611	25.3	5,141	22.9	-470	-9.1
Pacific	8,172	36.8	8,209	36.5	37	0.5
Asian	2,698	12.1	2,834	12.6	136	4.8
<i>Chinese</i>	419	1.9	433	1.9	14	3.2
<i>Indian</i>	1,491	6.7	1,597	7.1	106	6.6
<i>Other Asian</i>	788	3.5	804	3.6	16	2.0
Other	5,734	25.8	6,052	26.9	318	5.3
Unknown	-	-	231	1.0	231	
Total	22,215	100.0	22,467	100.0	252	1.1
<b>Maternal Age</b>						
<20 years	2,352	10.6	2,365	10.5	13	0.5
20-24 years	5,259	23.7	5,306	23.6	47	0.9
25-29 years	5,938	26.7	5,999	26.7	61	1.0
30-34 years	4,956	22.3	5,028	22.4	72	1.4
35-39 years	2,979	13.4	3,021	13.5	42	1.4
40+ years	731	3.3	748	3.3	17	2.3
<b>NZ Deprivation Index Decile 2006(CAU*)</b>						
1-2 (least deprived)	1,787	8.1	1,830	8.1	43	2.3
3-4	1,112	5.0	1,060	4.7	-52	-4.9
5-6	2,540	11.5	2,615	11.6	75	2.9
7-8	2,726	12.3	2,080	9.3	-646	-31.1
9-10 (most deprived)	13,999	63.2	14,876	66.2	877	5.9
<b>Suburb</b>						
Howick	2,553	11.5	2,573	11.5	20	0.8
Otara	2,531	11.4	2,594	11.6	63	2.4
Papatoetoe	2,835	12.8	2,987	13.3	152	5.1
Mangere	3,736	16.9	3,789	16.9	53	1.4
Manurewa	5,178	23.4	5,180	23.1	2	0.0
Papakura	2,567	11.6	2,562	11.4	-5	-0.2
Franklin	2,764	12	2,782	12	18	0.6

Note: \*NZ Deprivation Index is at Census Area Unit level (see section 2.1.1). Ethnicity is prioritised for NMDS data and preferred for Healthware data.

## 2.4 Literature Review Methodology

A literature review was undertaken with the aim of outlining the best practice in antenatal care for maternity populations similar to CMDHB. This review focussed on reviewing the evidence on the provision and organisation of antenatal care, barriers to initiating and sustaining antenatal care, and providing antenatal care to vulnerable populations. Publications on antenatal care in New Zealand were also reviewed. The results are presented in Chapter 6 with relevant publications referenced.

Pubmed and Medline were searched with an emphasis on systematic review articles in the first instance. The following search terms were used:

- systematic[sb] AND (antenatal care)
- systematic[sb] AND (prenatal care)
- "Prenatal Care/organization and administration"[Mesh]
- "Prenatal Care/utilization"[Mesh]
- "Antenatal care" AND New Zealand"

The Cochrane Library was also search using the terms "antenatal" and "prenatal", and a search of the grey literature was performed using the Google search engine in order to identify national and international antenatal care guidelines and reviews. The grey literature search included a search of the following websites: Ministry of Health, NZ College of Midwives, NZ Guidelines Group, World Health Organization, National Institute of Health and Clinical Excellence. Reference lists within publications were also reviewed in order to identify relevant articles.

## 2.5 Chapter Summary

Maternity data are available from a number of sources; however analyses are hampered by the lack of a high quality, consistent, national data source. Instead, data for this report was sourced from the Birth Registration Dataset, the National Minimum Dataset, and a CMDHB local dataset, Healthware. There was no consistent unique identifier across these three data sources to allow reliable data linkage between them.

The strengths and limitations of each data source with respect to maternity information have been described. Importantly, analyses of Healthware data in this report are novel and exploratory, as the reliability of this data source is unknown at this time.

**IMPORTANT CAUTION:** The Healthware data presented in this report have not been checked for accuracy or validity and should be interpreted with caution. Analyses of these data are exploratory and intended to demonstrate the potential of this data source and to stimulate discussion, strategy development, and further research.

## Chapter 3. CMDHB Maternity Population

CMDHB is the third largest DHB by population in New Zealand, estimated at 482,350 in 2009, and has the fastest growing population of any DHB with an annual growth rate of 3.2% since 2001. This is twice the New Zealand average of 1.6%. In 2009, 11% of the New Zealand population lived in CMDHB, but 14% of the births registered were to women living in Counties. In 2009, there were 8,651 births registered to women resident in CMDHB. If current ethnic and age-specific birth rates are maintained then in 2026 there will be 12,500 births.

This Chapter describes the CMDHB child bearing population (women with child-bearing potential), CMDHB mothers (women who deliver), and compares CMDHB birth and total fertility rates with national rates.

### 3.1 Women of Child Bearing Age in CMDHB

At the last census, women of child bearing age (15-49 years) made up 30.4% of the total CMDHB population, compared with 27.5% of the NZ population. Compared with the national childbearing population, those residing in CMDHB were generally younger, more frequently Maaori, Pacific, or Asian, and more often live in the most deprived areas (Table 4).

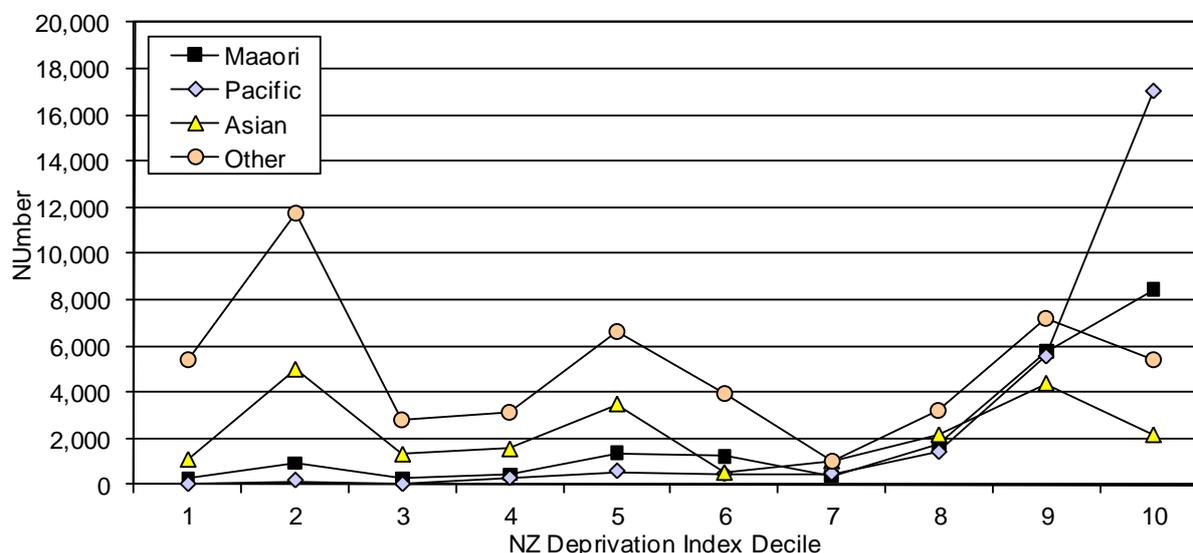
**Table 4: Women of Child Bearing Age in CMDHB and New Zealand, 2006**

	CMDHB		New Zealand	
	Number	Percent	Number	Percent
<b>Age Group (years)</b>				
15-19	18,700	15.6	154,130	14.4
20-24	16,290	13.6	145,295	13.6
25-29	15,260	12.7	133,635	12.5
30-34	16,780	14.0	149,680	14.0
35-39	18,510	15.4	163,420	15.3
40-44	18,270	15.2	166,540	15.6
45-49	16,060	13.4	156,030	14.6
<b>Total</b>	<b>119,870</b>	<b>100.0</b>	<b>1,068,730</b>	<b>100.0</b>
<b>Ethnicity</b>				
Maaori	20,860	17.4	167,520	15.7
Pacific	25,860	21.6	69,605	6.5
Asian	24,430	20.4	131,155	12.3
European/Other	48,730	40.6	700,450	65.5
<b>NZ Deprivation Index 2006 Decile (CAU)</b>				
1 least deprived	6,833	5.7	84,727	7.9
2	17,800	14.8	102,254	9.6
3	4,380	3.7	93,708	8.8
4	5,392	4.5	95,434	8.9
5	12,022	10.0	108,775	10.2
6	6,194	5.2	100,632	9.4
7	2,891	2.4	109,260	10.2
8	8,494	7.1	126,325	11.8
9	22,840	19.1	124,546	11.7
10 most deprived	33,022	27.5	120,996	11.3

Source: Statistic New Zealand Estimated Resident Population. Note: Child bearing age women are aged 15-49 years. NZ Deprivation Index is at Census Area Unit level (see section 2.1.1). Ethnicity is prioritised.

Within CMDHB at the last census, 76.4% of Maaori and 92.7% of Pacific women of child bearing age lived in high deprivation areas (decile of 8-10) compared with 38.3% and 31.2% of Asian or European/Other women respectively (Figure 4).

**Figure 4: Women of Child Bearing Age in CMDHB by NZ Deprivation Index Decile 2006 and Ethnicity, 2006**



Source: Statistics New Zealand Estimated Resident Population. Note: Child bearing age women are aged 15-49 years. NZ Deprivation Index is at Census Area Unit level (see section 2.1.1). Ethnicity is prioritised.

### 3.1.1 Child Bearing Population Growth in CMDHB

CMDHB population growth has been driven by inward migration of families from central Auckland, new housing developments, urban regeneration, and a high fertility rate. In recent years this has resulted in a change in DHB demographics with the influx of younger families increasing the number of women of child bearing age. Between 2001 and 2006 the population of women of child bearing age women grew by 3.4% per year, with higher population growth rates seen in young women aged 15-24 years (4.5%), and in Pacific (4.6%) and Asian (13.2%) women (Table 5).

**Table 5: Population Growth of Women of Child Bearing Age in CMDHB, 2001-2006**

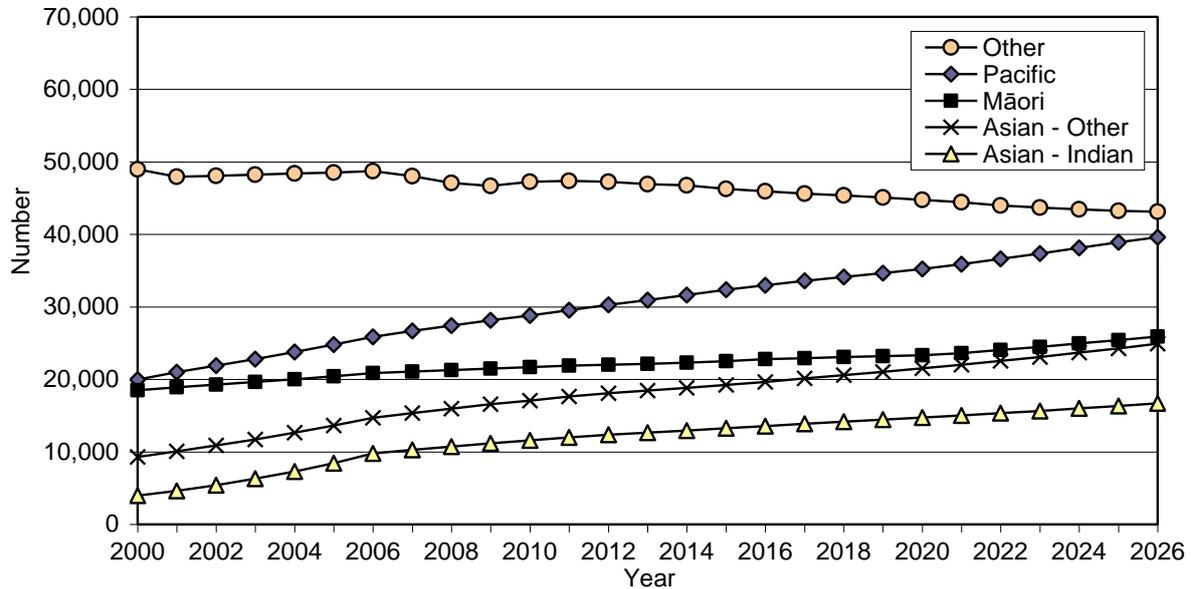
Age Group	2001	2006	Growth Rate	Ethnicity	2001	2006	Growth Rate
15-19	14,950	18,700	5.0%	Maaori	18,910	20,860	2.1%
20-24	13,560	16,290	4.0%	Pacific	20,990	25,860	4.6%
25-29	14,000	15,260	1.8%	Asian	14,695	24,430	13.2%
30-34	15,930	16,780	1.1%	Indian	4,640	9,760	22.1%
35-39	16,270	18,510	2.8%	Chinese	6,470	8,825	7.3%
40-44	14,860	18,270	4.6%	Other Asian	3,585	5,845	12.6%
45-49	12,960	16,060	4.8%	Euro/Other	47,930	48,730	0.3%
<b>Total</b>	<b>102,530</b>	<b>119,870</b>	<b>3.4%</b>	<b>Total</b>	<b>102,525</b>	<b>119,880</b>	<b>3.4%</b>

Source: Statistics New Zealand Estimated Resident Population. Note: Child bearing age women are aged 15-49 years. Ethnicity is prioritised.

In 2006, there were an estimated 119,870 women of child bearing age resident in CMDHB of which 17% were Maaori, 21% were Pacific, 20% were Asian, and 41% were of Other ethnicity. Population projections for CMDHB suggest that in 2026 there will be 148,100

female residents aged 15-49 years (Figure 5). Of these, 17% will be Maaori, 26% will be Pacific, 27% will be Asian, and 29% will be of Other ethnicity. This predicted change in demography is likely to impact the total number of births in CMDHB in the future.

**Figure 5: Women of Child Bearing Age in CMDHB, 2001-2026 by Ethnicity**

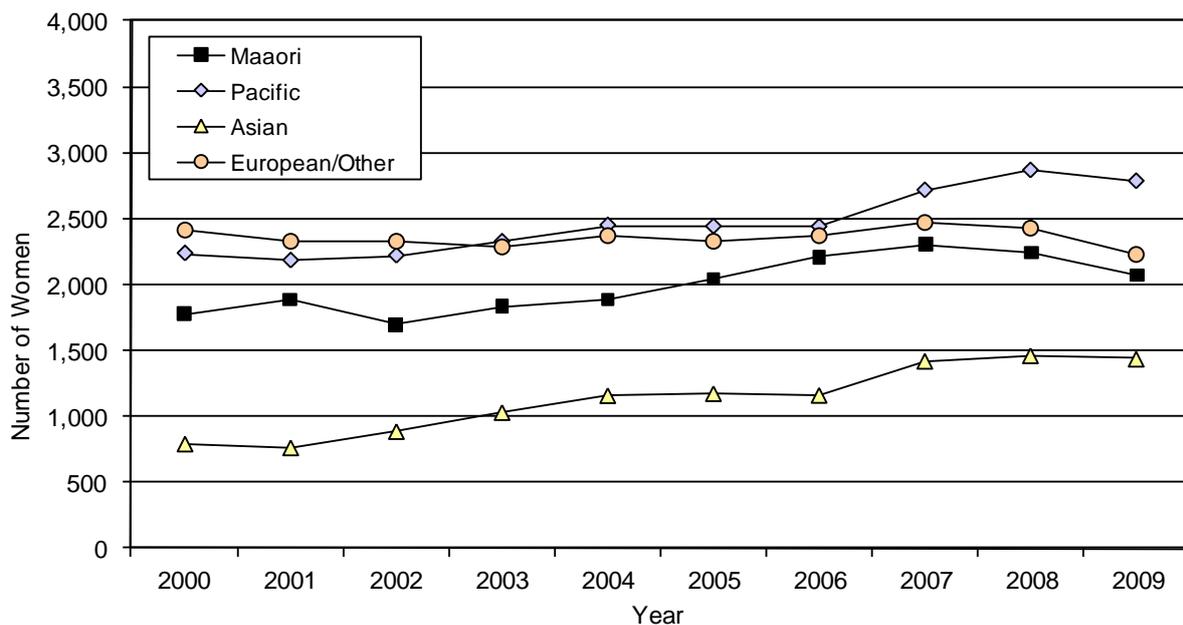


Source: Statistics New Zealand Estimated Resident Population. Note: Ethnicity is prioritised. Child bearing age women are aged 15-49 years

### 3.2 CMDHB Mothers

The last decade saw an increase in the number of CMDHB women who gave birth from 7,210 in 2000, to a peak of 8,996 in 2008, followed by 8,519 in 2009. Asian women had the greatest absolute increase in the number delivering, followed by Pacific and Maaori women (Figure 6). There was little change in the number of European/Other CMDHB women delivering annually during this time.

**Figure 6: Number of CMDHB Women giving Birth by Ethnicity, 2000-2009**



Source: Birth Registration Dataset. Ethnicity is prioritised.

During 2007-2009 there were 26,880 babies registered to 26,504 CMDHB women. Compared to nationally, the CMDHB women who delivered during this time were an average of one year younger with a greater proportion aged <30 years old (CMDHB: 58% vs NZ 50%) (Table 6).

There were marked differences by ethnic group, with CMDHB mothers more likely to be Maaori, Pacific, and Asian. While European/Other women accounted for 56% of the women who delivered in NZ during 2007-09, in CMDHB European/Other women accounted for only 27% of deliveries (Table 6).

CMDHB mothers are more likely to live in areas that are more deprived than mothers across New Zealand as a whole. Nearly 60% of CMDHB women live in decile 8-10 areas (most deprived) compared to 37% of women across NZ (Table 6).

**Table 6: Demography of Mothers in CMDHB and New Zealand, 2007-09**

	CMDHB		New Zealand	
	Number	Percent	Number	Percent
<b>Age Group</b>				
<20 years	2,547	9.6	15,097	7.9
20-24 years	5,797	21.9	34,781	18.1
25-29 years	6,974	26.3	46,942	24.4
30-34 years	6,365	24.0	53,698	27.9
35-39 years	3,870	14.6	34,508	18.0
40+ years	951	3.6	7,223	3.8
Total	26,504	100.0	192,249	100.0
<b>Age (Years)</b>				
Median	28 years		29 years	
Mean (95% CI)	28.16 (28.09-28.24)		29.08 (29.05-29.11)	
<b>Ethnicity</b>				
Maaori	6,616	25.0	44,967	23.5
Pacific	8,356	31.6	20,291	10.6
Asian	4,327	16.4	19,645	10.3
<i>Chinese</i>	<i>1,245</i>	<i>4.7</i>	<i>6,303</i>	<i>3.3</i>
<i>Indian</i>	<i>2,056</i>	<i>7.8</i>	<i>6,500</i>	<i>3.4</i>
<i>Other Asian</i>	<i>1,026</i>	<i>3.9</i>	<i>6,842</i>	<i>3.6</i>
European/Other	7,129	27.0	106,551	55.7
<b>NZ Deprivation Index 2006 Decile (Meshblock*)</b>				
1 least deprived	1,348	5.1	15,008	7.9
2	1,651	6.2	15,850	8.3
3	1,600	6.0	16,390	8.6
4	1,431	5.4	17,449	9.1
5	1,439	5.4	17,221	9.0
6	1,682	6.4	18,574	9.7
7	1,536	5.8	19,106	10.0
8	3,210	12.1	20,832	10.9
9	4,737	17.9	23,355	12.2
10 most deprived	7,867	29.7	27,325	14.3

Source: Birth Registration Dataset. Note: NZ Deprivation Index is at Census Area Unit level (see section 2.1.1). Ethnicity is prioritised.

During 2007-2009, CMDHB women who delivered tended to have a higher parity than women across New Zealand (Table 7). Nearly 10% of CMDHB women were para 3-5, and 1.3% had a parity of 6 or more compared with 6.3% and 0.7% respectively for NZ women. Parity data in the Birth Registration Dataset is indicative only, and is likely to be an underestimate of parity because it is the parity with the women's current partner only.

During 2007-2009, the proportion of CMDHB women with a singleton or multiple pregnancy was similar to that seen nationally (Table 7). In addition, the proportion of CMDHB women who had a preterm delivery (<36 weeks gestation) was the same as observed nationally (7.0%), while a lower proportion of CMDHB women delivered at 41 weeks gestation (CMDHB 13% vs NZ 16%), and a similar proportion delivered at 42 weeks or later (Table 7).

**Table 7: Pregnancy Features of Mothers in CMDHB and New Zealand, 2007-09**

	CMDHB		New Zealand	
	Number	Percent	Number	Percent
<b>Parity</b>				
Nulliparous	13,050	49.2	99,294	51.7
1-2	10,497	39.6	79,596	41.4
3-5	2,612	9.9	12,105	6.3
6 or more	345	1.3	1,254	0.7
<b>Number of Babies</b>				
Singleton	26,133	98.6	189,383	98.5
Twins	366	1.4	2,822	1.5
Triplets	5	0.0	44	0.0
<b>Gestation at Delivery</b>				
20-23 weeks	102	0.4	719	0.4
24-27 weeks	125	0.5	773	0.4
28-31 weeks	208	0.8	1,438	0.8
32-36 weeks	1,413	5.3	10,590	5.5
37-40 weeks	20,592	77.8	141,341	74.0
41 weeks	3,305	12.5	30,704	16.1
42+ Weeks	736	2.8	5,561	2.9

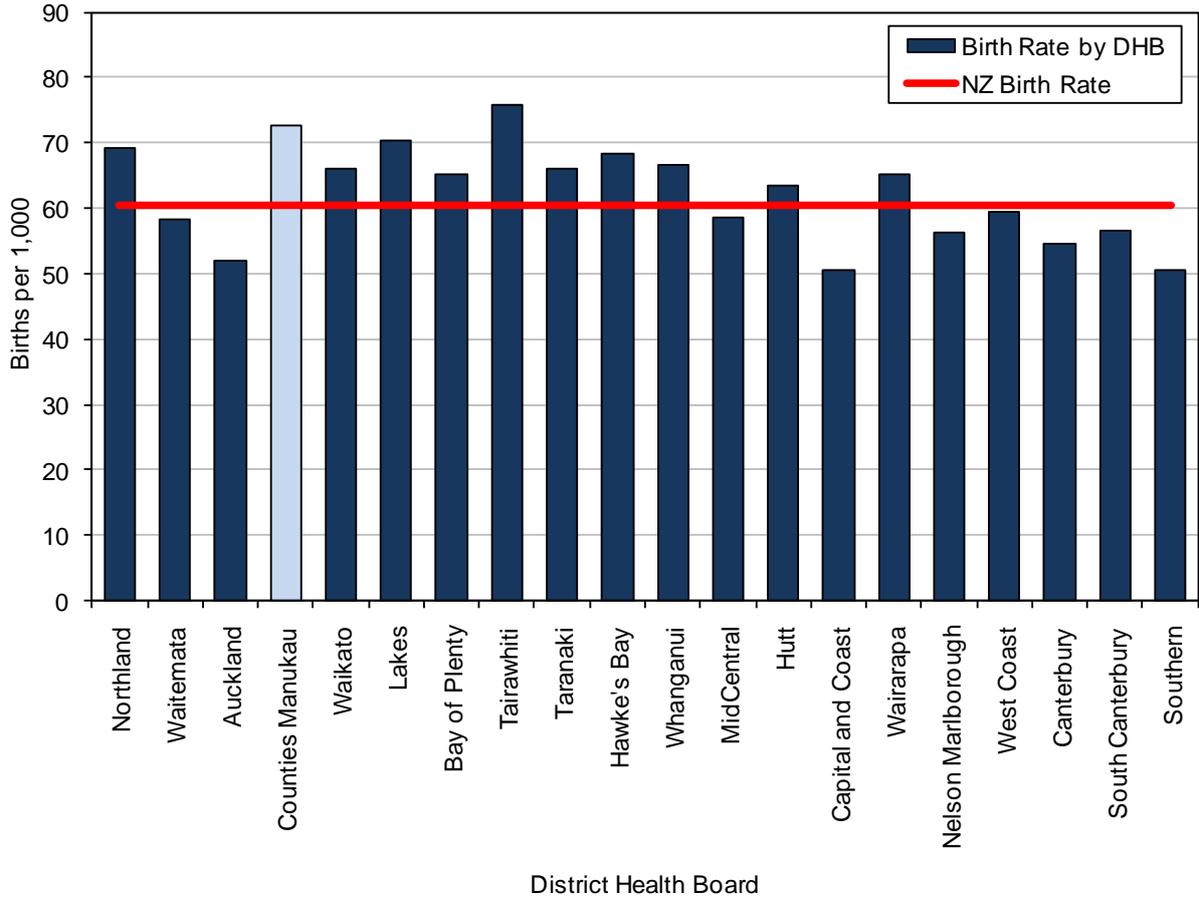
Source: Birth Registration Dataset. Note: Parity is with the current partner only.

### 3.3 Birth Rates in CMDHB compared with New Zealand

The CMDHB birth rate (births per 1,000 women aged 15-49 years) is second only to Tairāwhiti for DHBs in NZ (Figure 7), and over the last decade was consistently higher than the national birth rate (Figure 8). During 2007-2009 the CMDHB birth rate was 72.6 compared with 60.5 per 1,000 women nationally.

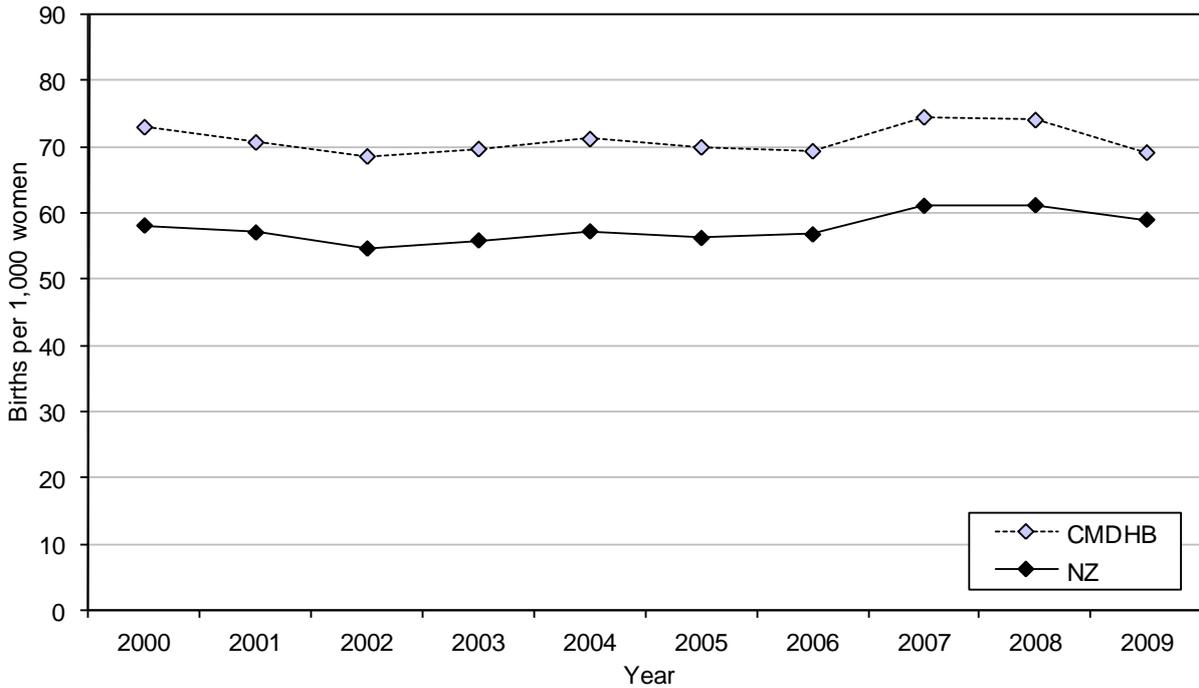
NZ experienced a baby boom during 2007-2009, with birth rates 6.8% higher than they were at the beginning of the decade driven primarily by higher birth rates in women over 30 years old (Figure 9). While CMDHB also experienced higher birth rates during this time, the increase was not as marked (2.6%) and was spread more evenly across the child bearing age range (Figure 9).

**Figure 7: Birth Rates in New Zealand by DHB, 2007-2009**



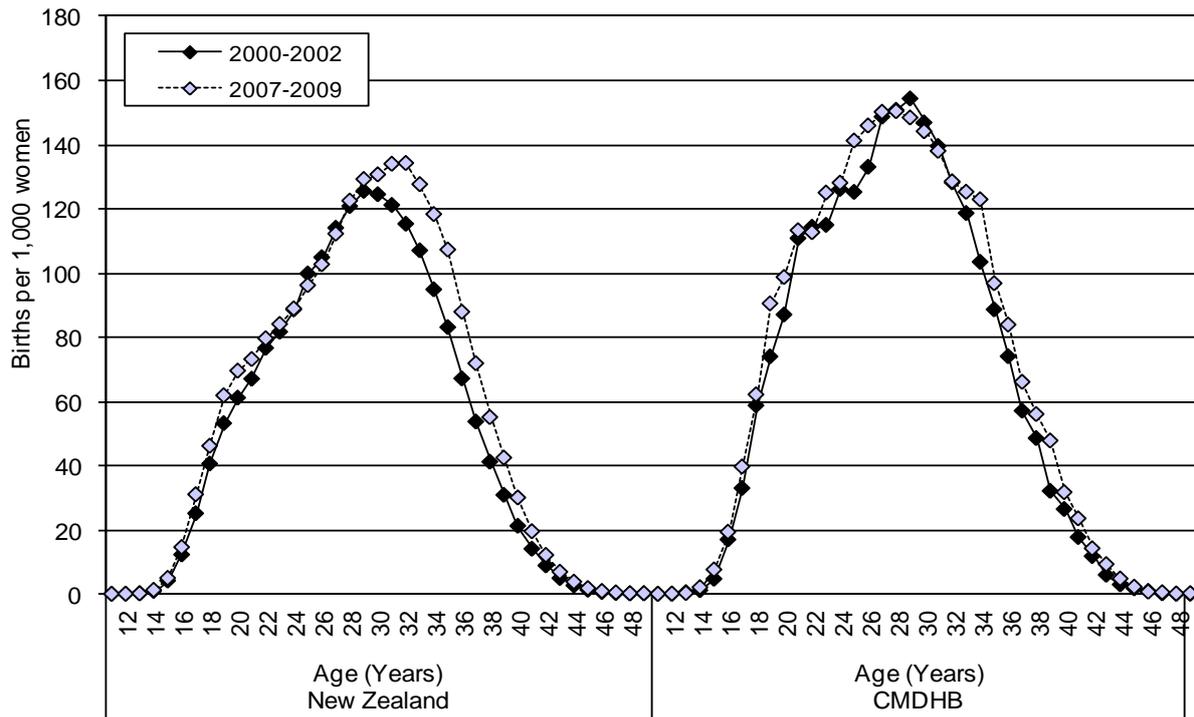
Numerator: Birth Registration Dataset; Denominator: Statistics New Zealand Estimated Resident Population. Birth rates is births per 1,000 women aged 15-49 years.

**Figure 8: Birth Rates in CMDHB and New Zealand, 2000-2009**



Numerator: Birth Registration Dataset; Denominator: Statistics New Zealand Estimated Resident Population. Birth rates is births per 1,000 women aged 15-49 years.

**Figure 9: Birth Rates in CMDHB and New Zealand by Age, 2000-2002 vs. 2007-2009**

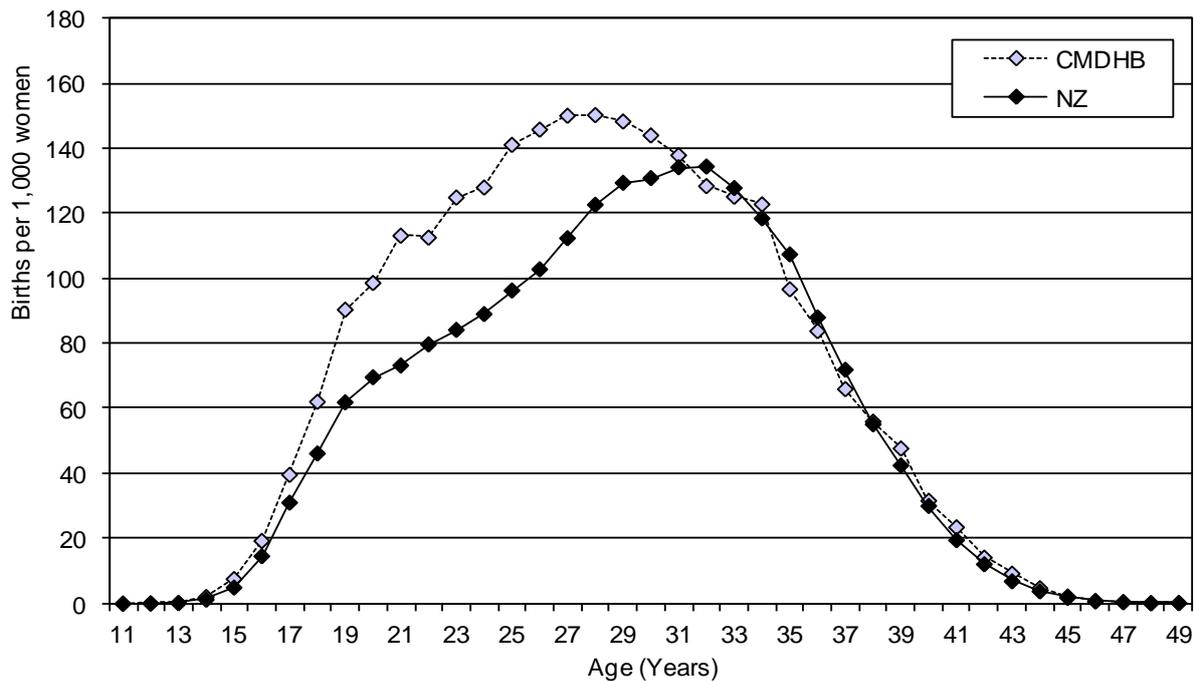


Numerator: Birth Registration Dataset; Denominator: Statistics New Zealand Estimated Resident Population.

**3.3.1 Birth Rates by Age and Ethnicity in CMDHB and New Zealand**

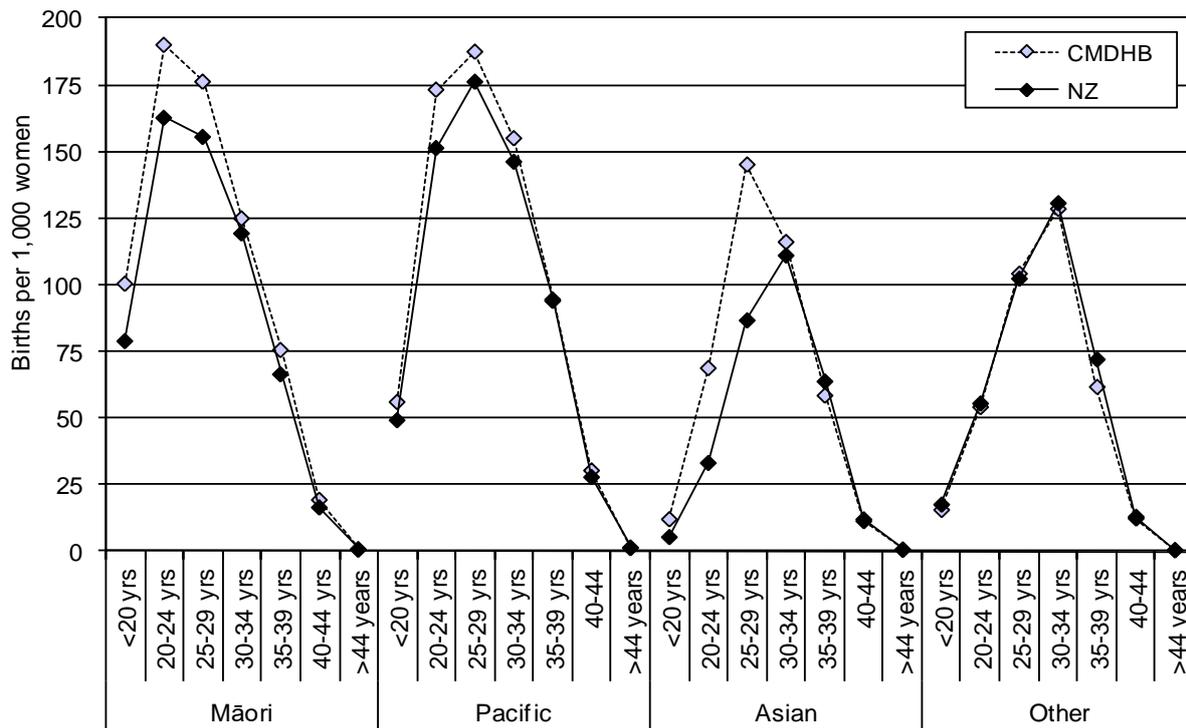
Higher birth rates in CMDHB, compared with NZ, are almost entirely due to higher rates in women aged less than 30 years old, particularly Maori, Pacific, and Asian women (Figure 10, Figure 11). Within the CMDHB Asian population during 2007-09, birth rates were higher for Indian women (65 per 1,000) than for women with other Asian ethnicities (48 per 1,000).

**Figure 10: Birth Rates in CMDHB and New Zealand by Age, 2007-2009**



Numerator: Birth Registration Dataset; Denominator: Statistics New Zealand Estimated Resident Population.

**Figure 11: Birth Rates in CMDHB and New Zealand by Ethnicity and Age Group, 2007-2009**

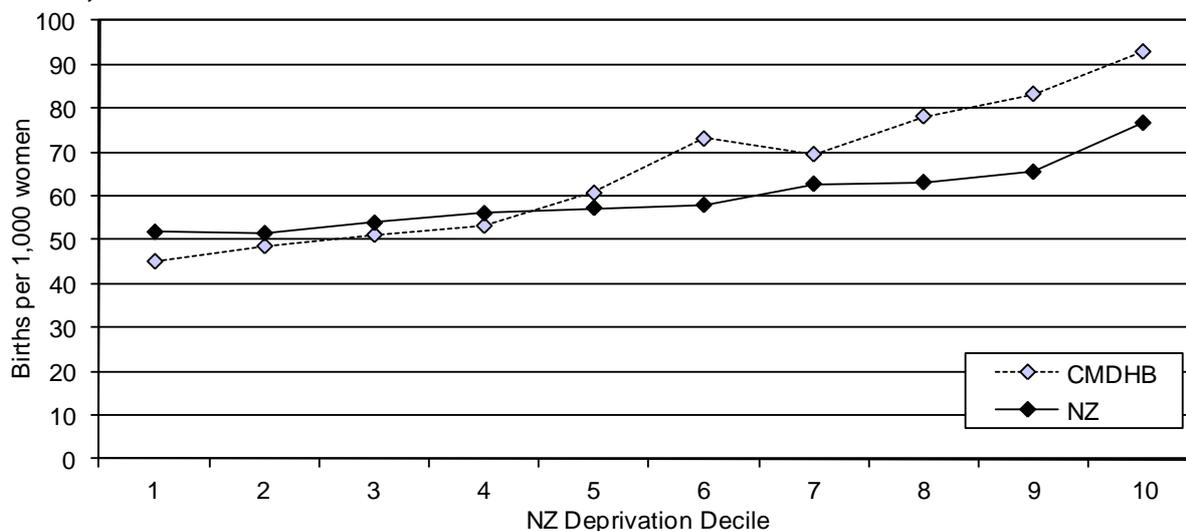


Numerator: Birth Registration Dataset; Denominator: Statistics New Zealand Estimated Resident Population.  
 Note: Ethnicity is prioritised.

### 3.3.2 Birth Rates by NZ Deprivation Index in CMDHB and New Zealand

Births rates both nationally and in CMDHB demonstrate a social gradient such that with each increase in NZ Deprivation Index decile an increase in birth rate is seen (Figure 12). CMDHB not only has a greater proportion of its childbearing population living in areas of high deprivation (deciles 8-10) than is seen nationally, but within decile 8-10 areas birth rates were significantly higher in CMDHB (28% higher than nationally during 2007-09).

**Figure 12: Birth Rates in CMDHB and New Zealand by New Zealand Deprivation Index Decile, 2007-2009**



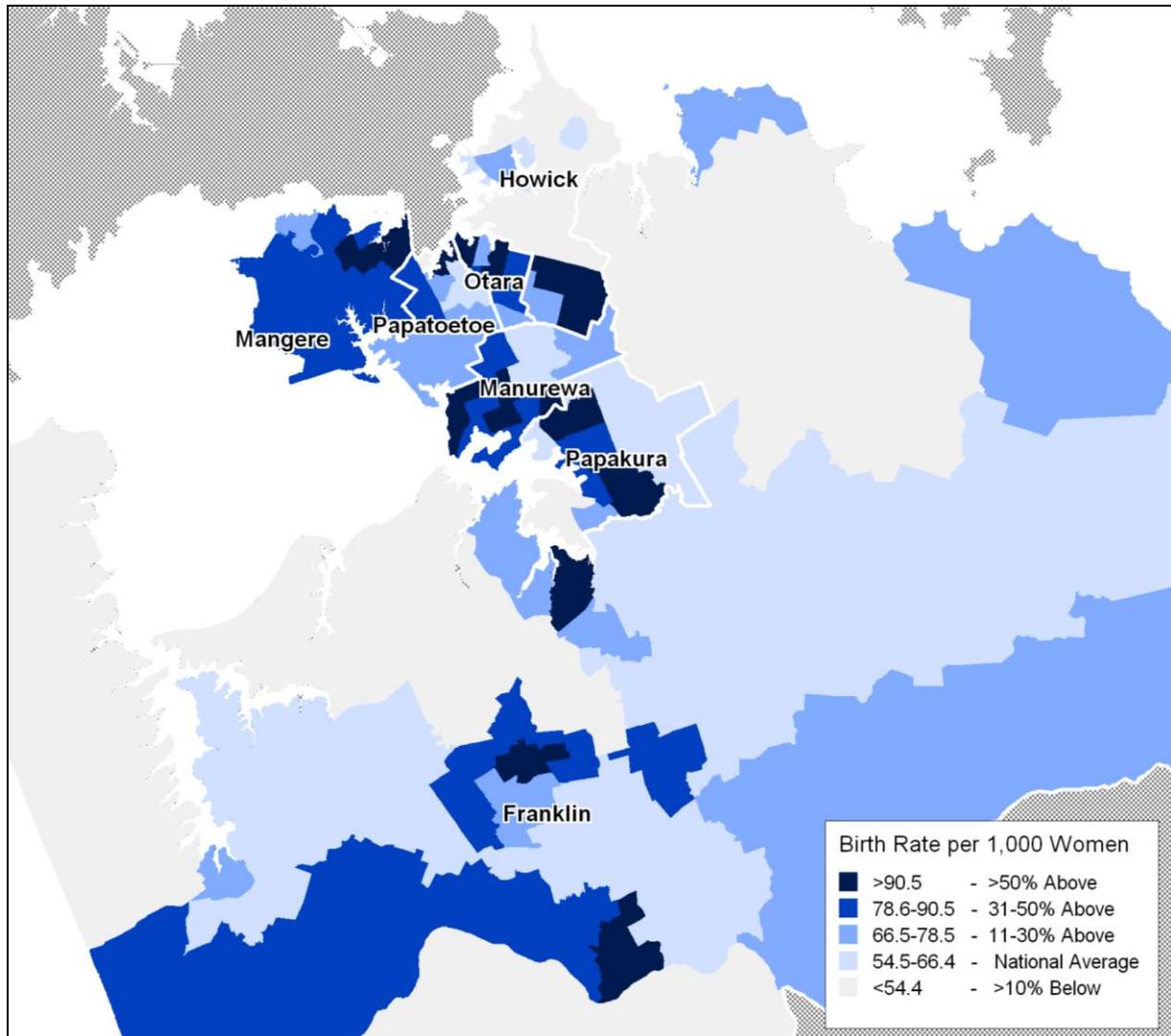
Numerator: Birth Registration Dataset; Denominator: Statistics New Zealand Estimated Resident Population.  
 Note: NZ Deprivation Index is at Census Area Unit level (see section 2.1.1).

### 3.3.3 Birth Rates by CMDHB Suburb

On average during 2007-2009 the birth rate in CMDHB was 20% higher than the national birth rate; however birth rates were not evenly distributed across CMDHB (Table 8, Figure 13). During 2007-09, Franklin, Manurewa, and Otara had the highest birth rates in CMDHB, whereas Howick had the lowest.

Across CMDHB the highest birth rates (>100 per 1,000 women per year) were for child bearing age Maaori women living in Papakura, Otara, and Manurewa, and Pacific women living in Manurewa, Mangere, Papakura, and Papatoetoe (Table 8). During 2007-09, Papakura, Otara, and Papatoetoe had the highest birth rates for young women aged <20 years (Table 8). Otara and Mangere had the highest birth rates for women aged 40 years and older.

**Figure 13: CMDHB Birth Rates by Census Area Unit Compared with the National Birth Rate, 2007-2009**



Numerator: Birth Registration Dataset; Denominator: Statistics New Zealand Estimated Resident Population.  
 Note: Rates are per 1,000 women aged 15-49 years. Suburbs are Auckland City subdivisions.

**Table 8: Birth Rates in CMDHB by Suburb, Ethnicity, and Age Group, 2007-09**

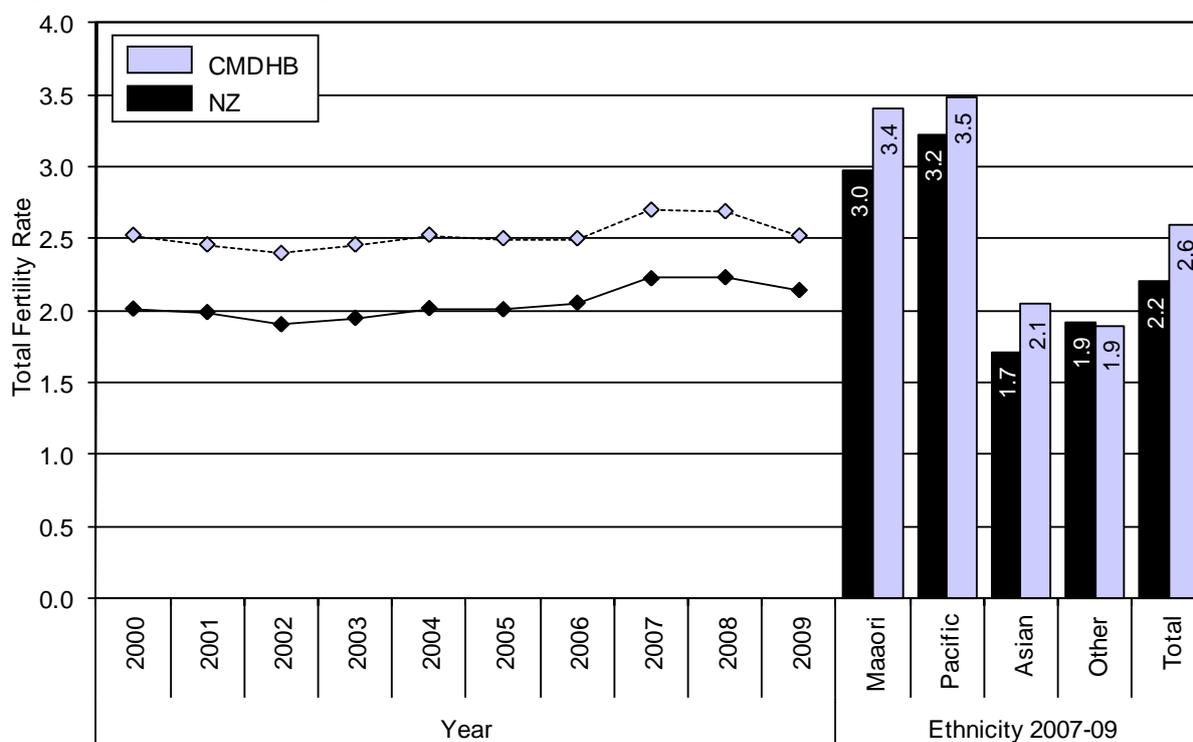
	Howick	Otara	Papatoetoe	Mangere	Manurewa	Papakura	Franklin	Total
Ethnicity								
Maaori	74.0	113.5	93.2	99.1	109.6	118.4	95.7	104.6
Pacific	71.0	96.6	106.4	99.7	114.9	109.1	113.9	103.1
Asian	43.4	62.5	68.9	65.7	69.0	59.6	50.6	59.3
Euro/Other	44.7	44.0	35.8	49.3	48.8	58.4	54.4	48.2
Total	46.7	86.5	62.4	75.7	89.9	81.6	93.6	72.6
Age (yrs)								
<20	12.9	67.9	44.7	55.1	64.3	61.6	33.3	44.2
20-24	42.4	153.1	117.1	148.8	149.8	141.1	89.8	111.6
25-29	102.1	163.3	154.9	168.5	159.5	165.5	145.5	145.1
30-34	119.3	133.6	112.4	127.6	128.4	126.8	146.6	126.7
35-39	63.7	83.9	61.0	82.3	71.0	68.9	74.8	70.7
40+	6.2	14.0	8.8	13.7	9.3	9.3	8.1	8.9

Numerator: Birth Registration Dataset; Denominator: Statistics New Zealand Estimated Resident Population.  
 Note: Birth rates are births per 1,000 women aged 15-49 years. Suburbs are the Auckland City subdivisions.  
 Ethnicity is prioritised. Suburbs are Auckland City subdivisions.

### 3.4 Total Fertility Rates in CMDHB and New Zealand

The Total Fertility Rate (TFR) is the average number of children a woman is likely to have during their lifetime based on current age-specific birth rates. The CMDHB TFR is consistently higher than the national rate (Figure 14) due to a higher TFR in Maaori, Pacific, and Asian women living in Counties compared to women from these ethnic groups living elsewhere in New Zealand.

**Figure 14: Total Fertility Rates in CMDHB and New Zealand by Year and Ethnicity**



Numerator: Birth Registration Dataset; Denominator: Statistics New Zealand. Note: Ethnicity is prioritised.

### **3.5 Chapter Summary**

While CMDHB contains 11% of the New Zealand population, 14% of New Zealand's births are to women who reside there. In 2009, 8,519 CMDHB women gave birth to 8600 infants.

The CMDHB population of child bearing women and the maternity population (those actually giving birth) have a substantially different demographic profile to the New Zealand population. CMDHB mothers are younger on average than mothers across New Zealand and a greater proportion are Maaori, Pacific and Asian, and live in areas of high deprivation.

During 2007-2009 the birth rate in CMDHB was 20% higher than the national birth rate, driven by higher birth rates in Maaori, Pacific and Asian women aged less than 30 years, and in women living in the most deprived areas. Within CMDHB, women living in Papakura, Manurewa, and Otara had the highest birth rates.

These significant population differences pose challenges in making direct comparison of health outcomes between the CMDHB population and the New Zealand population as a whole, and need to be considered when looking at maternity care and outcomes in Counties.



## Chapter 4. Maternity Care in CMDHB

Maternity care provision at a DHB level is shaped by the funding framework, the available workforce, and maternal choice. A woman's choice of maternity care provider is in turn influenced by her understanding of the system, preferences, past experience, the level of care required, and LMC availability.<sup>7-9</sup> This Chapter describes CMDHB maternity services and the women who use them, providing a picture of the CMDHB model of care. Where possible, CMDHB data are compared with national data.

A description of the data sources used can be found in Chapter 2, including their strengths and limitations. Where possible, NMDS data are presented, with local Healthcare data used when data were not available from other sources. Numbers reported are the number of women who gave birth and not the number of babies born.

### 4.1 CMDHB Maternity Services in CMDHB

All women resident in CMDHB are entitled to access free maternity care within the DHB. Women can access primary maternity services via a private lead maternity carer (LMC) who can be a self-employed midwife, GP, or private obstetrician, or via CMDHB maternity services. Private LMC services are funded directly by the Ministry of Health who pays the provider following a claim made under Section 88.

Maternity services offered by CMDHB are described in Table 9. CMDHB provided primary maternity services are bulk funded by the Ministry of Health. This funding is used to employ community and hospital based midwives and to contract with GPs for Shared Care. CMDHB has a unique system of Shared Care that developed in response to a Private LMC shortage. Women who choose Shared Care receive most of their antenatal care from a GP that enters into a Shared Care arrangement with the DHB. In addition, these women are offered three antenatal visits with a DHB employed community midwife and are delivered at a CMDHB facility by a DHB employed midwife. GPs that provide Shared Care are not required to have specific training in antenatal care and are not required to have a postgraduate Diploma of Obstetrics and Gynaecology. Women identified as high risk are referred to Secondary Care, which includes both the Obstetric Medical Clinic and Diabetes in Pregnancy Service.

**Table 9: CMDHB Maternity Services**

Service	Description
Closed Unit	Antenatal, labour, and postnatal care is provided by a CMDHB employed midwife with clinics held at Middlemore Hospital, Manukau or Botany SuperClinic, or in the community. Antenatal and postnatal care is provided by a CMDHB community midwife, whilst labour care is provided DHB employed midwives at Middlemore Hospital or one of the Primary Maternity Units. High risk women may receive closed unit care in conjunction with an Obstetric Senior Medical Officer.
Shared Care	Maternity care is shared between the woman's GP and a CMDHB midwife. Most antenatal care is provided by the GP, with three antenatal visits offered with a CMDHB community midwife. Labour care is provided by a CMDHB employed midwife, and postnatal care is provided by the CMDHB community midwife service. If a woman becomes high risk, care is transferred to the Closed Unit service.
Caseloading	This service provides continuity of care throughout pregnancy, labour, and the postnatal period. A CMDHB employed midwife works within a team to provide care as per the LMC model. Women deemed at high risk may continue with Caseloading care in conjunction with an Obstetric Senior Medical Officer.

Service	Description
Teenage Pregnancy	CMDHB community midwife clinics for young mothers aged <18 years run at Awhitia (on the Middlemore site) and at Manukau SuperClinic with social work and transport support. Home visits are provided if needed. This service provides continuity of care throughout pregnancy, labour, and the postnatal period.
Diabetes in Pregnancy	For women with previous or newly diagnosed diabetes (Type I & II or Gestational) and provided by a multidisciplinary team comprised of an obstetrician, midwife, diabetes physician, and dietician. CMDHB employed midwives provide antenatal and postnatal continuity of care.
Obstetric Medical Clinic	This clinic provides maternity care for women with complex medical problems during pregnancy and is located at Manukau SuperClinic. Women are seen by the specialist team with midwifery care provided by the women's LMC or a CMDHB employed midwife.

Source: CMDHB<sup>57</sup>

Women have a choice of birthing location and in CMDHB there are three primary birthing units located in Botany Downs, Papakura, and Pukekohe in addition to a delivery suite at Middlemore Hospital. Primary birthing units are staffed by CMDHB midwives but can be used by self-employed LMCs. These units are suitable for women with a low risk pregnancy.

In summary, the range of maternity services available to CMDHB resident women is similar for the most part to that offered elsewhere in New Zealand. In addition, CMDHB resident women have the option of receiving their antenatal care from their GP in a Shared Care arrangement with CMDHB midwives if their GP offers this service.

## 4.2 CMDHB Maternity Facility Use

Most pregnant women residing in CMDHB deliver in a CMDHB facility (inborn deliveries). Since 2000 the proportion of inborn deliveries has increased from 78% to 87% (Table 10). During 2007-09, 3,476 CMDHB resident women delivered in non-CMDHB facilities (Table 10). Almost all of these (92.8%) delivered in an Auckland DHB, 4.0% in a Waitemata DHB facility, and 3.2% elsewhere in New Zealand. The reduction in outborn deliveries since 2000 has been driven by a 26% reduction in deliveries at Auckland DHB facilities from an annual average of 1,404 during 2000-01 to 1,029 during 2008-09. This decline coincided with the relocation of National Women's Hospital from Greenlane to Grafton in 2004.

**Table 10: Deliveries in CMDHB Women by DHB of Delivery, 2000-2009**

DHB	Mothers Delivered									
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Counties	5,486	5,328	5,769	6,075	6,274	6,687	7,069	7,409	7,483	7,323
Auckland	1,447	1,361	1,426	1,401	1,252	1,107	1,025	1,167	1,058	1000
Waitemata	27	29	41	27	43	32	24	57	35	44
Elsewhere	51	50	41	44	55	41	42	42	35	38
<b>Total</b>	<b>7,011</b>	<b>6,768</b>	<b>7,277</b>	<b>7,547</b>	<b>7,624</b>	<b>7,867</b>	<b>8,160</b>	<b>8,675</b>	<b>8,611</b>	<b>8,405</b>
% Inborn	78.2%	78.7%	79.3%	80.5%	82.3%	85.0%	86.6%	85.4%	86.9%	87.1%

Source: National Minimum Dataset.

Outborn deliveries are not unique to CMDHB. During 2007, Whanganui DHB had the highest proportion of outborn infants (20.5%), followed by Waitemata (15.0%), Auckland (14.8%), and CMDHB (14.6%).<sup>6</sup> The remaining DHBs had an average of 4.9% outborn deliveries.

#### 4.2.1 Characteristics of CMDHB Women with Inborn vs. Outborn Deliveries

The potential reasons for a CMDHB resident women delivering outside CMDHB include preference, convenience, availability, medical indication (e.g. specialist neonatal care), and LMC preference.<sup>7</sup> Of the CMDHB resident women who delivered outside the DHB during 2007-09, 49.8% were European/Other, 30.3% were Asian, 11.0% were Pacific and 9% were Maaori. While 30.7% lived in the least deprived areas (decile 1-2), 23.4% lived in the most deprived areas (decile 9-10) and just over half lived in Howick (52.3%).

Compared with Maaori women resident in CMDHB, Pacific women were less likely to birth outside of the DHB, whereas Asian (especially Chinese) and European/Other women were most likely to have an outborn delivery (Table 11). Young women were least likely to have an outborn delivery, and the likelihood of delivering outside CMDHB increased with increasing age group until age 30, beyond which no further increase was seen.

**Table 11: CMDHB Women who Delivered Inside and Outside CMDHB, 2007-09**

	Inborn		Outborn	
	Number	Crude Rate per 100	Number	Crude Rate per 100
<b>Ethnicity</b>				
Maaori	5,611	94.7	312	5.3
Pacific	8,172	95.5	381	4.5
Asian	2,698	71.9	1,053	28.1
<i>Chinese</i>	419	37.0	714	63.0
<i>Indian</i>	1,491	90.0	165	10.0
<i>Other Asian</i>	788	81.9	174	18.1
European/Other	5,734	76.8	1,730	23.2
Total	22,215	86.5	3,476	13.5
<b>Maternal Age</b>				
<20 years	2,352	95.0	124	5.0
20-24 years	5,259	93.0	397	7.0
25-29 years	5,938	87.4	859	12.6
30-34 years	4,956	81.2	1,145	18.8
35-39 years	2,979	79.7	759	20.3
40+ years	731	79.2	192	20.8
<b>NZ Deprivation Index 2006 Decile (CAU*)</b>				
Decile 1-2	1,787	62.6	1,066	37.4
Decile 3-4	1,112	71.6	441	28.4
Decile 5-6	2,540	76.7	770	23.3
Decile 7-8	2,726	87.6	386	12.4
Decile 9-10	13,999	94.5	813	5.5
<b>Suburb</b>				
Howick	2,553	58.4	1,818	41.6
Otara	2,531	96.3	98	3.7
Papatoetoe	2,835	92.2	240	7.8
Mangere	3,736	90.3	401	9.7
Manurewa	5,178	93.8	342	6.2
Papakura	2,567	92.5	207	7.5
Franklin	2764	88.2	370	11.8

Source: National Minimum Dataset. Note: Ethnicity is prioritised. NZ Deprivation Index is at Census Area Unit level (see section 2.1.1). Suburbs are Auckland City subdivisions.

Women living in the most deprived areas (decile 9-10) were the least likely to have an outborn delivery and the likelihood of delivering outside CMDHB increased with decreasing deprivation. Women living in Otara area were least likely to have an outborn delivery (6.2 per 100 women), whereas women living in Howick were most likely to deliver outside of CMDHB (41.6 per 100 women).

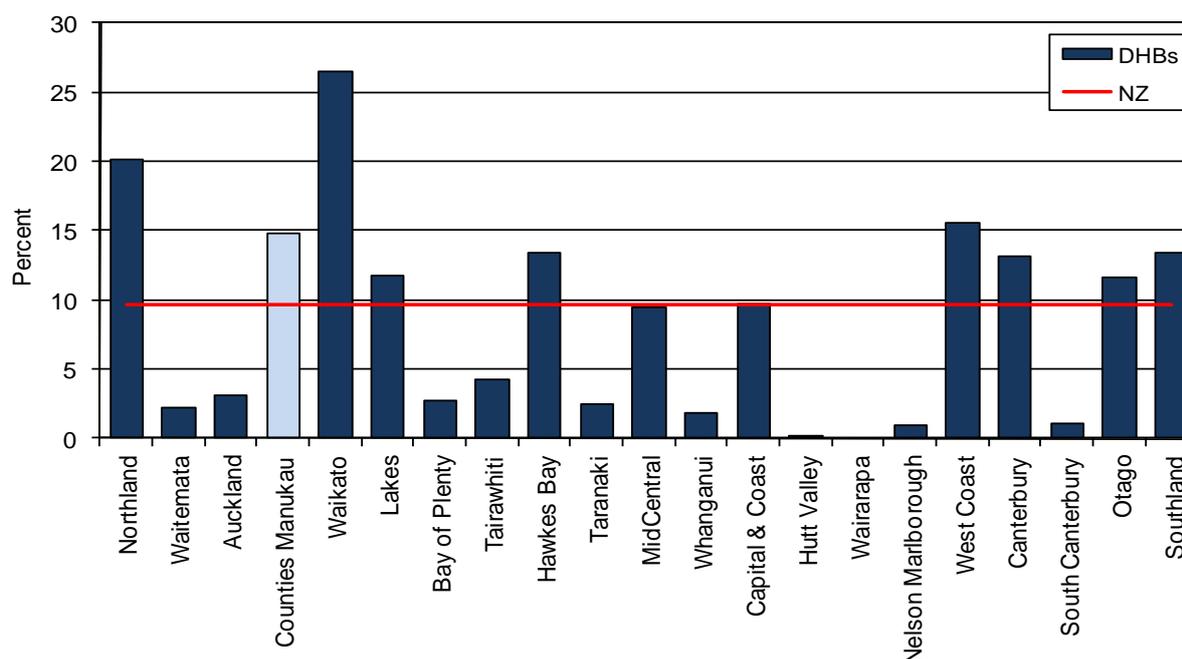
#### 4.2.2 Use of CMDHB Birthing Facilities by CMDHB Resident Women

CMDHB has four birthing facilities, a tertiary facility at Middlemore Hospital and three primary birthing units (PBUs) in Botany, Papakura, and Pukekohe. All of these PBUs offer both labour and postnatal inpatient services so a mother can deliver at one unit and transfer to another for her postnatal care. Local data show that over the last decade, 15-17% of CMDHB resident woman that delivered in CMDHB each year gave birth at a CMDHB PBU.

Prior to 2009, NMDS data are not a good source of delivery facility because only one event was captured for each delivery. Therefore, if a woman birthed in one facility and had her postnatal care at a different facility, it was the latter facility that was captured at discharge. From 2009, in-hospital postnatal care was recorded separately; so the birth event facility better reflects birth location, and therefore data presented here are limited to 2009-2010.

Of all CMDHB women who delivered anywhere in NZ during 2009-10, 14.8% delivered in a PBU compared to 9.6% for all NZ women (Figure 15). Of the major metropolitan DHB's during this time, CMDHB had the greatest proportion of its women delivering in a PBU.

**Figure 15: Proportion of Births at a Primary Birthing Unit by DHB, 2009-2010**



Source: National Minimum Dataset.

During 2009-10, 2,414 CMDHB resident women birthed at one of the three CMDHB primary birthing units each year, accounting for 16.5% of all births to CMDHB women in a CMDHB facility (Table 12). Of these deliveries, 36% took place at Papakura, 33% at Pukekohe, and 31% at Botany. Nearly half of these women (42.7%) were European/Other, 35.5% were Māori, 14.4% were Pacific and 7.4% were Asian. While 15.3% lived in the least deprived areas (decile 1-2), 46.3% lived in the most deprived areas (decile 9-10). Most of the women birthing in a PBU lived in the suburbs where these units are found (34.8% lived in Franklin, 23.0% in Papakura, and 16.6% in Howick).

**Table 12: CMDHB Women who Delivered at a CMDHB Facility, 2009-10**

	Number of Women Delivered				Percent of Deliveries at PBU
	MMH	Botany	Papakura	Pukekohe	
<b>Ethnicity<sup>1</sup></b>					
Maaori	2,825	145	490	223	23.3%
Pacific	5,230	150	133	65	6.2%
Asian	1,633	121	36	21	9.8%
<i>Chinese</i>	224	27	3	4	13.2%
<i>Indian</i>	954	38	20	13	6.9%
<i>Other Asian</i>	455	56	13	4	13.8%
European/Other	2,525	333	215	482	29.0%
Total	12,213	749	874	791	16.5%
<b>Maternal Age<sup>1</sup></b>					
<20 years	1,185	48	131	82	18.0%
20-24 years	2,975	151	265	172	16.5%
25-29 years	3,322	206	245	209	16.6%
30-34 years	2,703	214	136	185	16.5%
35-39 years	1,575	111	81	125	16.8%
40+ years	453	19	16	18	10.5%
<b>NZ Deprivation Index 2006 Decile (CAU*)<sup>1</sup></b>					
Decile 1-2	880	199	51	119	29.5%
Decile 3-4	534	96	20	57	24.5%
Decile 5-6	1,143	141	97	283	31.3%
Decile 7-8	1,483	97	129	8	13.6%
Decile 9-10	8,173	216	577	324	12.0%
<b>Suburb<sup>1</sup></b>					
Howick	1,296	400	1	0	23.6%
Otara	1,530	95	10	0	6.4%
Papatoetoe	1,753	54	7	1	3.4%
Mangere	2,506	50	4	1	2.1%
Manurewa	3,065	90	298	8	11.4%
Papakura	1,085	19	501	36	33.9%
Franklin	978	41	53	745	46.2%
<b>Maternity Provider (2007-09)<sup>2</sup></b>					
Private LMC	8,518	624	918	1,057	23.4%
Closed Unit	3,959	165	213	83	10.4%
Shared Care	5,045	180	171	14	6.7%
Caseloading	374	105	75	1	32.6%
Secondary Care	379	1	3	10	3.6%

Source: <sup>1</sup>National Minimum Dataset, <sup>2</sup>Healthware. Healthware data are from 2007-09. Note: MMH: Middlemore Hospital; PBU: Primary Birthing Unit. Ethnicity is prioritised. NZ Deprivation Index is at Census Area Unit level (see section 2.1.1). Suburbs are Auckland City subdivisions.

Women cared for by a Caseloading midwife or a Private LMC (a self-employed midwife, GP, or obstetrician) were most likely to deliver at a PBU. Women under Secondary Care, followed by those with Shared Care were least likely to deliver at a PBU (Table 12). European/Other and Maaori CMDHB women were most likely to deliver in a PBU, while Pacific women were the least likely. Young women <20 years had the highest rate of PBU deliveries of any age group, although differences across age groups were small. Women

living in the least deprived decile 1-2 areas most frequently delivered in a PBU, with PBU use decreasing with increasing deprivation. The highest PBU delivery rates occurred in areas with a unit with the highest rate observed in Franklin followed by Papakura and Botany.

### 4.2.3 CMDHB Facility Use by Non-CMDHB Resident Women

Each year a number of women who do not reside within CMDHB deliver at a CMDHB facility (Table 13). These women form part of the Provider population, and are included in other CMDHB publications. The use of CMDHB birthing facilities by women who don't reside within CMDHB has declined by 41% over the last decade from an annual average of 990 during 2000-01 to an average of 578 during 2008-09. During 2009, 85.2% of these women were Auckland DHB residents and 92.8% were delivered at Middlemore Hospital.

This situation is not unique to CMDHB. A proportion of mothers delivered in all DHBs usually reside elsewhere, particularly in DHBs with tertiary maternity and Level III specialist neonatal services. In 2007, Auckland DHB facilities delivered the greatest proportion of women from outside this DHB (29.7%), followed by MidCentral (8.7%), CMDHB (8.1%), and Capital and Coast (7.9%).<sup>6</sup> The remaining 17 DHBs average 3.5% of women delivering who normally reside outside of these DHBs. As the focus of this report is the domiciled population, deliveries in non-CMDHB domiciled women at a CMDHB facility are not described further.

**Table 13: Deliveries in CMDHB Facilities to non-CMDHB Domiciled Women by DHB of Residence and Birth Location, 2000-2009**

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
<b>DHB of Residence</b>										
Auckland	600	630	544	552	603	605	615	580	509	483
Waitemata	67	48	26	20	24	18	22	21	20	30
Other	256	373	80	70	48	63	52	49	59	54
Non-resident	0	5	2	2	1	4	0	0	2	0
<b>Delivery Location</b>										
Middlemore	584	684	508	493	510	515	536	494	473	526
Botany	197	190	92	99	109	134	122	120	82	21
Pukekohe	75	101	39	32	34	24	15	18	17	13
Papakura	67	81	13	20	21	17	16	18	18	7
Other	0	0	0	0	2	0	0	0	0	0
<b>Total</b>	<b>923</b>	<b>1,056</b>	<b>652</b>	<b>644</b>	<b>676</b>	<b>690</b>	<b>689</b>	<b>650</b>	<b>590</b>	<b>567</b>

Source: National Minimum Dataset

### 4.2.4 Section Summary

The majority of pregnant women residing in CMDHB deliver in a CMDHB facility (87%). CMDHB resident women who deliver in another DHB's facility mostly deliver at National Women's Hospital (93%). Of the CMDHB resident women who delivered outside the DHB during 2007-09, 49.8% were European/Other, 30.3% were Asian, 11.0% were Pacific and 9% were Maaori; just over half lived in Howick (52.3%).

Of all CMDHB women who delivered anywhere in NZ during 2009-10, 14.8% delivered in a primary birthing unit (PBU) compared to 9.6% for all NZ women (Figure 15). Of the major metropolitan DHB's during this time, CMDHB had the greatest proportion of its women delivering in a PBU. Within CMDHB, the highest PBU deliver rates occurred in areas with a unit i.e. Franklin, followed by Papakura and Botany. CMDHB women with the highest rates of PBU use were European/Other (30%) and Maaori women (23%) and those living in the least deprived areas (decile 1-2: 30%).

### 4.3 Maternity Provider

Pregnant women are expected to register with maternity provider, a lead maternity carer (LMC), for their antenatal care. In 2004, 1.3% of NZ women did not register with a LMC.<sup>49</sup> In this report, the acronym LMC is only used to refer to Private LMCs who are self-employed and can be a midwife, GP, or obstetrician. These three types of Private LMC are not reliably distinguishable in the local Healthware dataset and so are not reported separately, however, there are very few GP and obstetrician LMCs providing private services to CMDHB women. CMDHB primary maternity providers reported here are Closed Unit, Shared Care and Caseloading (as described in Table 9) while a small number of women receive lead maternity care from CMDHB specialist services (referred to as Secondary Care).

The maternity provider reported here is the provider at the time of birth, although for women who used Secondary Care only for labour and delivery the maternity provider at the onset of labour is used. A woman can change her maternity provider at any time during her pregnancy. In the CMDHB annual report there was little difference in maternity provider at booking/registration compared with at delivery.<sup>57</sup> This was also the case at a national level in 2004.<sup>49</sup> Having said this, the 2004 report found that 30% of women changed provider at least once during their pregnancy.<sup>49</sup>

#### 4.3.1 CMDHB Maternity Provider Use Compared to NZ

Of the CMDHB resident women who delivered in CMDHB during 2007-2009, nearly half (49.5%) used a Private LMC, 24.1% had Shared Care, 19.7% had Closed Unit, 2.5% had Caseloading, and 1.7% had Secondary Care. Of concern, 572 women (2.5%) arrived at the delivery suite in labour with no evidence of having had any structured antenatal care; these women are referred to as Unbooked in this report (Table 14).

Sourcing comparable national data proved difficult, although two sources of similar data were identified The Maternity Services Consumer Satisfaction Survey, a national survey of women who have recently used maternity services last conducted in 2007, reports the lead maternity carer the women first registered with.<sup>7</sup> Growing Up in NZ, a longitudinal study that started in 2010 recruiting pregnant women living in Auckland, Counties Manukau, or Waikato DHB, reports all types of care the women received during pregnancy.<sup>8</sup>

**Table 14: Maternity Provider Use in CMDHB vs. National and Regional Studies**

CMDHB 2007-09			Consumer Survey 2007 <sup>7</sup>		Growing Up in NZ 2010 <sup>8</sup>		
Provider	No.	%	Provider	No.	%	No.	%*
<b>Private LMC</b>	11,117	49.5	<b>Private MW</b>	1,987	71.0	4,596	69.1
			<b>GP Only</b>	112	4.0	93	1.4
			<b>Obstetrician</b>	252	9.0	836	12.6
<b>Shared Care</b>	5,410	24.1	<b>Shared Care</b>			362	5.4
<b>Closed unit</b>	4,420	19.7	<b>Hospital Midwife</b>	420	15.0	1157	17.4
<b>Caseloading</b>	555	2.5					
<b>Secondary Care</b>	393	1.7					
<b>None</b>	572	2.5	<b>None</b>	46	1.6	-	-
<b>Total</b>	22,467		<b>Total</b>	2,798		6,646	

Source: CMDHB data sourced from Healthware. Note: The Consumer Survey is a national survey of women who recently used maternity services. Growing Up in NZ is a longitudinal survey that recruited women from Auckland, Counties Manukau, and Waikato DHBs. \*Women could identify more than one type of care so the percentages total to more than 100%.

Significantly fewer CMDHB women use a private maternity provider (50%) than was reported in either of these two recent surveys (Consumer Survey: 84%; Growing Up: 83%).<sup>7, 8</sup> Private LMC care in CMDHB is almost exclusively provided by private (independent) midwives. In CMDHB, 50% of women used private LMC care compared to 70-71% in the two studies reported. In contrast GP lead care, in the form of Shared Care, occurred much more frequently in CMDHB (24.1%) than was observed in the national survey (4.0%), or regionally in Auckland, Manukau and the Waikato (6.8%). Private obstetrician care is rare in CMDHB women delivering at CMDHB, although a small number of women receive obstetrician led care from the CMDHB via Secondary Care (1.7%). In the 2007 national survey, 9.0% of women used an obstetrician for their pregnancy care.

In the 2007 national consumer survey 1.6% (95% CI: 1.2%-2.2%) of those surveyed reported that they had no antenatal care.<sup>7</sup> The proportion of CMDHB women who had no recorded antenatal care was significantly higher at 2.5% (95% CI: 2.3-2.8%).

### 4.3.2 CMDHB Maternity Provider by Year

During 2007-2009, the rate of private LMC care for CMDHB domiciled women who delivered at a CMDHB facility increased from 47.6% to 51.3% ( $p < 0.0001$ ). This trend remained after controlling for the effects of maternal ethnicity, age, deprivation, suburb, year, parity and delivery location.

In contrast, between 2007 and 2009 the rate of both Secondary and Caseloading care halved. This finding persisted after controlling for factors known to effect maternity provider use. More years of data are required in order to be confident of these trends.

**Table 15: Maternity Provider Use in CMDHB by Year, 2007-09**

	No.	Crude Rate per 100 (95% CI)	Crude OR (95% CI)	p value	Adjusted OR (95% CI)	p value
<b>Private LMC</b>						
2007	3,564	47.6 (46.5-48.7)	ref	ref	ref	ref
2008	3,745	49.5 (48.4-50.6)	1.1 (1.0-1.2)	0.0055	1.1 (1.0-1.2)	0.0093
2009	3,808	51.3 (50.2-52.5)	1.2 (1.1-1.3)	<0.0001	1.2 (1.1-1.3)	<0.0001
<b>Shared Care</b>						
2007	1,789	23.9 (22.9-24.9)	ref	ref	ref	ref
2008	1,886	24.9 (24.0-25.9)	1.1 (1.0-1.2)	ns	1.1 (1.0-1.1)	ns
2009	1,735	23.4 (22.4-24.4)	1.0 (0.9-1.1)	ns	0.9 (0.9-1.0)	ns
<b>Closed Unit</b>						
2007	1,789	23.9 (22.9-24.9)	ref	ref	ref	ref
2008	1,886	24.9 (24.0-25.9)	1.1 (1.0-1.2)	ns	1.1 (1.0-1.1)	ns
2009	1,735	23.4 (22.4-24.4)	1.0 (0.9-1.1)	ns	0.9 (0.9-1.0)	ns
<b>Secondary Care</b>						
2007	151	2.0 (1.7-2.3)	ref	ref	ref	ref
2008	157	2.1 (1.8-2.4)	1.0 (0.8-1.3)	ns	1.0 (0.8-1.3)	ns
2009	85	1.1 (0.9-1.4)	0.6 (0.4-0.7)	<0.0001	0.6 (0.4-0.7)	<0.0001
<b>Caseloading</b>						
2007	265	3.5 (3.1-4.0)	ref	ref	ref	ref
2008	154	2.0 (1.7-2.4)	0.6 (0.5-0.7)	<0.0001	0.5 (0.4-0.7)	<0.0001
2009	136	1.8 (1.5-2.1)	0.5 (0.4-0.6)	<0.0001	0.5 (0.4-0.6)	<0.0001

Source: Healthware. Note: Only includes CMDHB women who delivered in CMDHB. ref: reference group. OR: Odds Ratio. Adjusted OR control for the effects of maternal ethnicity, age, deprivation, suburb, parity and delivery location on maternity provider use

### 4.3.3 CMDHB Maternity Provider by Ethnicity

Maternity provider use differed significantly by maternal ethnicity ( $p < 0.0001$ ). Differences in maternity provider use by ethnic group persisted for all maternity provider types after adjusting for the effects of age group, deprivation, suburb, year, parity and delivery location (see adjusted odds ratio's in Table 25).

**Table 16: Maternity Provider Use in CMDHB by Ethnicity, 2007-09**

	No.	Crude Rate per 100 (95% CI)	Crude OR (95% CI)	p value	Adjusted OR (95% CI)	p value
<b>Private LMC</b>						
Maaori	2,290	44.5 (43.2-45.9)	0.3 (0.3-0.4)	<0.0001	0.4 (0.4-0.5)	<0.0001
Pacific	3,017	36.8 (35.7-37.8)	0.2 (0.2-0.3)	<0.0001	0.4 (0.4-0.4)	<0.0001
Chinese	123	28.4 (24.2-32.7)	0.2 (0.1-0.2)	<0.0001	0.2 (0.2-0.2)	<0.0001
Indian	818	51.2 (48.8-53.7)	0.4 (0.4-0.5)	<0.0001	0.5 (0.5-0.6)	<0.0001
Other Asian	382	47.5 (44.1-51.0)	0.3 (0.3-0.4)	<0.0001	0.5 (0.4-0.5)	<0.0001
Euro/Other	4,359	72.0 (70.9-73.2)	ref	ref	ref	ref
<b>Shared Care</b>						
Maaori	1,274	24.8 (23.6-26.0)	4.3 (3.9-4.9)	<0.0001	2.3 (2.0-2.6)	<0.0001
Pacific	3,033	36.9 (35.9-38.0)	7.6 (6.8-8.4)	<0.0001	3.1 (2.7-3.5)	<0.0001
Chinese	33	7.6 (5.1-10.1)	1.0 (0.7-1.5)	ns	0.7 (0.5-1.1)	ns
Indian	431	27.0 (24.8-29.2)	4.6 (3.9-5.3)	<0.0001	2.9 (2.4-3.3)	<0.0001
Other Asian	146	18.2 (15.5-20.8)	2.7 (2.2-3.3)	<0.0001	1.8 (1.4-2.2)	<0.0001
Euro/Other	455	7.5 (6.9-8.2)	ref	ref	ref	ref
<b>Closed Unit</b>						
Maaori	1,115	21.7 (20.6-22.8)	1.7 (1.5-1.9)	<0.0001	1.5 (1.4-1.7)	<0.0001
Pacific	1,587	19.3 (18.5-20.2)	1.4 (1.3-1.5)	<0.0001	1.3 (1.2-1.5)	<0.0001
Chinese	255	58.9 (54.3-63.5)	8.3 (6.8-10.2)	<0.0001	7.0 (5.7-8.7)	<0.0001
Indian	272	17.0 (15.2-18.9)	1.2 (1.0-1.4)	0.0358	1.2 (1.0-1.3)	ns
Other Asian	236	29.4 (26.2-32.5)	2.4 (2.0-2.8)	<0.0001	2.2 (1.8-2.6)	<0.0001
Euro/Other	903	14.9 (14.0-15.8)	ref	ref	ref	ref
<b>Secondary Care</b>						
Maaori	90	1.8 (1.4-2.1)	1.4 (1.0-1.9)	0.0306	1.6 (1.1-2.3)	0.0065
Pacific	175	2.1 (1.8-2.4)	1.7 (1.3-2.2)	0.0002	1.4 (1.0-2.0)	ns
Chinese	9	2.1 (0.7-3.4)	1.6 (0.8-3.2)	ns	1.3 (0.6-2.7)	ns
Indian	26	1.6 (1.0-2.2)	1.2 (0.8-1.9)	ns	1.2 (0.7-1.9)	ns
Other Asian	8	1.0 (0.3-1.7)	0.8 (0.4-1.6)	ns	0.6 (0.3-1.4)	ns
Euro/Other	80	1.3 (1.0-1.6)	ref	ref	ref	ref
<b>Caseloading</b>						
Maaori	106	2.1 (1.7-2.5)	0.6 (0.4-0.7)	<.0001	0.7 (0.5-0.9)	0.0043
Pacific	139	1.7 (1.4-2.0)	0.5 (0.4-0.6)	<.0001	0.7 (0.5-0.9)	0.0056
Chinese	9	2.1 (0.7-3.4)	0.5 (0.3-1.1)	ns	0.4 (0.2-0.8)	0.0138
Indian	41	2.6 (1.8-3.3)	0.7 (0.5-0.9)	0.0218	0.9 (0.6-1.2)	ns
Other Asian	28	3.5 (2.2-4.8)	0.9 (0.6-1.4)	ns	0.9 (0.6-1.4)	ns
Euro/Other	228	3.8 (3.3-4.2)	ref	ref	ref	ref

Source: Healthware. Note: Only includes CMDHB women who delivered in CMDHB. ref: reference group. OR: Odds Ratio. Adjusted OR control for the effects of age group, deprivation, suburb, year, parity and delivery location on maternity provider use. Ethnicity is preferred.

During 2007-09, CMDHB resident Maaori women most frequently used a Private LMC (45%), followed by Shared Care (25%) and Closed Unit (22%) (Table 25). Pacific women used Private LMC (37%) and Shared Care (36%) equally, and Closed Unit care less often (19%). European/Other CMDHB residents had the highest rate of Private LMC use (72%), and among the lowest Closed Unit (15%) and Shared Care (8%) use.

For Asian CMDHB residents, maternity provider use differed for Chinese and Indian women. Nearly two thirds of CMDHB resident Chinese women deliver outside the DHB compared with 10% of Indian women (Table 11). Of the CMDHB Chinese women who delivered in CMDHB, most used Closed Unit (59%) or a Private LMC (28%), with only 8% using Shared Care. In comparison, Indian women used Private LMC (51%) and Shared Care (27%) more frequently and Closed Unit care less often (17%).

Caseloading care is used by only a small number of women. The odds of using a Caseloading midwife are greatest for European/Other women, and lowest for Chinese women and Maaori and Pacific women after adjusting for the effects of factors that influence maternity provider use (Adjusted OR, Table 25).

A relatively small number of CMDHB women receive Secondary Care, CMDHB specialist obstetric care. After adjusting for the effects of other factors that influence maternity service use, no difference in the odds of using Secondary Care was found for European/Other, Asian, or Pacific women. In contrast, Maaori women had the highest odds of using Secondary Care, 1.6 times higher than the odds in European/Other women.

#### **4.3.4 CMDHB Maternity Provider by Age Group**

Maternity provider use differed significantly by age group ( $p < 0.0001$ ) with differences remaining for most services after adjusting for the effects of ethnicity, deprivation, suburb, year, parity and delivery location (see adjusted odds ratio's in Table 17).

Compared with women aged 30-34 years, women aged <25 and 40 years and older had significantly lower odds of using a Private LMC after adjusting for the effect of factors that influence maternity provider use. In contrast, women aged <25 years had significantly higher odds of using Shared Care and Closed Unit than women aged 30-34 years. Women aged 35 years and older also had higher odds of Closed Unit care use than women aged 30-34 years.

While Secondary Care does not provide care for many CMDHB women, use of Secondary Care increased with increasing age from <1% in women aged <20 years to 5.2% of women aged 40 years and older. After adjusting for factors that influence maternity provider use this trend remained significant, with the odds of Secondary Care use 2.5 times higher in women  $\geq 40$  years old than in women aged 30-34 years. In contrast, no significant differences in the use of a Caseloading midwife were demonstrated by age group after adjustment.

#### **4.3.5 CMDHB Maternity Provider Use by NZ Deprivation Index 2006**

While crude rates of Private LMC use generally declined with increasing deprivation, after adjusting for other factors affecting Private LMC use only women living in the most deprived areas (decile 9-10) had a lower odds of using a Private LMC (20% less) than women living in the least deprived areas (decile 1-2). Use of a Caseloading midwife followed this same trend, although only a small number of CMDHB women use this service (Table 18).

In contrast, Shared Care use generally increased with deprivation, with similar use by women living in decile 1-6 areas (7.6%-10.4%) and much higher use by women living in decile 7-8 (25%) and decile 9-10 (30%) areas. After adjusting for factors that influence maternity provider use, the odds of using Shared Care was 1.6 times higher in women living in decile 8-10 areas than in women living in decile 1-2 areas.

After adjusting for the effects of ethnicity, age group, suburb, year, parity and delivery location, Closed Unit and Secondary Care use did not differ significantly by NZ deprivation index decile.

**Table 17: Maternity Provider Use in CMDHB by Age Group, 2007-09**

	No.	Crude Rate per 100 (95% CI)	Crude OR (95% CI)	p value	Adjusted OR (95% CI)	p value
<b>Private LMC</b>						
<20 years	979	41.4 (39.4-43.4)	0.6 (0.6-0.7)	<0.0001	0.6 (0.5-0.6)	<0.0001
20-24 years	2,443	46.0 (44.7-47.4)	0.7 (0.7-0.8)	<0.0001	0.8 (0.7-0.8)	<0.0001
25-29 years	3,124	52.1 (50.8-53.3)	0.9 (0.9-1.0)	ns	1.0 (0.9-1.0)	ns
30-34 years	2,722	54.1 (52.8-55.5)	ref	ref	ref	ref
35-39 years	1,551	51.3 (49.6-53.1)	0.9 (0.8-1.0)	0.0267	0.9 (0.8-1.0)	ns
40+ years	298	39.8 (36.3-43.3)	0.6 (0.5-0.7)	<0.0001	0.7 (0.6-0.8)	<0.0001
<b>Shared Care</b>						
<20 years	682	28.8 (27.0-30.7)	1.6 (1.4-1.7)	<0.0001	1.4 (1.2-1.6)	<0.0001
20-24 years	1,490	28.1 (26.9-29.3)	1.5 (1.4-1.7)	<0.0001	1.2 (1.1-1.4)	<0.0001
25-29 years	1,428	23.8 (22.7-24.9)	1.2 (1.1-1.3)	0.0001	1.1 (1.0-1.2)	ns
30-34 years	1,055	21.0 (19.9-22.1)	ref	ref	ref	ref
35-39 years	576	19.1 (17.7-20.5)	0.9 (0.8-1.0)	ns	0.9 (0.8-1.0)	0.0261
40+ years	179	23.9 (20.9-27.0)	1.2 (1.0-1.4)	ns	1.0 (0.8-1.2)	ns
<b>Closed Unit</b>						
<20 years	574	24.3 (22.5-26.0)	1.5 (1.3-1.7)	<0.0001	1.8 (1.5-2.0)	<0.0001
20-24 years	1,034	19.5 (18.4-20.6)	1.1 (1.0-1.2)	0.0245	1.2 (1.1-1.4)	0.0001
25-29 years	1,062	17.7 (16.7-18.7)	1.0 (0.9-1.1)	ns	1.0 (0.9-1.1)	ns
30-34 years	912	18.1 (17.1-19.2)	ref	ref	ref	ref
35-39 years	637	21.1 (19.6-22.5)	1.2 (1.1-1.4)	0.0008	1.1 (1.0-1.3)	0.0258
40+ years	201	26.9 (23.7-30.0)	1.7 (1.4-2.0)	<0.0001	1.5 (1.2-1.8)	<0.0001
<b>Secondary Care</b>						
<20 years	16	0.7 (0.3-1.0)	0.3 (0.2-0.5)	<.0001	0.2 (0.1-0.4)	<0.0001
20-24 years	42	0.8 (0.6-1.0)	0.4 (0.3-0.5)	<.0001	0.3 (0.2-0.4)	<0.0001
25-29 years	82	1.4 (1.1-1.7)	0.6 (0.5-0.8)	0.0019	0.6 (0.4-0.8)	0.0003
30-34 years	109	2.2 (1.8-2.6)	ref	ref	ref	ref
35-39 years	105	3.5 (2.8-4.1)	1.6 (1.2-2.1)	0.0004	1.6 (1.2-2.2)	0.0004
40+ years	39	5.2 (3.6-6.8)	2.5 (1.7-3.6)	<.0001	2.5 (1.7-3.7)	<0.0001
<b>Caseloading</b>						
<20 years	42	1.8 (1.2-2.3)	0.6 (0.4-0.8)	0.003	0.8 (0.5-1.1)	ns
20-24 years	110	2.1 (1.7-2.5)	0.7 (0.5-0.9)	0.0046	0.8 (0.6-1.1)	ns
25-29 years	148	2.5 (2.1-2.9)	0.8 (0.7-1.0)	ns	0.9 (0.7-1.1)	ns
30-34 years	151	3.0 (2.5-3.5)	ref	ref	ref	ref
35-39 years	89	2.9 (2.3-3.5)	1.0 (0.8-1.3)	ns	1.1 (0.8-1.4)	ns
40+ years	15	2.0 (1.0-3.0)	0.7 (0.4-1.1)	ns	0.9 (0.5-1.5)	ns

Source: Healthware. Note: Only includes CMDHB women who delivered in CMDHB. ref: reference group. OR: Odds Ratio. Adjusted OR control for the effects of ethnicity, deprivation, suburb, year, parity and delivery location on maternity provider use.

**Table 18: Maternity Provider Use in CMDHB by New Zealand Deprivation Index 2006 Decile, 2007-09**

	No.	Crude Rate per 100 (95% CI)	Crude OR (95% CI)	p value	Adjusted OR (95% CI)	p value
<b>Private LMC</b>						
Decile 1-2	1,201	65.6 (63.5-67.8)	ref	ref	ref	ref
Decile 3-4	671	63.3 (60.4-66.2)	0.9 (0.8-1.1)	ns	1.0 (0.9-1.2)	ns
Decile 5-6	1,701	65.0 (63.2-66.9)	1.0 (0.9-1.1)	ns	1.0 (0.9-1.2)	ns
Decile 7-8	1,022	49.1 (47.0-51.3)	0.5 (0.5-0.6)	<0.0001	0.9 (0.8-1.1)	ns
Decile 9-10	6,518	43.8 (43.0-44.6)	0.4 (0.4-0.5)	<0.0001	0.8 (0.7-0.9)	0.0014
<b>Shared Care</b>						
Decile 1-2	139	7.6 (6.4-8.8)	ref	ref	ref	ref
Decile 3-4	110	10.4 (8.5-12.2)	1.4 (1.1-1.8)	0.0104	1.1 (0.8-1.5)	ns
Decile 5-6	242	9.3 (8.1-10.4)	1.3 (1.0-1.6)	0.0421	1.0 (0.8-1.3)	ns
Decile 7-8	513	24.7 (22.8-26.5)	4.1 (3.3-5.0)	<0.0001	1.6 (1.2-2.0)	0.0002
Decile 9-10	4,405	29.6 (28.9-30.3)	5.3 (4.5-6.4)	<0.0001	1.6 (1.3-2.0)	<0.0001
<b>Closed Unit</b>						
Decile 1-2	370	20.2 (18.4-22.1)	ref	ref	ref	ref
Decile 3-4	221	20.8 (18.4-23.3)	1.0 (0.9-1.3)	ns	1.0 (0.8-1.3)	ns
Decile 5-6	512	19.6 (18.1-21.1)	1.0 (0.8-1.1)	ns	1.1 (0.9-1.3)	ns
Decile 7-8	411	19.8 (18.0-21.5)	1.0 (0.8-1.2)	ns	1.0 (0.8-1.2)	ns
Decile 9-10	2,905	19.5 (18.9-20.2)	1.0 (0.9-1.1)	ns	1.1 (0.9-1.3)	ns
<b>Secondary Care</b>						
Decile 1-2	21	1.1 (0.7-1.6)	ref	ref	ref	ref
Decile 3-4	9	0.8 (0.3-1.4)	0.7 (0.3-1.6)	ns	0.7 (0.3-1.6)	ns
Decile 5-6	47	1.8 (1.3-2.3)	1.6 (0.9-2.7)	ns	1.6 (0.9-2.7)	ns
Decile 7-8	34	1.6 (1.1-2.2)	1.5 (0.8-2.5)	ns	1.1 (0.6-2.1)	ns
Decile 9-10	282	1.9 (1.7-2.1)	1.7 (1.1-2.7)	0.0182	1.2 (0.7-2.1)	ns
<b>Caseloading</b>						
Decile 1-2	89	4.9 (3.9-5.8)	ref	ref	ref	ref
Decile 3-4	43	4.1 (2.9-5.2)	0.8 (0.6-1.2)	ns	0.9 (0.6-1.4)	ns
Decile 5-6	75	2.9 (2.2-3.5)	0.6 (0.4-0.8)	0.0007	0.7 (0.5-1.0)	ns
Decile 7-8	61	2.9 (2.2-3.7)	0.6 (0.4-0.8)	0.0025	0.7 (0.5-1.0)	ns
Decile 9-10	287	1.9 (1.7-2.2)	0.4 (0.3-0.5)	<.0001	0.7 (0.5-1.0)	0.03

Source: Healthware. Note: Only includes CMDHB women who delivered in CMDHB. ref: reference group. OR: Odds Ratio. Adjusted OR control for the effects of ethnicity, age group, suburb, year, parity and delivery location on maternity provider use. NZ Deprivation Index is at Census Area Unit level (see section 2.1.1).

### 4.3.6 CMDHB Maternity Provider Use by Suburb

During 2007-09, maternity provider use varied depending on where within CMDHB a woman lived. Differences persisted even after adjusting for factors known to influence maternity provider use (see adjusted odds ratios in Table 19).

Private LMC use was highest in Franklin (81%), Papakura (57%), and Howick (52%) and lowest in Otara (26%). After adjusting for factors known to influence maternity provider use, Franklin women continued to have the highest odds of Private LMC at 2.7 times higher than for Howick women, and women living in Otara had the lowest odds (30% lower than for Howick residents).

In contrast, Shared Care use was highest in women living in Otara (53%) and lowest in women living Howick (14%), Papakura (14%), and Franklin (2.3%). After adjustment the odds of using Shared Care in comparison to Howick residents was 2.6 times higher in Otara women and 80% lower in Franklin women.

Closed Unit use was highest in women living in Howick (28%) and lowest for women living in Otara (14%) and Franklin (13%). After adjusting for factors that influence maternity provider use, women living in all other areas of CMDHB had a lower odds of using Closed Unit care than women living in Howick, and those with lowest odds were women living in Otara (70% less) and Manurewa (50% less).

**Table 19: Maternity Provider Use in CMDHB by Residential Area, 2007-09**

	No.	Crude Rate per 100 (95% CI)	Crude OR (95% CI)	p value	Adjusted OR (95% CI)	p value
<b>Private LMC</b>						
Howick	1,324	51.5 (49.5-53.4)	ref	ref	ref	ref
Otara	663	25.6 (23.9-27.2)	0.3 (0.3-0.4)	<0.0001	0.7 (0.6-0.8)	<0.0001
Papatoetoe	1,440	48.2 (46.4-50.0)	0.9 (0.8-1.0)	ns	1.6 (1.4-1.9)	<0.0001
Mangere	1,429	37.7 (36.2-39.3)	0.6 (0.5-0.7)	<0.0001	1.3 (1.1-1.5)	0.0004
Manurewa	2,560	49.4 (48.1-50.8)	1.0 (0.9-1.1)	ns	1.6 (1.4-1.8)	<0.0001
Papakura	1,450	56.6 (54.7-58.5)	1.3 (1.2-1.5)	<0.0001	1.5 (1.3-1.7)	<0.0001
Franklin	2,251	80.9 (79.5-82.4)	4.1 (3.6-4.6)	<0.0001	2.7 (2.3-3.1)	<0.0001
<b>Shared Care</b>						
Howick	347	13.5 (12.2-14.8)	ref	ref	ref	ref
Otara	1,369	52.8 (50.9-54.7)	7.7 (6.7-8.9)	<0.0001	2.6 (2.2-3.1)	<0.0001
Papatoetoe	761	25.5 (23.9-27.0)	2.2 (1.9-2.6)	<0.0001	0.9 (0.8-1.1)	ns
Mangere	1,215	32.1 (30.6-33.6)	3.2 (2.8-3.6)	<0.0001	1.1 (0.9-1.3)	ns
Manurewa	1,309	25.3 (24.1-26.5)	2.2 (2.0-2.6)	<0.0001	1.0 (0.9-1.2)	ns
Papakura	345	13.5 (12.1-14.8)	1.0 (0.9-1.2)	ns	0.7 (0.5-0.8)	<0.0001
Franklin	64	2.3 (1.7-2.9)	0.2 (0.1-0.2)	<0.0001	0.2 (0.2-0.3)	<0.0001
<b>Closed Unit</b>						
Howick	720	28.0 (26.2-29.7)	ref	ref	ref	ref
Otara	353	13.6 (12.3-14.9)	0.4 (0.4-0.5)	<0.0001	0.3 (0.3-0.4)	<0.0001
Papatoetoe	623	20.9 (19.4-22.3)	0.7 (0.6-0.8)	<0.0001	0.6 (0.5-0.7)	<0.0001
Mangere	884	23.3 (22.0-24.7)	0.8 (0.7-0.9)	0.0003	0.6 (0.5-0.7)	<0.0001
Manurewa	938	18.1 (17.1-19.2)	0.6 (0.5-0.7)	<0.0001	0.5 (0.4-0.5)	<0.0001
Papakura	533	20.8 (19.2-22.4)	0.7 (0.6-0.8)	<0.0001	0.7 (0.6-0.8)	<0.0001
Franklin	369	13.3 (12.0-14.5)	0.4 (0.3-0.5)	<0.0001	0.6 (0.5-0.7)	<0.0001
<b>Secondary Care</b>						
Howick	28	1.1 (0.7-1.5)	ref	ref	ref	ref
Otara	61	2.4 (1.8-2.9)	2.3 (1.4-3.6)	0.0004	1.9 (1.1-3.4)	0.0252
Papatoetoe	48	1.6 (1.2-2.1)	1.5 (0.9-2.4)	ns	1.2 (0.7-2.1)	ns
Mangere	84	2.2 (1.7-2.7)	2.1 (1.4-3.3)	0.0007	1.7 (1.0-2.9)	ns
Manurewa	97	1.9 (1.5-2.2)	1.8 (1.2-2.7)	0.0078	1.6 (1.0-2.7)	ns
Papakura	43	1.7 (1.2-2.2)	1.6 (1.0-2.6)	ns	1.7 (1.0-3.0)	ns
Franklin	32	1.2 (0.8-1.5)	1.1 (0.6-1.8)	ns	1.0 (0.5-1.8)	ns
<b>Caseloading</b>						
Howick	134	5.2 (4.3-6.1)	ref	ref	ref	ref
Otara	47	1.8 (1.3-2.3)	0.3 (0.2-0.5)	<0.0001	0.8 (0.5-1.2)	ns
Papatoetoe	51	1.7 (1.2-2.2)	0.3 (0.2-0.4)	<0.0001	0.7 (0.5-1.1)	ns
Mangere	54	1.4 (1.0-1.8)	0.3 (0.2-0.4)	<0.0001	0.7 (0.4-1.0)	ns
Manurewa	116	2.2 (1.8-2.6)	0.4 (0.3-0.6)	<0.0001	0.8 (0.6-1.2)	ns
Papakura	108	4.2 (3.4-5.0)	0.8 (0.6-1.1)	ns	1.3 (0.9-1.9)	ns
Franklin	45	1.6 (1.1-2.1)	0.3 (0.2-0.4)	<0.0001	0.7 (0.5-1.0)	0.036

Source: Healthware. Note: Only includes CMDHB women who delivered in CMDHB. ref: reference group. OR: Odds Ratio. Adjusted OR control for the effects of ethnicity, age group, deprivation, year, parity and delivery location on maternity provider use.

Secondary Care is used by a small number of CMDHB women. Women living in Papatoetoe, Mangere, Manurewa, Papakura, and Franklin had the same odds of using Secondary Care, whereas women living in Otara had 1.9 times higher odds of using Secondary Care. Similarly for Caseloading care, only for women living in Franklin (30% lower) did the odds of use differ from that seen in women living elsewhere in the DHB.

#### 4.3.7 CMDHB Maternity Provider by Delivery Location

Women may chose their maternity provider depending on where they wish to give birth as some maternity providers only deliver in certain locations. During 2007-09 maternity provider use varied by delivery location (Table 20) with differences persisting after adjusting for the effects of factors that influence maternity provider use (maternal ethnicity, age group, deprivation, suburb, year and parity).

Primary birthing units are most frequently used by CMDHB women with a Private LMC. Almost all (91%) of the women who delivered at the Pukekohe Birthing Unit during 2007-09 were delivered by a Private LMC, whilst 66% of those who delivered at the Papakura, and 58% of those delivered at the Botany primary birthing unit were cared for by a Private LMC. Women cared for by a Private LMC consequently have higher odds of delivery at a primary birthing unit than at Middlemore hospital. With the exception of the Pukekohe primary birthing unit, women cared for by a Caseloading midwife also have greater odds of delivering at a primary birthing unit than at Middlemore hospital.

**Table 20: Maternity Provider Use in CMDHB by Delivery Location, 2007-09**

	No.	Crude Rate per 100 (95% CI)	Crude OR (95% CI)	p value	Adjusted OR (95% CI)	p value
<b>Private LMC</b>						
Middlemore	8,518	45.2 (44.5-46.0)	ref	ref	ref	ref
Botany	624	57.8 (54.9-60.8)	1.6 (1.4-1.8)	<0.0001	1.6 (1.4-1.8)	<0.0001
Papakura	918	65.8 (63.3-68.2)	2.3 (2.0-2.6)	<0.0001	2.1 (1.8-2.3)	<0.0001
Pukekohe	1,057	90.7 (89.0-92.3)	11.2 (9.2-13.7)	<0.0001	4.9 (3.9-6.1)	<0.0001
<b>Shared Care</b>						
Middlemore	5,045	26.8 (26.2-27.4)	ref	ref	ref	ref
Botany	180	16.7 (14.5-18.9)	0.5 (0.4-0.6)	<0.0001	0.7 (0.6-0.9)	0.0009
Papakura	171	12.2 (10.5-14.0)	0.4 (0.3-0.4)	<0.0001	0.6 (0.5-0.7)	<0.0001
Pukekohe	14	1.2 (0.6-1.8)	0.03 (0.02-0.05)	<0.0001	0.2 (0.1-0.4)	<0.0001
<b>Closed Unit</b>						
Middlemore	3,959	21.0 (20.4-21.6)	ref	ref	ref	ref
Botany	165	15.3 (13.1-17.4)	0.7 (0.6-0.8)	<0.0001	0.5 (0.4-0.6)	<0.0001
Papakura	213	15.3 (13.4-17.1)	0.7 (0.6-0.8)	<0.0001	0.6 (0.5-0.8)	<0.0001
Pukekohe	83	7.1 (5.6-8.6)	0.3 (0.2-0.3)	<0.0001	0.3 (0.2-0.4)	<0.0001
<b>Secondary Care</b>						
Middlemore	379	2.0 (1.8-2.2)	ref	ref	ref	ref
Botany	1	0.1 (0.0-0.3)	0.0 (0.0-0.3)	0.0018	0.1 (0.0-0.4)	0.0041
Papakura	3	0.2 (0.0-0.5)	0.1 (0.0-0.3)	<0.0001	0.1 (0.0-0.3)	0.0001
Pukekohe	10	0.9 (0.3-1.4)	0.4 (0.2-0.8)	0.0054	0.5 (0.2-1.1)	0.0986
<b>Caseloading</b>						
Middlemore	374	2.0 (1.8-2.2)	ref	ref	ref	ref
Botany	105	9.7 (8.0-11.5)	5.2 (4.1-6.5)	<0.0001	3.9 (3.0-5.0)	<0.0001
Papakura	75	5.4 (4.2-6.6)	2.8 (2.1-3.5)	<0.0001	2.2 (1.7-3.0)	<0.0001
Pukekohe	1	0.1 (0.0-0.3)	0.0 (0.0-0.3)	0.0014	0.0 (0.0-0.3)	0.0015

Source: Healthware. Note: Only includes CMDHB women who delivered in CMDHB. ref: reference group. OR: Odds Ratio. Adjusted OR control for the effects of maternal ethnicity, age group, deprivation, suburb, year and parity on maternity provider use.

In contrast, women with Shared Care, Closed Unit, and Secondary Care have higher odds of delivering at Middlemore Hospital than at a primary birthing unit. For women with Shared Care, this may be related to proximity as 86% of these women live in a suburb without a primary birthing unit (Otara, Manurewa, Mangere, and Papatoetoe). A lower proportion of women with Closed Unit care (63%) live in a suburb without a primary birthing unit compared to those under Shared Care. However, women identified as high risk during their pregnancy can continue their care under Closed Unit, with additional obstetrician care, which is also likely to contribute to the higher rate of delivery at Middlemore. Almost all of the women using Secondary Care delivered at Middlemore Hospital, and as Secondary Care is for women at high risk this is finding was expected.

#### 4.3.8 CMDHB Maternity Provider by Parity

The type of maternity provider used differed depending on the number of previous births a woman had experienced (parity) with some differences persisting after adjustment for factors that influence maternity provider use (see adjusted odds ratios in Table 21).

Women with no previous children (nulliparous women) most frequently used a Private LMC (53%) with the odds of Private LMC use decreasing significantly with increasing parity after adjusting for the effects of year, ethnicity, age group, deprivation, suburb, and delivery location. Closed Unit use showed an inverse trend with crude rates of use increasing from 19% in nulliparous women to 25% in women with a parity of 6 or higher, a trend that persisted after adjusting for factors that influence maternity provider use.

**Table 21: Maternity Provider Use in CMDHB by Parity, 2007-09**

	No.	Crude Rate per 100 (95% CI)	Crude OR (95% CI)	p value	Adjusted OR (95% CI)	p value
<b>Private LMC</b>						
Nulliparous	4,514	52.5 (51.5-53.6)	ref	ref	ref	ref
1-2	4,937	51.8 (50.8-52.8)	1.0 (0.9-1.0)	ns	0.8 (0.8-0.9)	<0.0001
3-5	1,459	39.8 (38.2-41.4)	0.6 (0.6-0.7)	<0.0001	0.6 (0.6-0.7)	<0.0001
6 or more	207	30.6 (27.1-34.1)	0.4 (0.4-0.5)	<0.0001	0.5 (0.4-0.6)	<0.0001
<b>Shared Care</b>						
Nulliparous	1,978	23.0 (22.1-23.9)	ref	ref	ref	ref
1-2	2,098	22.0 (21.2-22.8)	0.9 (0.9-1.0)	ns	1.1 (1.0-1.1)	ns
3-5	1,129	30.8 (29.3-32.3)	1.5 (1.4-1.7)	<0.0001	1.3 (1.2-1.4)	<0.0001
6 or more	205	30.3 (26.9-33.8)	1.7 (1.4-2.0)	<0.0001	1.2 (1.0-1.4)	ns
<b>Closed Unit</b>						
Nulliparous	1,633	19.0 (18.2-19.8)	ref	ref	ref	ref
1-2	1,860	19.5 (18.7-20.3)	0.9 (0.9-1.0)	ns	1.2 (1.1-1.3)	<0.0001
3-5	760	20.7 (19.4-22.0)	1.5 (1.4-1.7)	<0.0001	1.4 (1.2-1.5)	<0.0001
6 or more	167	24.7 (21.5-28.0)	1.7 (1.4-2.0)	<0.0001	1.6 (1.3-1.9)	<0.0001
<b>Secondary Care</b>						
Nulliparous	104	1.2 (1.0-1.4)	ref	ref	ref	ref
1-2	187	2.0 (1.7-2.2)	1.6 (1.3-2.1)	<0.0001	1.2 (0.9-1.5)	ns
3-5	82	2.2 (1.8-2.7)	1.9 (1.4-2.6)	<0.0001	0.7 (0.5-1.0)	ns
6 or more	20	3.0 (1.7-4.2)	2.7 (1.7-4.4)	<0.0001	0.6 (0.4-1.1)	ns
<b>Caseloading</b>						
Nulliparous	181	2.1 (1.8-2.4)	ref	ref	ref	ref
1-2	283	3.0 (2.6-3.3)	1.4 (1.2-1.7)	0.0003	1.2 (1.0-1.5)	0.0442
3-5	82	2.2 (1.8-2.7)	1.1 (0.8-1.4)	ns	1.1 (0.8-1.5)	ns
6 or more	9	1.3 (0.5-2.2)	0.7 (0.3-1.3)	ns	0.7 (0.3-1.4)	ns

Source: Healthware. Note: Only includes CMDHB women who delivered in CMDHB. OR: Odds Ratio. Adjusted OR control for the effects of maternal ethnicity, age group, deprivation, suburb, year and delivery location on maternity provider use.

After adjusting for other factors, there was no difference in Secondary Care use by parity, and only small differences for women using Shared Care (highest odds in para 3-5 women) or Caseloading (highest odds in para 1-2 women).

#### **4.3.9 CMDHB Women with No Antenatal Care (Unbooked Women)**

During 2007-2009, 572 (2.6%) CMDHB resident women who delivered in CMDHB were Unbooked with no evidence of having had any structured antenatal care in their Healthware records. There was an increase in the proportion of Unbooked women between 2007 and 2008 which persisted into 2009 (Table 22). This increase persisted after adjusting for factors that influence booking rates. While this increase is concerning, more years of data are required to be confident of this trend.

The Unbooked rate at delivery declined significantly with increasing gestation ( $p < 0.0001$ ) and was 22.1% (95% CI: 14.8-29.5) at 20-23 weeks, 6.4% (95% CI: 3.0-9.8) at 28-31 weeks, 2.3% (95% CI: 2.1-2.5) at 37-41 weeks, and 1.1% (95% CI: 0.5-1.7) in women delivering beyond 41 weeks. However, most of the Unbooked women (80.6%) delivered after 36 weeks gestation. Almost all of the Unbooked women during this time presented at Middlemore Hospital (96.3%) which saw the highest rate of Unbooked women (2.9 per 100 women) of all the CMDHB facilities (Table 22).

Most of the Unbooked women during 2007-09 (92.6%) were Maaori or Pacific. After adjusting for factors that influence booking rates, the odds of being Unbooked was nearly 7 times greater in Maaori women and 4 times greater in Pacific women than in European/Other women. In contrast, the odds of an Unbooked pregnancy in Asian women did not differ significantly from the odds in European/Other women although the numbers of Unbooked Asian women were very small.

Nearly half (45.3%) of the Unbooked women during 2007-09 were aged less than 25 years old. All age groups below 30 years old had higher odds of an Unbooked pregnancy than 30-34 year olds after adjustment, with women aged 20-24 years having the highest Unbooked rate (3.5%). The odds of being Unbooked were no difference in women aged 35 years and older than it was in women aged 30-34 years.

While the crude Unbooked rate increased with increasing deprivation, after adjusting for the effects of ethnicity, age group, suburb, year, delivery location, and parity no differences in the proportion of women who were Unbooked by decile were found. Similarly, while the crude Unbooked rates differed by suburb, after the effects of factors influencing booking were accounted for no significant differences persisted.

Crude rates of Unbooked pregnancies were similar for nulliparous women and women who were para 1-2 (i.e. 2.1% and 1.8% respectively). Beyond a parity of two, the crude rate of Unbooked pregnancies increased from 4% in para 3-5 women to 10% in women with a parity of 6 or more. This trend persisted after adjusting for factors that influence booking rates, with the adjusted odds of an Unbooked pregnancy 6.5 times higher in women with a parity of 6 or more than seen in nulliparous women.

**Table 22: Demographic and Pregnancy Characteristics of Unbooked Women, CMDHB 2007-2009**

	No.	Crude Rate per 100 (95% CI)	Crude OR (95% CI)	p	Adjusted OR (95% CI)	p
<b>Delivery Year</b>						
2007	156	2.1 (1.8-2.4)	ref	ref	ref	ref
2008	208	2.7 (2.4-3.1)	1.3 (1.1-1.6)	0.0081	1.4 (1.1-1.7)	0.0058
2009	208	2.8 (2.4-3.2)	1.4 (1.1-1.7)	0.0045	1.4 (1.1-1.8)	0.0014
<b>Ethnicity</b>						
Maaori	266	5.2 (4.6-5.8)	12.2 (8.2-18.1)	<.0001	6.9 (4.5-10.5)	<0.0001
Pacific	258	3.1 (2.8-3.5)	7.2 (4.9-10.8)	<.0001	4.1 (2.7-6.3)	<0.0001
Chinese	4	0.9 (0.0-1.8)	2.1 (0.7-6.0)	ns	2.5 (0.9-7.3)	ns
Indian	9	0.6 (0.2-0.9)	1.3 (0.6-2.7)	ns	1.1 (0.5-2.3)	ns
Other Asian	4	0.5 (0.0-1.0)	1.1 (0.4-3.2)	ns	1.0 (0.4-3.0)	ns
Euro/Other	27	0.4 (0.3-0.6)	ref	ref	ref	ref
<b>Age Group</b>						
<20 years	72	3.0 (2.4-3.7)	2.0 (1.4-2.7)	<0.0001	2.2 (1.5-3.2)	<0.0001
20-24 years	187	3.5 (3.0-4.0)	2.3 (1.8-3.0)	<0.0001	2.7 (2.0-3.6)	<0.0001
25-29 years	155	2.6 (2.2-3.0)	1.7 (1.3-2.2)	0.0003	1.9 (1.4-2.5)	<0.0001
30-34 years	79	1.6 (1.2-1.9)	ref	ref	ref	ref
35-39 years	63	2.1 (1.6-2.6)	1.3 (1.0-1.9)	ns	1.0 (0.7-1.4)	ns
40+ years	16	2.1 (1.1-3.2)	1.4 (0.8-2.4)	ns	0.7 (0.4-1.2)	ns
<b>NZ Deprivation Index 2006</b>						
Decile 1-2	10	0.5 (0.2-0.9)	ref	ref	ref	ref
Decile 3-4	6	0.6 (0.1-1.0)	1.0 (0.4-2.9)	ns	0.9 (0.3-2.5)	ns
Decile 5-6	38	1.5 (1.0-1.9)	2.7 (1.3-5.4)	0.0057	1.5 (0.7-3.0)	ns
Decile 7-8	39	1.9 (1.3-2.5)	3.5 (1.7-7.0)	<0.0001	1.3 (0.6-2.7)	ns
Decile 9-10	479	3.2 (2.9-3.5)	6.1 (3.2-11.3)	<0.0001	1.5 (0.7-3.0)	ns
<b>Suburb</b>						
Howick	20	0.8 (0.4-1.1)	ref	ref	ref	ref
Otara	101	3.9 (3.1-4.6)	5.2 (3.2-8.4)	<0.0001	1.1 (0.6-2.0)	ns
Papatoetoe	64	2.1 (1.6-2.7)	2.8 (1.7-4.6)	<0.0001	0.9 (0.5-1.6)	ns
Mangere	123	3.2 (2.7-3.8)	4.3 (2.7-6.9)	<0.0001	0.9 (0.5-1.6)	ns
Manurewa	160	3.1 (2.6-3.6)	4.1 (2.6-6.5)	<0.0001	1.0 (0.6-1.8)	ns
Papakura	83	3.2 (2.6-3.9)	4.3 (2.6-7.0)	<0.0001	1.6 (0.9-2.8)	ns
Franklin	21	0.8 (0.4-1.1)	1.0 (0.5-1.8)	ns	1.0 (0.5-1.9)	ns
<b>Delivery Location</b>						
Middlemore	551	2.9 (2.7-3.2)	ref	ref	ref	ref
Botany	4	0.4 (0.0-0.7)	0.1 (0.0-0.3)	<.0001	0.2 (0.1-0.5)	0.0016
Papakura	16	1.1 (0.6-1.7)	0.4 (0.2-0.6)	0.0002	0.2 (0.1-0.4)	<0.0001
Pukekohe	1	0.1 (0.0-0.3)	0.0 (0.0-0.2)	0.0004	0.0 (0.0-0.3)	0.0016
<b>Parity</b>						
Nulliparous	183	2.1 (1.8-2.4)	ref	ref	ref	ref
1-2	167	1.8 (1.5-2.0)	0.8 (0.7-1.0)	0.0655	1.0 (0.8-1.2)	ns
3-5	153	4.2 (3.5-4.8)	2.0 (1.6-2.5)	<.0001	2.3 (1.8-3.0)	<0.0001
6 or more	68	10.1 (7.8-12.3)	5.1 (3.8-6.9)	<.0001	6.5 (4.5-9.4)	<0.0001

Source: Healthware. Note: OR: Odds Ratio. Adjusted OR based on a multivariate analysis with maternity provider as the outcome and ethnicity, age group, deprivation, suburb, year, delivery location, and parity as the explanatory variables. ns: not statistically significant. Only includes CMDHB women who delivered in CMDHB. Ethnicity is preferred.

### 4.3.10 Maternity Provider Summary

A Private LMC (50%) was the most frequently used maternity provider in CMDHB, followed by Shared Care (24%), Closed Unit (20%), Caseloading (2.5%) and Secondary Care (1.7%). Of concern, 2.5% of CMDHB resident women had no evidence of structured antenatal during 2007-09 and were Unbooked.

Maternity Provider use in CMDHB varied by year during 2007-2009, with evidence of an increase in Private LMC use and a decrease in Secondary and Caseloading care use. In addition, an increase in the proportion of Unbooked women was also observed. More years of data are required to be confident of these changes.

There were independent differences in maternity provider use by ethnicity, age group, deprivation, suburb, delivery location, and parity. A summary of the results of a multivariate analysis that took all of these factors into account when looking at use of maternity providers in CMDHB is shown below.

**Table 23: Summary of Independent Factors Influencing Maternity Provider use in CMDHB by Maternity Provider, 2007-2009**

	Private LMC	Shared Care	Closed Unit	Case-loading	Secondary	No Care (Unbooked)
<b>Groups with the Highest Odds of Use</b>						
Ethnicity	Euro/Other	Pacific Indian	Chinese	Euro/Other Indian Other Asian	Maaori	Maaori Pacific
Age	25-34 yrs	<25 yrs	<20 yrs	-	40+ yrs	<30 yrs
Deprivation	Decile 1-6	7-10	-	-	-	-
Suburb	Franklin	Otara	Howick	-	Otara	-
Facility	Pukekohe	MMH	MMH	Botany	MMH	MMH
Parity	0	3-5	6+	1-2	-	6+
<b>Groups with the Lowest Odds of Use</b>						
Ethnicity	Chinese	Chinese	Euro/Other, Indian	Chinese	-	Euro/Other, Asian
Age	<20 yrs	35-39 yrs	25-34 yrs	-	<20 years	≥30 yrs
Deprivation	Decile 9-10	Decile 1-6	-	Decile 9-10	-	-
Suburb	Otara	Franklin	Otara	Franklin	-	-
Facility	MMH	Pukekohe	Pukekohe	Pukekohe	Botany Papakura	Pukekohe
Parity	6+	0, 1-2, 6+	0	-	-	0, 1-2

Source: Healthware. Note: Based on adjusted odds ratio's from a multivariate analyses with each maternity provider as the outcome and ethnicity, age group, deprivation, suburb, year, parity and delivery location as the explanatory variables. Only includes CMDHB resident women who delivered in CMDHB. Ethnicity is preferred.

## 4.4 Chapter Summary

The majority of pregnant CMDHB women deliver in a CMDHB facility (87%). CMDHB resident women who deliver in another DHB's facility mostly deliver at National Women's Hospital (93%). Of the CMDHB resident women who delivered outside the DHB during 2007-09, 49.8% were European/Other, 30.3% were Asian, 11.0% were Pacific and 9% were Maaori, and just over half lived in Howick (52.3%).

Of all CMDHB women who delivered anywhere in NZ during 2009-10, 14.8% delivered in a primary birthing unit (PBU) compared to 9.6% for all NZ women. Of the major metropolitan DHB's during this time, CMDHB had the greatest proportion of its women delivering in a PBU. Within CMDHB, the highest PBU delivery rates occurred in areas with a unit i.e. Franklin, followed by Papakura and Botany. CMDHB women with the highest rates of PBU use were European/Other (30%) and Maaori women (23%) and those living in the least socioeconomically deprived areas (decile 1-2: 30%).

CMDHB provides a range of maternity services that are similar to those provided elsewhere in New Zealand, including hospital midwife care, secondary care, teen pregnancy, diabetes in pregnancy and obstetric medical services, maternity hospital facilities and birthing units. CMDHB also has a unique system of Shared Care, and women who choose this receive most of their antenatal care from a GP that enters into a contractual arrangement with the DHB. These women are also offered three antenatal visits with a DHB employed community midwife and are delivered at a CMDHB facility by a DHB employed midwife.

With the exception of Shared Care, the range of maternity providers in CMDHB is similar to that offered elsewhere in New Zealand. CMDHB women are less likely to use a private LMC (50% vs 84% nationally), more likely to use a hospital midwife (24% vs 15% nationally), while 24% of CMDHB women use Shared Care. CMDHB women are also more likely to have no antenatal care. This project found that 2.5% of CMDHB women who used a CMDHB facility had no evidence of having had antenatal care (referred to here as Unbooked) which is higher than the 1.6% reported in a 2007 national survey of maternity service consumers.<sup>7</sup>

Maternity provider use in CMDHB varied by year during 2007-2009, with evidence of an increase in Private LMC use and a decrease in CMDHB provided Secondary Care and Caseloading care. An increase in the proportion of Unbooked women was also observed over these three years. More years of data are required to be confident of these trends.

Most of the Unbooked women during 2007-09 (92.6%) were Maaori or Pacific, and nearly half were aged <25 years old (45.3%). After adjusting for the factors that influenced booking in a univariate analysis (ethnicity, age group, deprivation, suburb, year, delivery location, and parity), only ethnicity, age group, and parity independently influenced the likelihood of being Unbooked (multivariate analysis). In the multivariate analysis, the odds of being Unbooked was 7 times greater in Maaori women and 4 times greater in Pacific women than in European/Other women; the odds of being Unbooked was approximately 2 times higher in women aged <30 compared with those aged 30 years and older, and compared with nulliparous women, para 3-5 women had 2.3 times the odds, and women of a parity of 6 or more had 6.5 times the odds of being Unbooked.



## Chapter 5. Accessing Maternity Care in CMDHB

Several observational studies have demonstrated an association between little or no antenatal care and increased odds of preterm birth, low birth weight, and maternal, fetal and neonatal death in both high-income and developing countries.<sup>11-20</sup> Antenatal care is necessary, but not sufficient, for optimising outcomes for mothers and infants, and is the vehicle via which components of antenatal care with proven effectiveness are delivered to pregnant women. This Chapter uses data available from Healthware to examine two aspects of engagement with antenatal care in CMDHB women, initiation of antenatal care and utilisation of CMDHB provided care.

**IMPORTANT CAUTION:** The data presented in this chapter are exploratory only and have significant limitations (see Section 2.3.2). These analyses were performed to improve understanding of the potential and limitations of Healthware data and to stimulate discussion, hypothesis generation, and future research.

### 5.1 Pregnancy Booking

Women wanting to deliver in a CMDHB facility need to be booked to deliver by their maternity provider. At CMDHB booking is expected to occur after 15 weeks<sup>58</sup>, however a woman can register with a maternity provider and book prior to this time. In order to book a woman at CMDHB, a registration form that includes demographic and clinical information must be completed and submitted (see Appendix 4). This form is usually completed and submitted by the maternity provider in consultation with the woman. For women using a CMDHB midwife (e.g. via Closed Unit, Caseloading, or Secondary Care) booking is expected to occur as part of the first antenatal visit. For women with Shared Care this form is completed and submitted by the Shared Care GP.

Healthware records the booking date, but no record is made of when a woman had her first antenatal assessment. The booking process is likely to significantly influence the extent to which the booking date reflects the onset of antenatal care, and this process is likely to differ by provider.

#### 5.1.1 Relationship between Booking Gestation and First Antenatal Contact

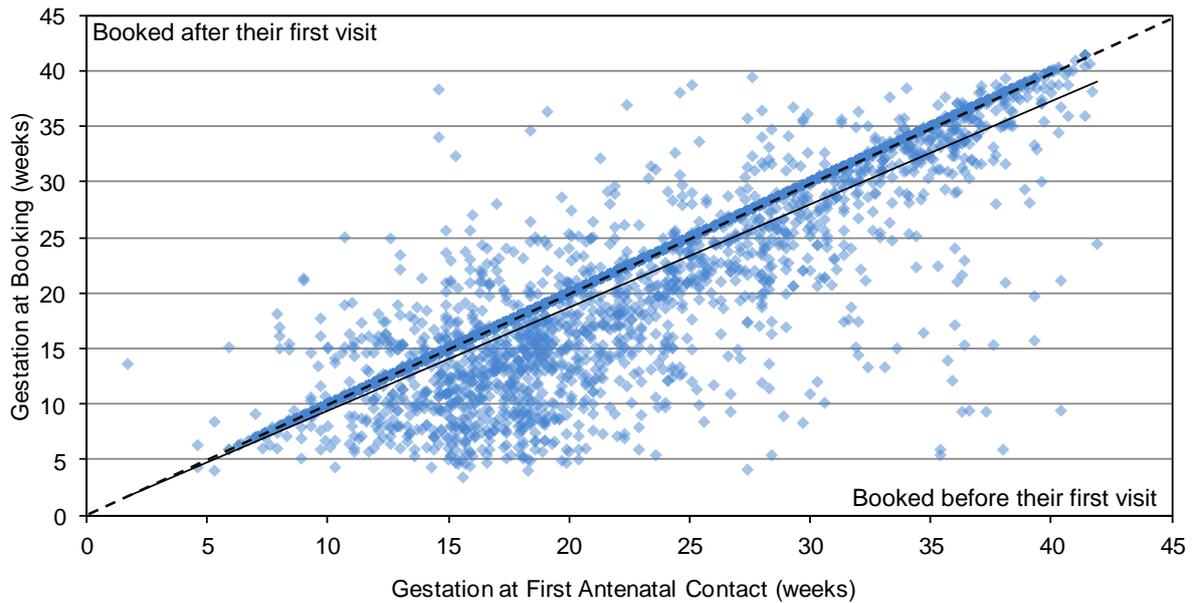
Booking gestation has been used as a proxy for the onset of antenatal care because the date of the first antenatal assessment is not captured in any accessible local or national datasets. The extent to which Booking Date reflects the onset of antenatal care is unknown for most CMDHB women and requires further investigation.

CMDHB provided antenatal contacts are recorded in Healthware and examined in section 5.2. The accuracy and completeness of these antenatal visit data are unknown. The relationship between the booking gestation and the gestation at a woman's first CMDHB provided antenatal contact has been examined here for women with Closed Unit and Caseloading midwife care. Examining this relationship for women with Shared Care is not sensible as CMDHB provided antenatal clinics do not commence for these women until 18 weeks and they are advised to obtain early pregnancy care from their Shared Care GP. In addition, the relationship between booking and onset of antenatal care for women with Secondary Care has not been examined because antenatal contacts for these women are not well captured on Healthware, particularly clinic appointments with a doctor.

Figure 16 and Figure 17 show the relationship between a woman's gestation at booking and her gestation at her first CMDHB provided antenatal contact for women with Closed Unit and

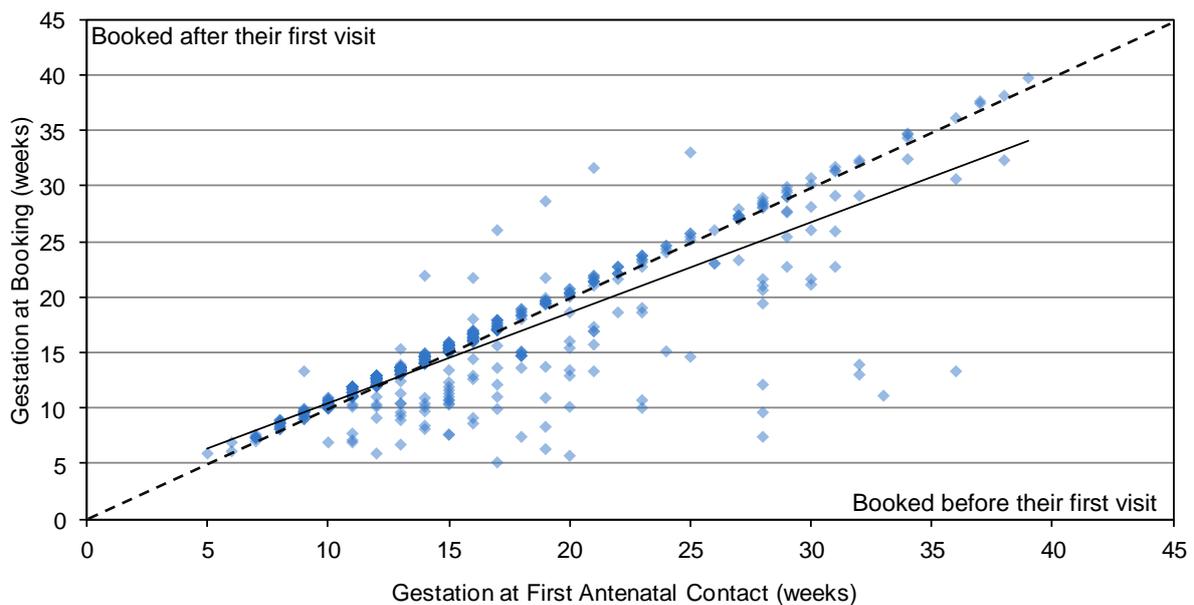
Caseloading care respectively. Each point on the graphs represents one woman, and some points overlay each other. The points are transparent so that where several points overlay each other it appears darker. Points that lie on the imaginary line between zero on both axes and 45 on both axes (the dashed line) represent women who were booked at the same time as their first CMDHB provided antenatal contact. Points above the dashed line represent women who were booked *after* their first CMDHB provided antenatal contact. Points below the dashed line represent women who were booked *before* their first CMDHB provided antenatal contact. The solid trend line shows the relationship between booking gestation and the gestation at first CMDHB antenatal contact for this group of women.

**Figure 16: Relationship between Booking Gestation and Gestation at First CMDHB Antenatal Contact for CMDHB Women with Closed Unit Care, 2007-2008.**



Source: Healthware. Note: Only includes CMDHB resident women who delivered in CMDHB. Points on the dashed line indicate women who were booked at the same time as their first CMDHB provided antenatal contact.

**Figure 17: Relationship between Booking Gestation and Gestation at First CMDHB Antenatal Contact for CMDHB Women with a Caseloading Midwife, 2007-2008.**



Source: Healthware. Note: Only includes CMDHB resident women who delivered in CMDHB. Points on the dashed line indicate women who were booked at the same time as their first CMDHB provided antenatal contact.

For both Closed Unit and Caseloading Care, women were more frequently booked before rather than after their first antenatal visits. This may occur if a woman transferred care between maternity providers during her pregnancy.

For Closed Unit care, booking dates were within two weeks of the first antenatal visit date for 75.2% (95% CI 73.9%-76.5%) of women during 2007-09. There was a strong relationship between the gestation at booking and at the first antenatal contact (slope = 0.93 (95% CI: 0.91-0.94),  $p < 0.0001$ ,  $R^2 = 0.7820$ ) with a woman's booking occurring on average one week prior to her first antenatal contact (Figure 16). For these women, booking gestation is likely to be a reasonable reflection of onset of antenatal care.

For women with a Caseloading midwife, booking dates were within two weeks of the first antenatal visit date for 81.7% (95% CI: 78.5%-85.0%) of women during 2007-09. There was a strong relationship between the gestation at booking and at the first antenatal contact (slope = 0.82 (95% CI: 0.77-0.86),  $p < 0.0001$ ,  $R^2 = 0.7299$ ) with a woman's booking occurring on average one week prior to her first antenatal contact (Figure 17). For these women, booking gestation is likely to be a reasonable reflection of onset of antenatal care.

**IMPORTANT CAUTION:** In the remainder of this section, booking date is used as a proxy for the onset of antenatal care. The extent to which booking date reflects this is unknown for most CMDHB women. The analysis presented in this section is therefore exploratory, and was performed in order to stimulate discussion and further research.

### 5.1.2 Booking Gestation

NICE guidelines recommend that healthy pregnant women have a booking appointment with their maternity provider early in pregnancy, ideally before 10 weeks gestation.<sup>21</sup> This recommendation has been echoed by the New Zealand PMMRC.<sup>2, 3</sup> During 2007-2009, only 16.8% of CMDHB women who delivered at CMDHB were booked by 10 weeks (Table 24). An additional 44.8% of women booked late at 10-18 weeks gestation, whilst 38.4% either booked very late (after 18 weeks) or did not book at all. The mean booking gestation did not vary by year for the three years of data examined.

**Table 24: Booking Gestation Category for CMDHB Resident Women, 2007-2009**

Booking	Number	Percent	Cumulative %
Early (<10 weeks)	3,783	16.8	16.8
Late (10-18 weeks)	10,065	44.8	61.6
Very Late (>18 weeks)	8,047	35.8	-
19-28 weeks	4,959	22.1	83.7
29+ weeks	3,088	13.7	97.4
Unbooked	572	2.6	100.0

Source: Healthware. Note: Only includes CMDHB resident women who delivered in CMDHB.

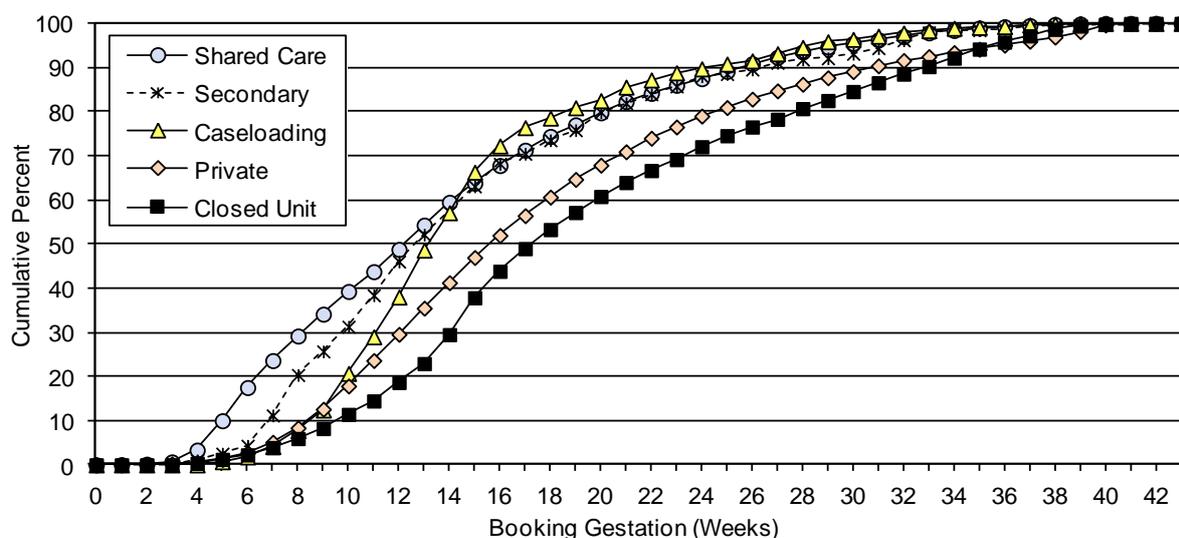
In addition to the 572 (2.5%) CMDHB women who presented Unbooked to a CMDHB facility in labour during 2007-09, 516 (2.3%) women booked in the week prior to delivering, while 567 (2.5%) booked 2-4 weeks prior to delivering. Therefore, of the CMDHB women who delivered in CMDHB during 2007-2009, 7.4% did not book at all or booked in the last 4 weeks of their pregnancy.

Unbooked women had no evidence of having had any structured antenatal care and were discussed in more detail in the previous chapter (see section 4.3.9). All remaining analyses in this section only include CMDHB women who booked and delivered in CMDHB, therefore Unbooked women are excluded.

### 5.1.3 Booking by Maternity Provider and Delivery Location

A women's gestation at booking varied depending on the maternity service provider she used and where she delivered. Women who used Shared Care, Secondary Care, or a Caseloading midwife tended to be booked earlier than women who received care from a Private LMC (Figure 18). Women using Closed Unit care booked tended to book later in pregnancy. NICE guidelines for early booking were met by 34% of women using Shared Care, 26% of women using Secondary Care, 12-13% of women with a Private LMC or Caseloading midwife, and only 8% of women with Closed Unit care (Table 25). Mean booking gestation varied significantly by maternity service provider ( $p < 0.0001$ ) with women who used Shared Care, Caseloading, or Secondary Care booking an average of 5 weeks earlier than those using Closed Unit care.

**Figure 18: Cumulative Booking for CMDHB Women by Maternity Provider, 2007-09**



Source: Healthware. Note: Only includes CMDHB resident women who booked and delivered in CMDHB

**Table 25: Booking Category and Mean Booking Gestation for CMDHB Women by Maternity Service Provider, 2007-09**

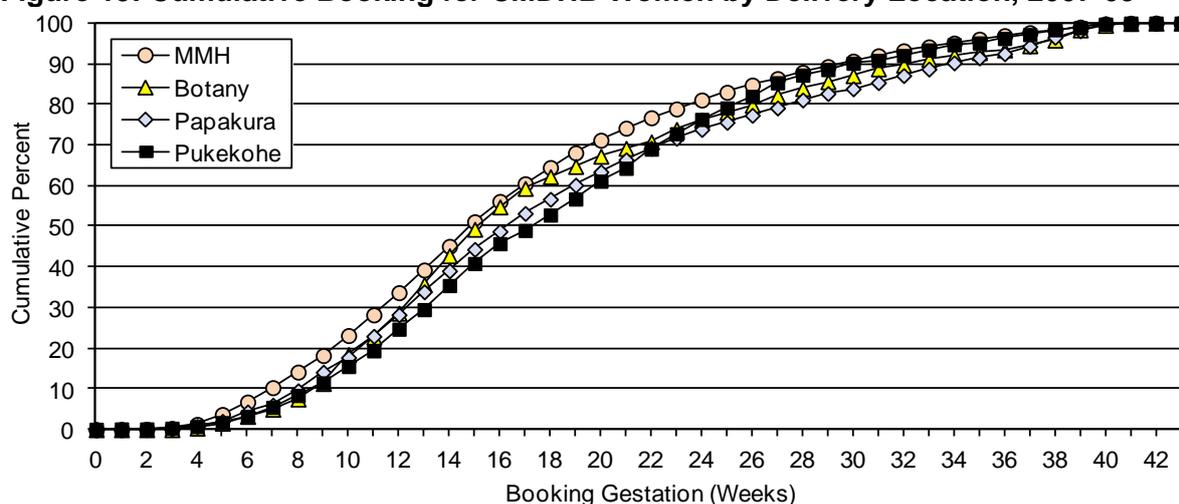
	Early <10 wks % (95% CI)	Late 10-18 wks % (95% CI)	Very Late >18 wks % (95% CI)	Mean Gestation weeks (95% CI)
<b>Maternity Provider</b>				
Private LMC	12.6 (12.0-13.2)	47.9 (47.0-48.8)	39.5 (38.6-40.4)	18.6 (18.4-18.7)
Closed unit	8.2 (7.4-9.0)	45.0 (43.5-46.4)	46.8 (45.3-48.3)	20.3 (20.0-20.5)
Shared Care	34.2 (32.9-35.5)	40.1 (38.8-41.4)	25.7 (24.5-26.8)	14.6 (14.4-14.8)
Caseloading	12.3 (9.6-15.1)	66.1 (62.1-70.0)	21.6 (18.2-25.0)	15.6 (15.1-16.1)
Secondary Care	26.0 (21.7-30.4)	47.4 (42.5-52.4)	26.5 (22.2-30.9)	15.5 (14.8-16.3)
<b>Delivery Location</b>				
Middlemore	18.2 (17.7-18.8)	46.2 (45.5-47.0)	35.5 (34.8-36.2)	17.5 (17.4-17.6)
Botany	11.3 (9.5-13.2)	50.9 (47.9-53.9)	37.8 (34.9-40.7)	18.9 (18.3-19.4)
Papakura	14.1 (12.3-16.0)	42.5 (39.9-45.1)	43.3 (40.7-45.9)	19.5 (19.0-20.0)
Pukekohe	11.5 (9.7-13.3)	41.3 (38.5-44.1)	47.2 (44.3-50.1)	19.3 (18.8-19.8)

Source: Healthware. Note: Only includes CMDHB resident women who booked and delivered in CMDHB.

Differences were observed in booking by delivery location (Table 25, Figure 19). Women who delivered at Middlemore Hospital tended to book earlier than women delivering at a

Primary Birthing Units. NICE early booking guidelines were met by 18% of women who delivered at Middlemore, 14% of those using the Papakura Birthing Unit, and 11% of those using the Botany and Pukekohe Birthing Units. Mean booking gestation differed significantly by delivery location ( $p < 0.0001$ ) with women who delivered at a Primary Birthing Unit booked an average of 1.4-2 weeks later than women who delivered at Middlemore Hospital.

**Figure 19: Cumulative Booking for CMDHB Women by Delivery Location, 2007-09**



Source: Healthware. Note: Only includes CMDHB resident women who booked and delivered in CMDHB.

### 5.1.4 Booking by Ethnicity and Age Group

Booking gestation varied by ethnicity and age group. Women who were Asian or European/Other tended to book earlier than Maaori and Pacific women (Figure 20, Table 26). Among Asian ethnic groups, Indian women tended to book the earliest. In addition, women aged 25-34 years tended to book earlier than women less than 25 years old, although the differences were less marked (Figure 21, Table 26).

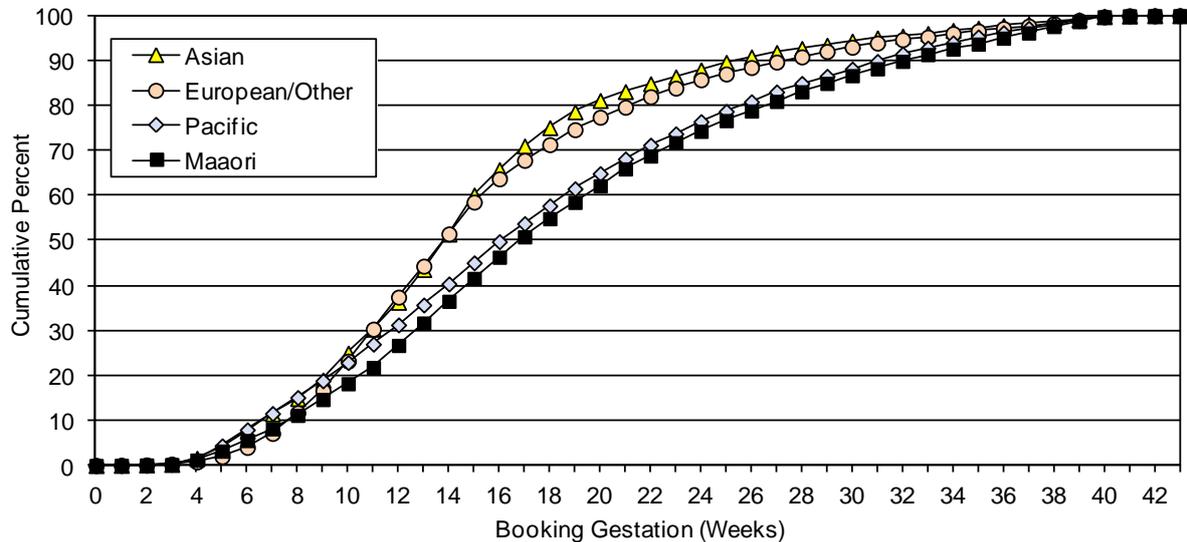
**Table 26: Booking Category and Mean Booking Gestation by Ethnicity and Age Group, 2007-09**

	Early <10wks % (95% CI)	Late 10-18wks % (95% CI)	Very Late >18 wks % (95% CI)	Mean Gestation Weeks (95% CI)
<b>Ethnicity</b>				
Maaori	14.7 (13.7-15.7)	40.2 (38.8-41.6)	45.1 (43.7-46.5)	19.3 (19.1-19.6)
Pacific	18.8 (18.0-19.7)	38.9 (37.8-40.0)	42.3 (41.2-43.4)	18.5 (18.3-18.7)
Chinese	9.1 (6.4-11.8)	65.7 (61.2-70.2)	25.2 (21.1-29.3)	16.7 (16.1-17.3)
Indian	24.1 (22.0-26.2)	53.1 (50.7-55.6)	22.8 (20.7-24.9)	15.4 (15.0-15.8)
Other Asian	14.4 (11.9-16.8)	56.9 (53.4-60.3)	28.8 (25.6-31.9)	16.7 (16.1-17.2)
Other	16.6 (15.7-17.6)	54.7 (53.4-56.0)	28.7 (27.5-29.8)	16.6 (16.4-16.8)
<b>Age Group</b>				
<20 years	13.6 (12.2-15.0)	41.9 (39.8-43.9)	44.5 (42.5-46.6)	18.9 (18.5-19.2)
20-24 years	18.3 (17.3-19.4)	41.9 (40.6-43.3)	39.8 (38.4-41.1)	18.2 (17.9-18.4)
25-29 years	18.2 (17.2-19.2)	47.2 (45.9-48.5)	34.6 (33.4-35.8)	17.5 (17.2-17.7)
30-34 years	17.7 (16.6-18.7)	49.1 (47.7-50.5)	33.3 (32.0-34.6)	17.4 (17.1-17.6)
35-39 years	16.3 (15.0-17.7)	48.1 (46.3-49.9)	35.6 (33.9-37.3)	17.6 (17.3-17.9)
40+ years	15.4 (12.8-18.1)	47.7 (44.1-51.3)	36.9 (33.4-40.4)	18.2 (17.5-18.8)

Source: Healthware. Note: Only includes CMDHB resident women who booked and delivered in CMDHB. Ethnicity is preferred.

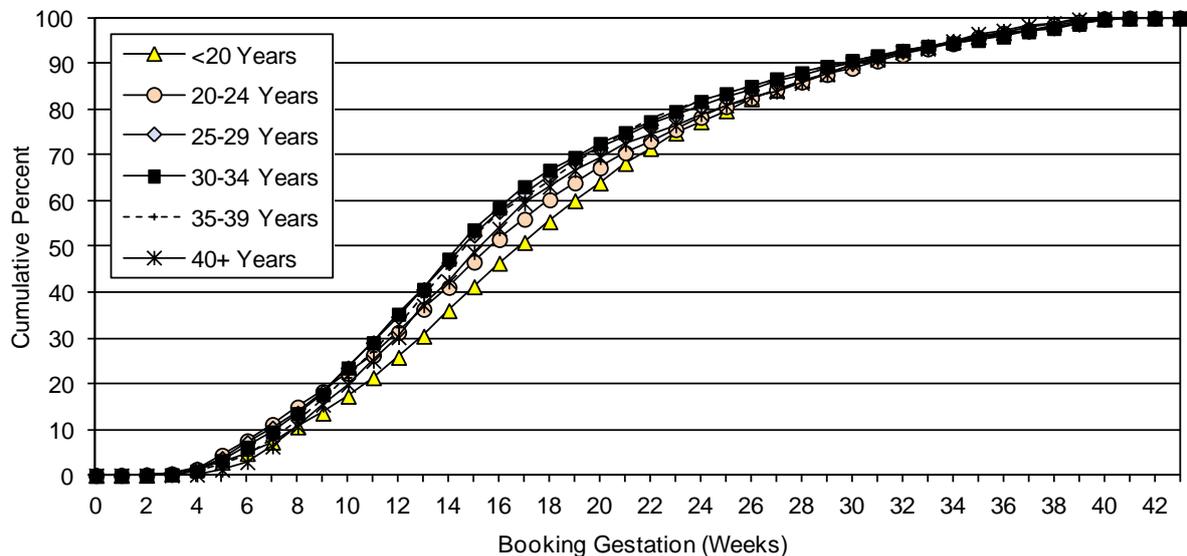
Indian women most frequently to met NICE early booking guidelines (24%), followed by Pacific women (18.8%), and European/Other women (Table 26). Chinese women least frequently met these guidelines (9.1%), followed by Other Asian (14%) and Maaori women (15%). NICE guidelines were met by 18% of women aged 20-34 years, compared with only 15% of women aged 40 years and older, and 14% of young women (<20 years).

**Figure 20: Cumulative Booking for CMDHB Women by Ethnicity, 2007-09**



Source: Healthware. Note: Only includes CMDHB resident women who booked and delivered in CMDHB. Ethnicity is preferred.

**Figure 21: Cumulative Booking for CMDHB Women by Age Group, 2007-09**

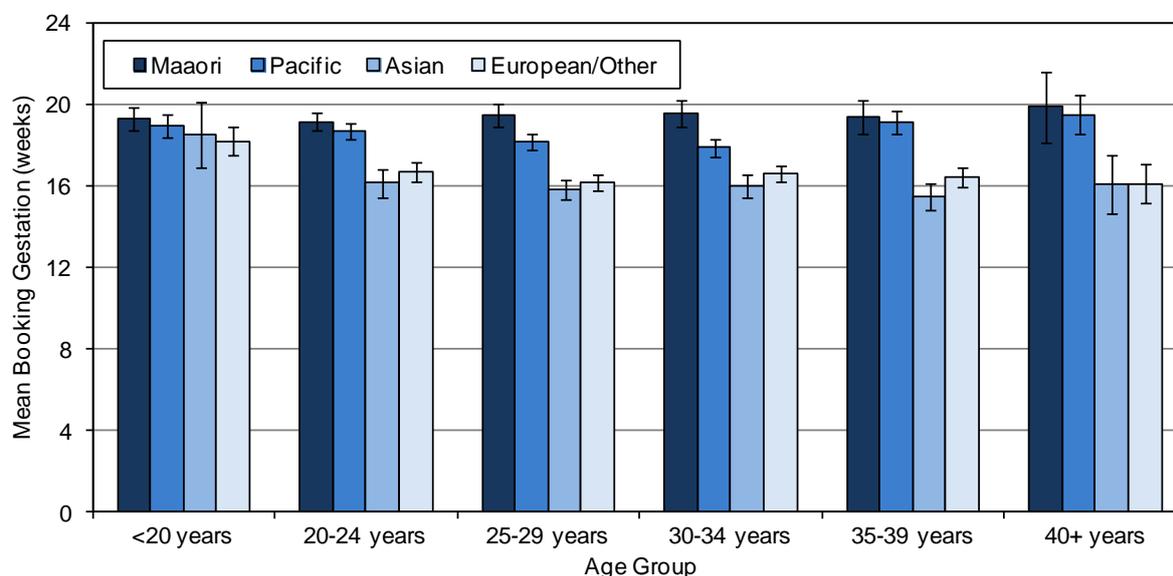


Source: Healthware. Note: Only includes CMDHB resident women who booked and delivered in CMDHB.

During 2007-2009, mean booking gestation varied significantly within age group by ethnicity ( $p < 0.006$ ) (Figure 22). For Maaori women there was no significant difference in mean booking gestation by age group. For Pacific women, those aged 35-39 years (19.1 weeks) and 40 years (19.5 weeks) and older had a significantly higher mean booking gestation than women aged 30-34 years (17.9 weeks). Trends by age group in Asian and European/Other women were similar by age group. In both of these ethnic groups, young women aged <20 years had a significantly higher mean booking gestation than women aged 20 years and older.

Marked ethnic disparities in mean booking gestations were observed in all but very young women (<20 years). In particular, the gap in mean booking gestation between Maaori and European/Other women increased from 1.1 weeks in <20 year olds to 3.7 weeks in women aged 40 years and older.

**Figure 22: Mean Booking Gestation for CMDHB Women by Age Group and Ethnicity, 2007-2009**



Source: Healthware. Note: Only includes CMDHB resident women who booked and delivered in CMDHB. Ethnicity is preferred. Error bars indicate 95% confidence intervals.

### 5.1.5 Booking by NZ Deprivation Index 2006 and Suburb

There were small differences in mean booking gestation depending on the NZ Deprivation Index 2006 (NZDep06) decile of the area a women lived in ( $p < 0.0001$ ). Women than lived in the most deprived area's (decile 9-10) booked on average 0.5-1.0 week later than women living in areas that were decile 1-8 (Table 27). Despite this, a greater proportion of women living in decile 9-10 areas booked early (18.0%), compared to 14.3% of women living in decile 1-2.

**Table 27: Booking Category and Mean Booking Gestation by NZ Deprivation Index, 2007-09**

NZDep	Early <10wks % (95% CI)	Late 10-18wks % (95% CI)	Very Late >18 wks % (95% CI)	Mean Gestation Weeks (95% CI)
1-2	14.3 (12.7-15.9)	56.2 (53.9-58.4)	29.6 (27.5-31.7)	17.1 (16.8-17.5)
3-4	16.4 (14.2-18.7)	51.4 (48.4-54.4)	32.2 (29.3-35.0)	17.4 (16.9-17.9)
5-6	13.8 (12.4-15.1)	52.4 (50.5-54.3)	33.8 (32.0-35.7)	17.4 (17.1-17.7)
7-8	19.5 (17.7-21.2)	48.7 (46.5-50.8)	31.9 (29.9-33.9)	17.0 (16.6-17.4)
9-10	18.0 (17.4-18.7)	42.8 (42.0-43.6)	39.2 (38.4-40.0)	18.1 (18.0-18.2)

Source: Healthware. Note: Only includes CMDHB resident women who booked and delivered in CMDHB.

Differences in booking gestation were observed by suburb (Table 28). Women living in Otago had the earliest mean booking gestation at 16.9 weeks, whilst women living in Mangere had the highest at 18.6. Women living in Otago most frequently met the NICE early booking guidelines (27%), followed by women living in Papatoetoe (19%), and Mangere

(18%). Only 15% of women living in Howick and Papakura, and 13% of women living in Franklin met these guidelines.

**Table 28: Booking Category and Mean Booking Gestation by Suburb, 2007-09**

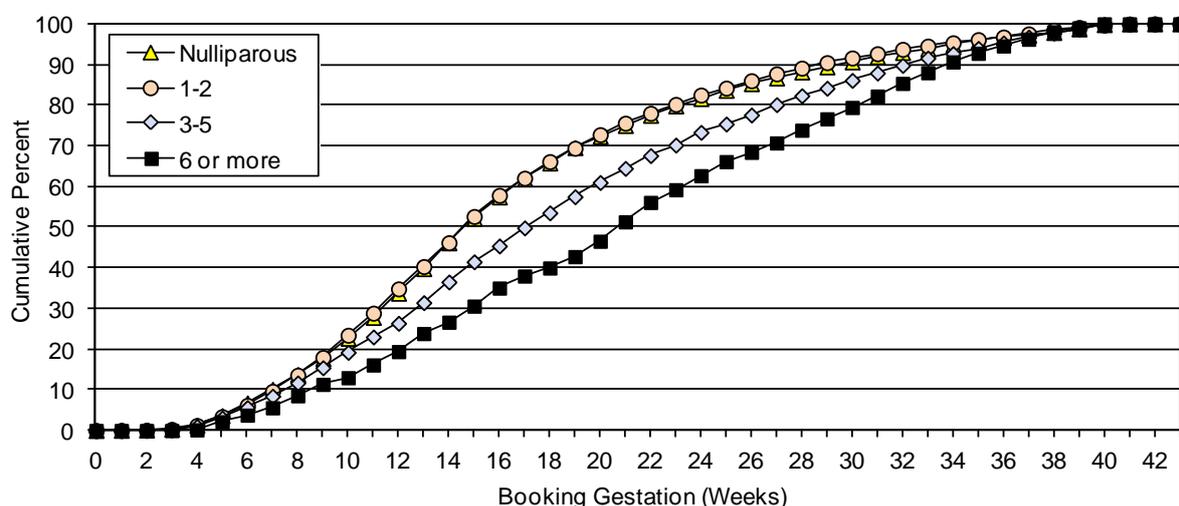
Suburb	Early <10wks % (95% CI)	Late 10-18wks % (95% CI)	Very Late >18 wks % (95% CI)	Mean Gestation Weeks (95% CI)
Howick	14.9 (13.5-16.3)	55.8 (53.9-57.7)	29.3 (27.5-31.0)	17.0 (16.7-17.4)
Otara	27.2 (25.5-29.0)	37.0 (35.1-38.9)	35.8 (33.9-37.7)	16.9 (16.5-17.2)
Papatoetoe	18.5 (17.1-20.0)	47.7 (45.9-49.5)	33.7 (32.0-35.4)	17.1 (16.9-17.4)
Mangere	17.7 (16.5-18.9)	40.1 (38.5-41.7)	42.2 (40.6-43.8)	18.6 (18.3-18.8)
Manurewa	15.9 (14.9-16.9)	44.8 (43.4-46.1)	39.3 (38.0-40.7)	18.3 (18.1-18.6)
Papakura	15.1 (13.7-16.5)	50.9 (48.9-52.9)	34.0 (32.1-35.8)	17.8 (17.5-18.1)
Franklin	13.0 (11.7-14.2)	48.7 (46.8-50.6)	38.3 (36.5-40.1)	18.0 (17.7-18.3)

Source: Healthware. Note: Only includes CMDHB resident women who booked and delivered in CMDHB.

### 5.1.6 Booking by Parity

Nulliparous women and women who were para 1-2 had a very similar booking gestation distribution (Figure 23). Women who were para 3-5 tended to book later than nulliparous women, while women whose parity was six or more tended to have the latest booking gestations. NICE early booking guidelines were met by 18% of women whose parity was 0-2, compared with 15% of para 3-5 women, and 11% of women with a parity of 6 or more (Table 29). In addition, 60% of women para 6 or more booked after 18 weeks gestation, compared with 34% of women who were para 0-2.

**Figure 23: Cumulative Booking for CMDHB Women by Parity, 2007-09**



Source: Healthware. Note: Only includes CMDHB resident women who booked and delivered in CMDHB.

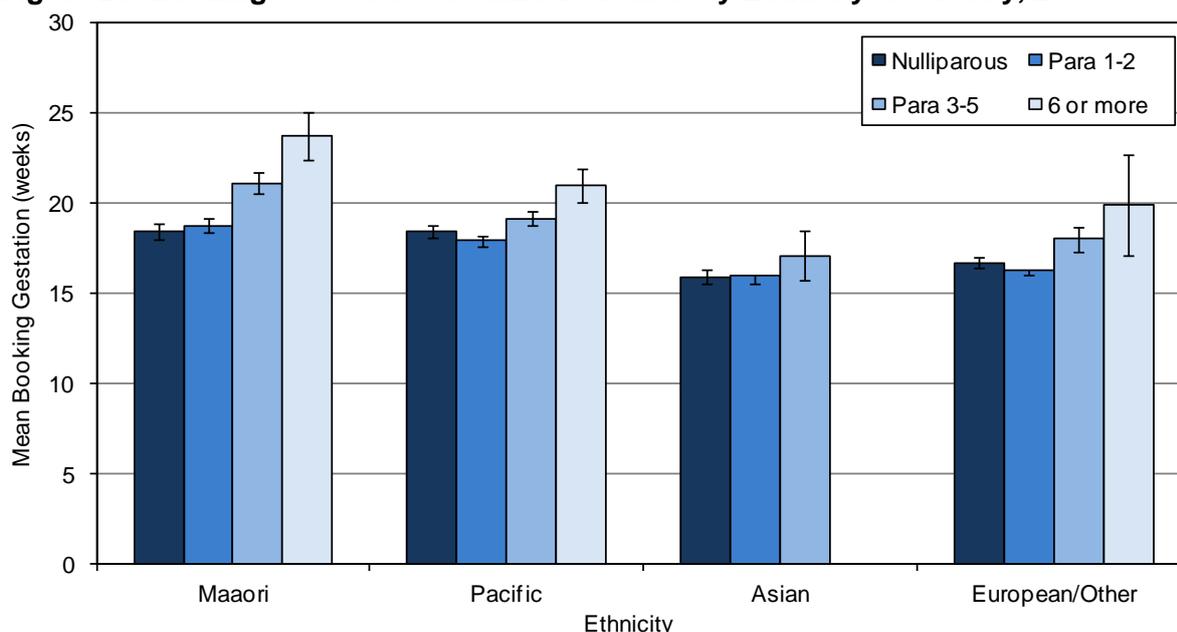
Mean booking gestation varied significantly by parity ( $p < 0.0001$ ) with women with a parity of 6 or more booking on average 3.5 weeks later than nulliparous women (Table 29). Mean booking gestation varied within ethnic group by parity ( $p = 0.0006$ ). Mean booking gestation increased with parity for Maaori, Pacific, and European/Other women; however no difference in mean booking gestation was observed for Asian women with increasing parity (Figure 24). Maaori women with a parity of 6 or more had the highest mean booking gestation at 23.7 weeks. In women with a parity of 3-5 or 6 or more, Maaori women had a significantly higher mean booking gestation than Pacific women with the same parity.

**Table 29: Booking Category and Mean Booking Gestation by Parity, 2007-09**

Parity	Early <10wks % (95% CI)	Late 10-18wks % (95% CI)	Very Late >18 wks % (95% CI)	Mean Gestation Weeks (95% CI)
Nulliparous	17.7 (16.9-18.5)	48.1 (47.0-49.1)	34.2 (33.2-35.2)	17.4 (17.2-17.6)
1-2	18.0 (17.2-18.7)	48.2 (47.1-49.2)	33.9 (32.9-34.8)	17.3 (17.1-17.4)
3-5	15.4 (14.2-16.6)	38.1 (36.5-39.7)	46.5 (44.8-48.1)	19.5 (19.2-19.8)
6 or more	11.3 (8.8-13.9)	28.6 (25.0-32.2)	60.0 (56.1-63.9)	21.9 (21.2-22.6)

Source: Healthware. Note: Only includes CMDHB resident women who booked and delivered in CMDHB.

**Figure 24: Booking Gestation for CMDHB Women by Ethnicity and Parity, 2007-09**



Source: Healthware. Note: Only includes CMDHB resident women who booked and delivered in CMDHB. Ethnicity is preferred.

### 5.1.7 Booking and Delivery Gestation

Women who delivered before 37 weeks had a lower mean booking gestation than women who delivered at term (37-41 weeks) or that delivered after 41 weeks (post-term) (Table 30). Women who delivered post-term had the lowest rate of early booking (13%) and the highest rate of very late booking (40%).

**Table 30: Booking Category and Mean Booking Gestation by Gestation at Delivery, 2007-09**

Gestation (weeks)	Early <10wks % (95% CI)	Late 10-18wks % (95% CI)	Very Late >18 wks % (95% CI)	Mean Gestation Weeks (95% CI)
<37	18.1 (16.3-19.9)	47.0 (44.7-49.3)	34.9 (32.7-37.1)	16.8 (16.5-17.2)
37-41	17.5 (16.9-18.0)	45.8 (45.1-46.5)	36.7 (36.0-37.4)	17.8 (17.7-17.9)
42+	13.3 (11.4-15.2)	46.5 (43.8-49.3)	40.2 (37.5-42.9)	19.1 (18.6-19.6)

Source: Healthware. Note: Only includes CMDHB resident women who booked and delivered in CMDHB.

### 5.1.8 Factors Associated with Booking Gestation

A woman's booking gestation was influenced by her maternity provider, delivery location, ethnicity, age group, NZ Deprivation Index 2006 decile, suburb of residence, parity. Gestation at delivery was also included in the model as booking gestation differed significantly in women who delivered post term compared to those that delivered preterm of at term.

In order to determine whether these characteristics affected booking gestation independently of each other, a multivariate logistic regression analysis was performed for each category (early, late, very late) with maternity provider, delivery location, maternal ethnicity, age, NZDep06, suburb, parity and delivery gestation as the explanatory variables. Crude and adjusted odds ratios for women who booked Early (<10 weeks gestation) and Very Late (>18 weeks) are presented. Table 31 contains a summary of the main findings.

**Table 31: Summary of Independent Factors Influencing Early and Very Late Booking in CMDHB, 2007-2009**

	Ethnicity	Age Group	Suburb	Provider	Parity	Delivery Location
<b>Groups with the Highest Odds</b>						
<b>Early Booking</b>	Euro/Other Indian	25+	Otara	Shared Care Secondary	0-2	-
<b>Very Late Booking</b>	Pacific, Maaori	<20, 20-24	-	Closed Unit	3-5, 6+	Pukekohe
<b>Groups with the Lowest Odds</b>						
<b>Early Booking</b>	Maaori Pacific Chinese	<20	-	Closed Unit	6+	Botany
<b>Very Late Booking</b>	Euro/Other Asian	30+	Papakura	Shared Care Caseloading	0	Middlemore

Source: Healthware. Note: Based on adjusted odds ratios from a multivariate analysis with booking category as the outcome and ethnicity, age group, deprivation, suburb, year, parity, maternity provider and delivery location as the explanatory variables. Only includes CMDHB resident women who delivered in CMDHB. Ethnicity is preferred. No difference in the odds of Early or Very Late booking found by NZ Deprivation Index decile.

#### 5.1.8.1 Factors Associated with Early Booking (<10 weeks)

After adjusting for the effects of the other factors, ethnicity, age group, suburb, maternity provider, parity and delivery gestation were independently associated with the odds of booking Early (Table 32). The following observations were made:

- Maaori, Pacific, Chinese and Other Asian women had 40-50% lower odds of booking early than European/Other women.
- The odds of booking early declined with decreasing age in women <30 years old. Young women aged <20 years had the lowest odds of booking early.
- When compared with women living in Howick, the odds of booking early were no different for women living in Papatoetoe, Mangere, Manurewa, Papakura and Franklin. Women living in Otara had higher odds of booking Early (1.5 times).
- The odds of booking Early were the same for women with Private LMC and Caseloading care. In comparison, women using Shared Care or Secondary Care had significantly higher odds of Early Booking and women using Closed Unit care had 30% lower odds of booking Early.

- Women who delivered at Middlemore, Papakura and Pukekohe had the same odds of booking early. In comparison, the odds of Early Booking for women who delivered at Botany was 40% lower.
- Nulliparous women and women whose parity was 1-2 had the same odds of Early Booking. Thereafter, the odds of booking Early declined with increasing parity and were 30% lower in para 3-5 women and 60% lower in women with a parity of 6 or more.
- Women who delivered post-term (at 42 or more weeks) had 30% lower odds of having booked Early than women who delivered at term.
- Deprivation did not affect early booking independently of the other factors included in the model.

#### **5.1.8.2 Factors Associated with Very Late Booking (>18 weeks)**

After adjusting for the effects of the other factors, ethnicity, age group, suburb, maternity provider, parity and delivery gestation were independently associated with the odds of a Very Late booking (Table 33). The following observations were made:

- European/Other women and Asian women had the same odds of booking after 18 weeks gestation. In comparison, the odds of booking Very Late were double in Maaori and Pacific women.
- The odds of booking Very Late increased with decreasing age in women <30 years old. Young women aged <20 years had 1.8 times higher odds of booking Very Late than 30-34 year old women.
- When compared with women living in Howick, the odds of booking Very Late were no different for women living in Otara, Papatoetoe, Mangere, Manurewa, and Franklin. Women living in Papakura had 20% lower odds of a Very Late booking.
- Compared with women with a Private LMC, the odds of a very late booking were 1.2 times higher in women using Closed Unit care, and 50-60% lower in women with Shared Care, a Caseloading midwife, and Secondary Care.
- Women who delivered at Middlemore had the lowest odds of a Very Late booking. The odds of a Very Late booking were highest for women delivering at Pukekohe followed by Botany and Papakura.
- The odds of booking Very Late increased with increasing parity and were lowest in Nulliparous women. In comparison the odds in para 1-2 women were 1.1 times higher, in para 3-5 women were 1.8 times higher, and in women with a parity of 6 or more were 3.3 times higher.
- Women who delivered post-term (at 42 or more weeks) had slightly higher (1.1 times) odds of having booked Very Late than women who delivered at term.
- Deprivation did not affect Very Late booking independently of the other factors included in the model.

**Table 32: Demographic and Pregnancy Characteristics for CMDHB Women who Booked Early in Pregnancy (< 10 Weeks), 2007-09**

	No.	Crude Rate per 100 (95% CI)	Crude OR (95% CI)	p	Adjusted OR (95% CI)	p
<b>Ethnicity</b>						
Maaori	716	13.9 (13.0-14.9)	0.8 (0.7-0.9)	0.0001	0.6 (0.6-0.7)	<0.0001
Pacific	1,497	18.2 (17.4-19.1)	1.1 (1.0-1.2)	0.0091	0.6 (0.6-0.7)	<0.0001
Chinese	39	9.0 (6.3-11.7)	0.5 (0.4-0.7)	<0.0001	0.5 (0.4-0.7)	0.0002
Indian	382	23.9 (21.8-26.0)	1.6 (1.4-1.8)	<0.0001	1.0 (0.8-1.2)	ns
Other Asian	115	14.3 (11.9-16.7)	0.8 (0.7-1.0)	ns	0.6 (0.5-0.8)	<0.0001
Euro/Other	1,002	16.6 (15.6-17.5)	ref	ref	ref	ref
<b>Age Group</b>						
<20 years	312	13.2 (11.8-14.6)	0.7 (0.6-0.8)	<0.0001	0.6 (0.5-0.7)	<0.0001
20-24 years	938	17.7 (16.7-18.7)	1.0 (0.9-1.1)	ns	0.9 (0.8-1.0)	0.0307
25-29 years	1,063	17.7 (16.8-18.7)	1.0 (0.9-1.1)	ns	1.0 (0.9-1.1)	ns
30-34 years	874	17.4 (16.3-18.4)	ref	ref	ref	ref
35-39 years	483	16.0 (14.7-17.3)	0.9 (0.8-1.0)	ns	1.0 (0.9-1.1)	ns
40+ years	113	15.1 (12.5-17.7)	0.8 (0.7-1.0)	ns	1.0 (0.8-1.2)	ns
<b>NZ Deprivation Index 2006 (CAU)</b>						
Decile 1-2	260	14.2 (12.6-15.8)	ref	ref	ref	ref
Decile 3-4	173	16.3 (14.1-18.5)	1.2 (1.0-1.5)	ns	1.2 (0.9-1.4)	ns
Decile 5-6	355	13.6 (12.3-14.9)	0.9 (0.8-1.1)	ns	1.0 (0.8-1.2)	ns
Decile 7-8	397	19.1 (17.4-20.8)	1.4 (1.2-1.7)	<0.0001	1.1 (0.9-1.3)	ns
Decile 9-10	2,597	17.5 (16.8-18.1)	1.3 (1.1-1.5)	0.0005	1.0 (0.9-1.2)	ns
<b>Suburb</b>						
Howick	381	14.8 (13.4-16.2)	ref	ref	ref	ref
Otara	679	26.2 (24.5-27.9)	2.0 (1.8-2.3)	<.0001	1.5 (1.3-1.9)	<0.0001
Papatoetoe	542	18.1 (16.8-19.5)	1.3 (1.1-1.5)	0.0009	1.1 (0.9-1.3)	ns
Mangere	649	17.1 (15.9-18.3)	1.2 (1.0-1.4)	0.0137	1.1 (0.9-1.4)	ns
Manurewa	799	15.4 (14.4-16.4)	1.0 (0.9-1.2)	ns	1.0 (0.8-1.2)	ns
Papakura	375	14.6 (13.3-16.0)	1.0 (0.8-1.2)	ns	1.0 (0.8-1.2)	ns
Franklin	358	12.9 (11.6-14.1)	0.9 (0.7-1.0)	0.0400	1.0 (0.8-1.2)	ns
<b>Maternity Provider</b>						
Private LMC	1,402	12.6 (12.0-13.2)	ref	ref	ref	ref
Closed Unit	364	8.2 (7.4-9.0)	0.6 (0.6-0.7)	<.0001	0.7 (0.6-0.8)	<0.0001
Shared Care	1,847	34.1 (32.9-35.4)	3.6 (3.3-3.9)	<.0001	4.0 (3.7-4.4)	<0.0001
Caseloading	69	12.4 (9.7-15.2)	1.0 (0.8-1.3)	ns	1.0 (0.8-1.3)	ns
Secondary	101	25.7 (21.4-30.0)	2.4 (1.9-3.0)	<.0001	2.5 (2.0-3.2)	<0.0001
<b>Delivery Location</b>						
Middlemore	3,332	17.7 (17.2-18.2)	ref	ref	ref	ref
Botany	122	11.3 (9.4-13.2)	0.6 (0.5-0.7)	<0.0001	0.6 (0.5-0.7)	<0.0001
Papakura	195	14.0 (12.1-15.8)	0.8 (0.6-0.9)	0.0004	1.0 (0.9-1.2)	ns
Pukekohe	134	11.5 (9.7-13.3)	0.6 (0.5-0.7)	<0.0001	0.9 (0.7-1.1)	ns
<b>Parity</b>						
Nulliparous	1,489	17.3 (16.5-18.1)	ref	ref	ref	ref
1-2	1,683	17.7 (16.9-18.4)	1.0 (0.9-1.1)	0.5614	1.0 (0.9-1.0)	ns
3-5	542	14.8 (13.6-15.9)	0.8 (0.7-0.9)	0.0005	0.7 (0.6-0.8)	<0.0001
6 or more	69	10.2 (7.9-12.5)	0.5 (0.4-0.7)	<.0001	0.4 (0.3-0.6)	<0.0001
<b>Gestation at Delivery</b>						
<37	243	16.8 (14.8-18.7)	1.0 (0.8-1.1)	ns	1.0 (0.9-1.1)	ns
37-41	3,295	17.1 (16.5-17.6)	ref	ref	ref	ref
42+	163	13.1 (11.2-15.0)	0.7 (0.6-0.9)	0.0003	0.7 (0.5-0.8)	<0.0001

Source: Healthware. Note: OR: Odds Ratio. Only includes CMDHB women who delivered in CMDHB. Ethnicity is preferred.

**Table 33: Demographic and Pregnancy Characteristics for CMDHB Women who Booked Very Late in Pregnancy (> 18 Weeks), 2007-09**

	No.	Crude Rate per 100 (95% CI)	Crude OR (95% CI)	p	Adjusted OR (95% CI)	p
<b>Ethnicity</b>						
Maaori	2,199	42.8 (41.4-44.1)	1.9 (1.7-2.0)	<0.0001	2.0 (1.8-2.1)	<0.0001
Pacific	3,361	40.9 (39.9-42.0)	1.7 (1.6-1.9)	<0.0001	2.2 (2.0-2.4)	<0.0001
Chinese	108	24.9 (20.9-29.0)	0.8 (0.7-1.0)	ns	0.9 (0.7-1.1)	ns
Indian	362	22.7 (20.6-24.7)	0.7 (0.6-0.8)	<0.0001	1.0 (0.9-1.1)	ns
Other Asian	230	28.6 (25.5-31.7)	1.0 (0.9-1.2)	ns	1.2 (1.0-1.4)	ns
Euro/Other	1,727	28.5 (27.4-29.7)	ref	ref	ref	ref
<b>Age Group</b>						
<20 years	1,021	43.2 (41.2-45.2)	1.6 (1.4-1.7)	<0.0001	1.8 (1.6-2.0)	<0.0001
20-24 years	2,035	38.4 (37.0-39.7)	1.3 (1.2-1.4)	<0.0001	1.4 (1.3-1.6)	<0.0001
25-29 years	2,021	33.7 (32.5-34.9)	1.0 (1.0-1.1)	ns	1.1 (1.0-1.2)	0.0125
30-34 years	1,647	32.8 (31.5-34.1)	ref	ref	ref	ref
35-39 years	1,053	34.9 (33.2-36.6)	1.1 (1.0-1.2)	ns	1.0 (0.9-1.1)	ns
40+ years	270	36.1 (32.7-39.5)	1.2 (1.0-1.4)	ns	0.9 (0.8-1.1)	ns
<b>NZ Deprivation Index 2006 (CAU)</b>						
Decile 1-2	538	29.4 (27.3-31.5)	ref	ref	ref	ref
Decile 3-4	339	32.0 (29.2-34.8)	1.1 (1.0-1.3)	ns	1.1 (0.9-1.3)	ns
Decile 5-6	872	33.3 (31.5-35.2)	1.2 (1.1-1.4)	0.0054	1.0 (0.9-1.2)	ns
Decile 7-8	651	31.3 (29.3-33.3)	1.1 (1.0-1.3)	ns	1.0 (0.9-1.2)	ns
Decile 9-10	5,644	37.9 (37.2-38.7)	1.5 (1.3-1.6)	<0.0001	1.1 (0.9-1.2)	ns
<b>Suburb</b>						
Howick	747	29.0 (27.3-30.8)	ref	ref	ref	ref
Otara	892	34.4 (32.6-36.2)	1.3 (1.1-1.4)	<0.0001	1.0 (0.8-1.1)	ns
Papatoetoe	986	33.0 (31.3-34.7)	1.2 (1.1-1.4)	0.0014	0.9 (0.8-1.1)	ns
Mangere	1,548	40.9 (39.3-42.4)	1.7 (1.5-1.9)	<0.0001	1.1 (0.9-1.2)	ns
Manurewa	1,974	38.1 (36.8-39.4)	1.5 (1.4-1.7)	<0.0001	1.1 (0.9-1.2)	ns
Papakura	842	32.9 (31.0-34.7)	1.2 (1.1-1.3)	0.003	0.8 (0.7-1.0)	0.0207
Franklin	1,058	38.0 (36.2-39.8)	1.5 (1.3-1.7)	<0.0001	1.1 (0.9-1.3)	ns
<b>Maternity Provider</b>						
Private LMC	4,375	39.4 (38.4-40.3)	ref	ref	ref	ref
Closed Unit	2,064	46.7 (45.2-48.2)	1.4 (1.3-1.4)	<0.0001	1.2 (1.1-1.3)	<0.0001
Shared Care	1,385	25.6 (24.4-26.8)	0.5 (0.5-0.6)	<0.0001	0.4 (0.4-0.4)	<0.0001
Caseloading	119	21.4 (18.0-24.9)	0.4 (0.3-0.5)	<0.0001	0.4 (0.3-0.5)	<0.0001
Secondary	104	26.5 (22.1-30.8)	0.6 (0.4-0.7)	<0.0001	0.5 (0.4-0.6)	<0.0001
<b>Delivery Location</b>						
Middlemore	6,493	34.5 (33.8-35.2)	ref	ref	ref	ref
Botany	406	37.6 (34.7-40.5)	1.1 (1.0-1.3)	0.0353	1.4 (1.2-1.6)	<0.0001
Papakura	598	42.8 (40.2-45.4)	1.4 (1.3-1.6)	<0.0001	1.3 (1.2-1.5)	<0.0001
Pukekohe	550	47.2 (44.3-50.0)	1.7 (1.5-1.9)	<0.0001	1.7 (1.4-2.0)	<0.0001
<b>Parity</b>						
Nulliparous	2,878	33.5 (32.5-34.5)	ref	ref	ref	ref
1-2	3,172	33.3 (32.3-34.2)	1.0 (0.9-1.1)	0.7592	1.1 (1.0-1.1)	0.0574
3-5	1,632	44.5 (42.9-46.1)	1.6 (1.5-1.7)	<0.0001	1.8 (1.7-2.0)	<0.0001
6 or more	365	54.0 (50.2-57.8)	2.3 (2.0-2.7)	<0.0001	3.3 (2.7-4.0)	<0.0001
<b>Gestation at Delivery</b>						
<36	627	32.9 (30.8-35.0)	0.9 (0.8-1.0)	0.0092	0.9 (0.8-1.0)	ns
37-41	6,926	35.9 (35.2-36.5)	ref	ref	ref	ref
42+	494	39.7 (37.0-42.5)	1.2 (1.0-1.3)	0.0057	1.1 (1.0-1.3)	0.0307

Source: Healthware. Note: OR: Odds Ratio. ns: not statistically significant. Only includes CMDHB women who delivered in CMDHB. Ethnicity is preferred. Suburbs are determined by Auckland City subdivision boundaries.

### 5.1.9 Section Summary

During 2007-2009, 16.8% of CMDHB women who delivered at CMDHB were booked by 10 weeks, 44.8% of women booked late at 10-18 weeks gestation, whilst 38.4% either booked very late (after 18 weeks) or did not book at all.

This analysis suggests that only a small proportion of CMDHB meet NICE guidelines of initiating antenatal care before they are 10 weeks gestation. For most CMDHB women, the degree to which booking date reflects the onset of antenatal care is unknown. However, for those with Closed Unit Care and Caseloading care, there is a reasonable strong relationship between booking gestation and the gestation at first antenatal contact. In these two groups, 8.2% and 12.3% booked early, by 10 weeks gestation, respectively. Women with Shared Care had the highest odds of an early booking, which may be a result of the contractual relationship between the GP and the DHB incentivising the GP to complete the booking process earlier.

Just over a third (36%) of CMDHB women booked very late (after 18 weeks gestation). Women with the highest odds of very late booking were Pacific and Maaori, aged <25 years, and with a parity of 3 or more. These same factors were independently associated with increased odds of being Unbooked (see Section 4.3.9). In addition, women with Closed Unit care had higher odds of booking late. This could be a reflection of Closed Unit care as care of last resource, or late referral of higher risk women to CMDHB services and warrants further investigation.

## 5.2 CMDHB Provided Antenatal Care

There are no national data available for examining the antenatal care provided in New Zealand. Few publications related to antenatal care in New Zealand were found.

In CMDHB, antenatal care data are recorded in Healthware. These data have some significant limitations. Data are only collected for antenatal contacts or visits provided by CMDHB staff, therefore no data are collected for antenatal care provided by Private LMCs or GPs providing Shared Care. The completeness and accuracy of the data currently collected in Healthware is unknown. The types of antenatal visits/contacts recorded in Healthware include acute and follow-up assessments at Middlemore Hospital (e.g. in ALBU, on the ward), home visits, phone consultations, and clinic visits. A review of antenatal visit records suggests that Healthware underestimates the number of contacts provided by CMDHB staff and more frequently records visits/contacts with midwives than doctors.

**CAUTION:** The data presented in this section are exploratory only and have significant limitations (see Section 2.3.2). These analyses were performed to improve understanding of the potential and limitations of Healthware data and to stimulate discussion, hypothesis generation, and future research.

### 5.2.1 Location of Antenatal Visit Contacts

During 2007-2009, 11,733 (52%) CMDHB resident women who delivered in CMDHB had 56,304 scheduled antenatal contacts with CMDHB staff recorded on Healthware (Table 34). CMDHB offers antenatal clinics at 20 locations across the DHB including clinics at Manukau and Botany SuperClinics, the three primary maternity units in Botany, Papakura, and Pukekohe, on the Middlemore Hospital site, the Auckland Women's Regional Corrections

Facility, and at community locations in Beachlands, Clendon, Mangere, Manurewa, Otara, and Papatoetoe (see map Appendix 5).

Overall attendance was high at 89%, however this varied by location. Attendance was highest for women scheduled to be seen at Middlemore Hospital (100%) and at Botany (99%), and was lowest for women attending a Community Midwife Clinic (85%) or Manukau SuperClinic (87%), with the exception of phone consultations. Most of the attended contacts took place face to face at a clinic held in the community (85%), 8% occurred at Middlemore Hospital, 7% in a woman's home, and a small number of phone consultations were recorded. The reasons for the visit were not recorded in a consistent way that could be analysed. It is possible that visits scheduled to occur at Middlemore were in response to an acute of evolving issue, increasing the likelihood of attendance. This reason is unlikely to be applicable to attendance at Botany.

**Table 34: CMDHB Antenatal Contacts with CMDHB Resident Women by Location, 2007-2009**

Location	Number Scheduled	Number Attended	Attendance Rate	Percent of Total Attended
Community MW Clinic	25,532	21,604	84.6	43.2
Botany	5,705	5,652	99.1	11.3
Papakura	7,663	6,978	91.1	14.0
Pukekohe	1,991	1,824	91.6	3.7
Manukau SuperClinic	7,615	6,596	86.6	13.2
Middlemore	3,916	3,901	99.6	7.8
Home	3,675	3,258	88.7	6.5
Phone	207	148	71.5	0.3
Total	56,304	49,961	88.7	100.0

Source: Healthware. Note: MW: midwife. Only includes data for CMDHB resident women who delivered in CMDHB.

CMDHB has a protocol for management of non-attendance at antenatal clinics. After the first instance of non-attendance, attempts are to be made to reschedule another appointment as soon as possible and a letter is sent to the woman with the new appointment time (see Appendix 6). If a second non-attendance occurs, a letter is sent to the woman and her GP (if in Shared Care or referred by GP) stating that further appointments will only be made on request. This second letter places the responsibility on the woman and/or her GP to arrange further antenatal care and is referred to as a Letter of Responsibility. Healthware does not have a data field for recording whether or not a Letter of Responsibility has been sent; therefore, the implementation of this protocol has not been examined.

### 5.2.2 Women Accessing CMDHB Antenatal Care

While 52% of CMDHB resident women were scheduled at least one antenatal contact, only 49% received at least one contact. A profile of the women who had at least one antenatal contact with a CMDHB maternity provider recorded in Healthware is shown in Table 35.

Unbooked women and women cared for by a Private LMC were the least likely to have CMDHB provided antenatal contact recorded in Healthware. Almost all women with a Caseloading midwife (98%) had a CMDHB provided antenatal contact, while only 85% of those with Shared Care did. Women with Caseloading, Closed Unit and Secondary Care had, on average, more contacts than women with Shared Care, although this is a reflection of the number of visits offered to women with the different types of care.

**Table 35: CMDHB Resident Women with Any CMDHB Antenatal Contact, 2007-09**

	Women		Number of Contacts	
	Number	% (95% CI)	Median	Mean (95% CI)
<b>Maternity Provider</b>				
Private LMC	1,369	12.3 (11.7-13.0)	1	2.1 (2.0-2.2)
Closed Unit	4,177	94.4 (93.7-95.1)	6	6.3 (6.2-6.4)
Shared Care	4,597	85.3 (84.3-86.2)	3	3.0 (2.9-3.0)
Caseloading	543	97.8 (96.6-99.0)	9	8.3 (8.0-8.6)
Secondary	375	86.8 (83.6-90.0)	6	6.8 (6.2-7.3)
Unbooked	17	3.0 (1.6-4.4)	1	1.4 (0.8-1.9)
<b>Ethnicity</b>				
Maaori	2,489	48.4 (47.0-49.8)	3	4.0 (3.9-4.1)
Pacific	4,801	58.5 (57.4-59.6)	3	4.0 (3.9-4.1)
Chinese	318	73.4 (69.3-77.6)	7	7.1 (6.7-7.4)
Indian	882	55.2 (52.8-57.7)	3	4.7 (4.5-4.9)
Other Asian	441	54.9 (51.4-58.3)	5	5.5 (5.2-5.8)
European/Other	2,037	33.7 (32.5-34.8)	5	5.6 (5.4-5.8)
<b>Age Group</b>				
<20 years	1,300	55.0 (53.0-57.0)	3	4.4 (4.3-4.6)
20-24 years	2,645	49.8 (48.5-51.2)	3	4.0 (3.9-4.1)
25-29 years	2,836	47.3 (46.0-48.5)	3	4.3 (4.2-4.5)
30-34 years	2,333	46.4 (45.0-47.8)	4	4.8 (4.7-5.0)
35-39 years	1,510	50.0 (48.2-51.8)	4	5.1 (4.9-5.3)
40+ years	454	60.7 (57.2-64.2)	4	5.1 (4.8-5.4)
<b>NZ Deprivation Index 2006 (CAU)</b>				
Decile 1-2	714	39.0 (36.8-41.3)	6	6.1 (5.8-6.3)
Decile 3-4	431	40.7 (37.7-43.6)	5	5.6 (5.3-6.0)
Decile 5-6	993	38.0 (36.1-39.8)	5	5.5 (5.3-5.8)
Decile 7-8	1,088	52.3 (50.2-54.5)	3	4.6 (4.4-4.8)
Decile 9-10	7,849	52.8 (52.0-53.6)	3	4.2 (4.1-4.2)
<b>Suburb</b>				
Howick	1,319	51.3 (49.3-53.2)	6	6.1 (6.0-6.3)
Otara	1,600	61.7 (59.8-63.6)	3	3.4 (3.3-3.5)
Papatoetoe	1,594	53.4 (51.6-55.2)	3	4.4 (4.2-4.5)
Mangere	2,220	58.6 (57.0-60.2)	3	4.2 (4.0-4.3)
Manurewa	2,512	48.5 (47.1-49.9)	3	4.2 (4.0-4.3)
Papakura	1,159	45.2 (43.3-47.2)	5	5.3 (5.1-5.6)
Franklin	674	24.2 (22.6-25.8)	4.5	5.2 (5.0-5.5)

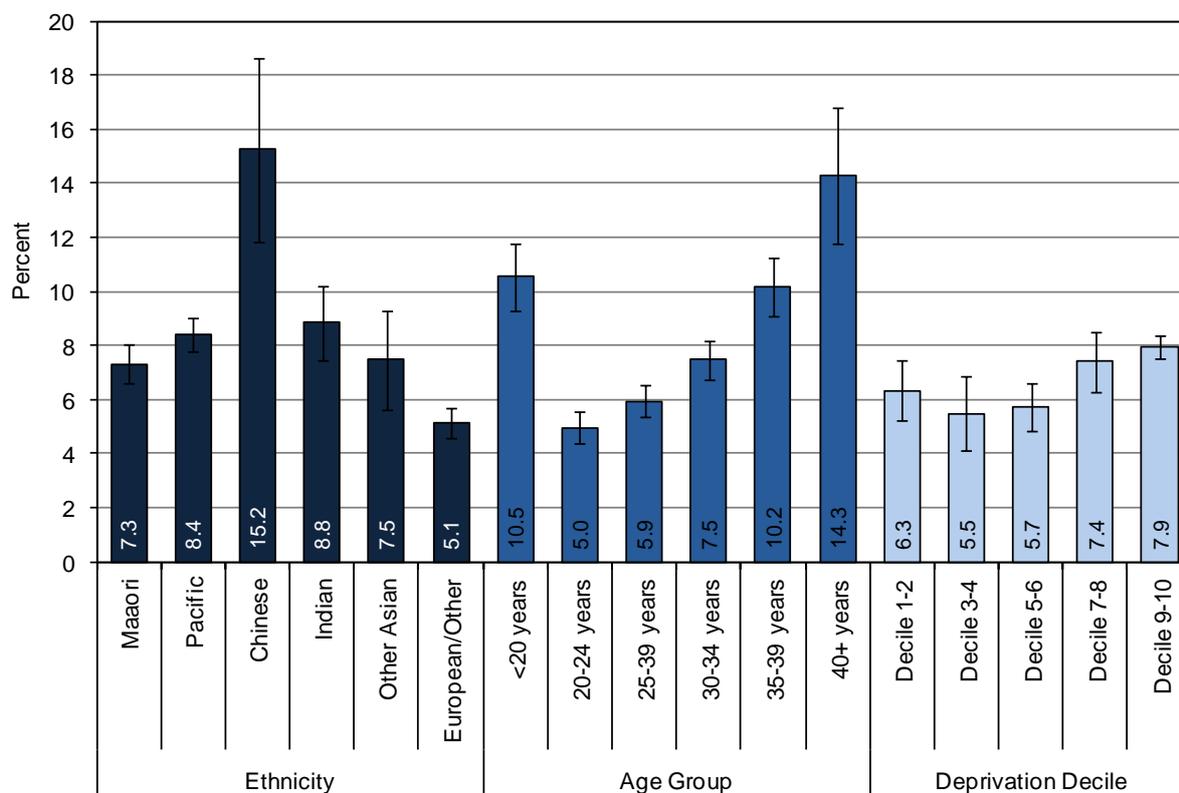
Source: Healthware. Note: Only includes data for CMDHB resident women who delivered in CMDHB. Ethnicity is preferred. A contact is defined as one or more antenatal visits recorded in Healthware and can include a visit at a clinic or home, an acute or follow-up visit at Middlemore hospital, or a telephone consultation. Does not include hospital admissions.

### 5.2.3 CMDHB Provided Antenatal Home Visits

During 2007-2009, 1,658 CMDHB resident women had 3,675 home visits recorded on Healthware, of which 3,258 (89%) were successful and the woman was seen. The reasons for a home visit include diabetes in pregnancy management, routine care, follow-up for non-attendance, delivery of medication, and follow-up of unresolved issues.

The proportion of women who had a home visit recorded on Healthware declined significantly during the study period from 9.5% (95% CI: 8.6-10.0) in 2007 to 7.1% (95% CI: 6.5-7.7) in 2008 and 5.7% (95% CI: 5.2-6.3) in 2009. This trend should be viewed with caution as it could be caused by a number of things including changes in data capture, service capacity, or care. Despite this apparent decline in the number of women visited, the average number of visits per woman did not change over this time. Most women only received one (62.6%) or two (17.8%) home visits, while 7.0% had three visits and 12.7% had four or more visits. The proportion of women who received a home visit varied by maternity provider and was highest for women with Secondary (56%), followed by Caseloading (34%) and Closed Unit care (18%). In contrast, only 5.5% of women with Shared Care and 1% of those with a Private LMC had a CMDHB provided home visit.

**Figure 25: Proportion of CMDHB Resident Women who Received a CMDHB Provided Home Visit, 2007-2009**

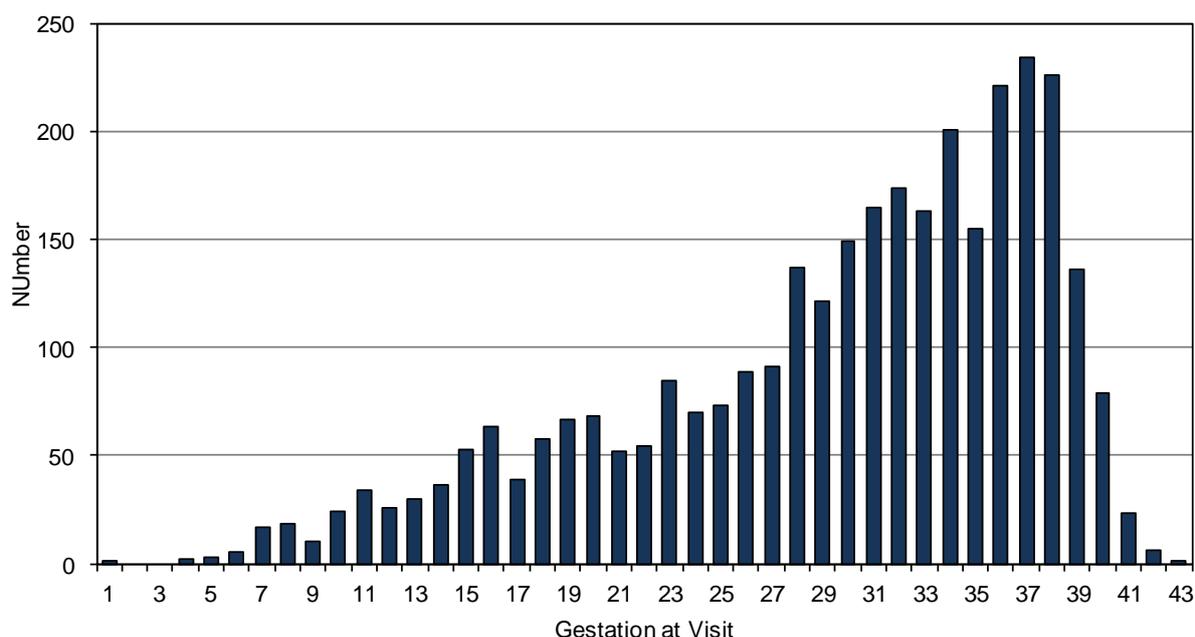


Source: Healthware. Note: Only includes data for CMDHB resident women who delivered in CMDHB. Ethnicity is preferred.

Of the CMDHB resident women who delivered in CMDHB during 2007-2009, CMDHB provided home visits occurred more frequently in some groups (Figure 25). Those most likely to receive one or more CMDHB provided home visits were Chinese, Indian, or Pacific, aged less than 20 years or 35 years and older, and living in more deprived areas (deciles 7-10). In addition, the proportion that had a home visit increased with increasing parity and was 6.8% (95% CI: 6.2-7.3), 7.2% (95% CI: 6.7-7.8), 8.6% (95% CI 7.7-9.5), and 10.5% (95% CI: 8.2-12.8), in women whose parity was 0, 1-2, 3-5, and 6 or more respectively.

Home visits most frequently occurred near term, with 6.3% occurring before 15 weeks gestation, 26.4% occurring at a gestation of 15-28 weeks, and 67% occurring after 28 completed weeks (Figure 26).

**Figure 26: Home Visits in CMDHB Residents by the Gestation of the Visit Date, 2007-2009**



Source: Healthware. Note: Only includes data for CMDHB resident women who delivered in CMDHB.

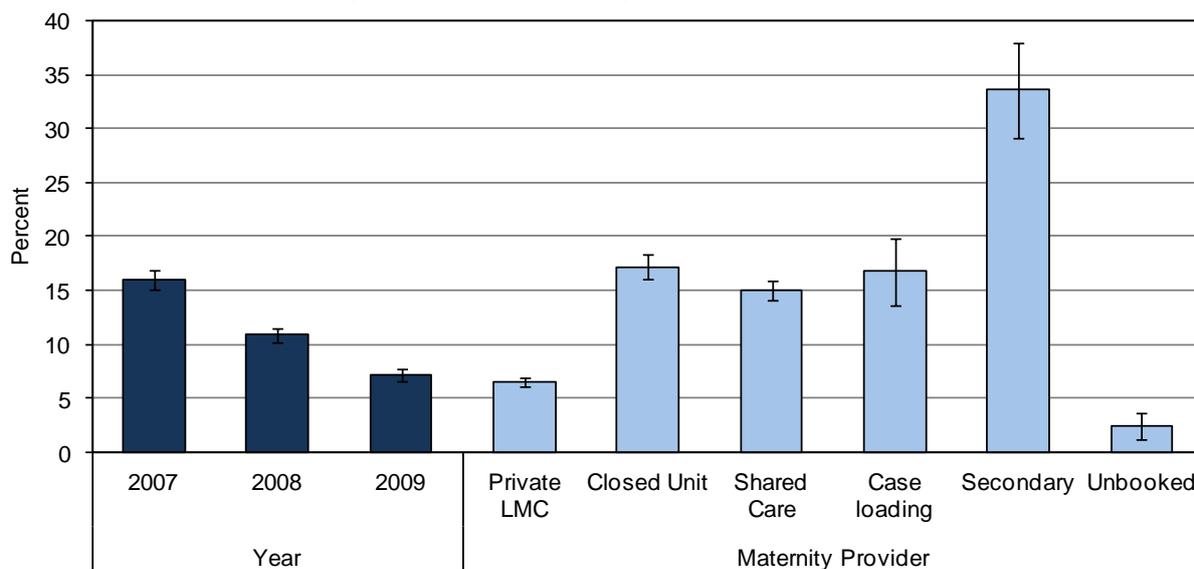
### 5.2.4 CMDHB Provided Antenatal Visits at Middlemore Hospital

Healthware records antenatal visits that occur at Middlemore hospital. A review of Healthware records revealed that these are generally either acute assessments for problems arising during pregnancy, review for induction of labour, or early labour assessments. The contacts reported here do not include hospital admissions.

During 2007-2009, 2,546 CMDHB resident women had 3,916 scheduled antenatal contacts at Middlemore, for which attendance was very high (99.6%). Similarly to home visits, the proportion of women who had an antenatal contact at Middlemore declined over the study period from 16.0% in 2007, to 10.9% in 2008, and to 7.1% in 2009 (Figure 27). This apparent trend may represent a change in data capture, service capacity, or the model of care. In addition, the proportion of Antenatal contacts at Middlemore differed by maternity provider and was highest for women with Secondary Care (33.6%), followed by women with Caseloading (17.2%), Closed Unit (16.8%), and Shared care (15.0%). Women with Private LMC care were significantly less likely to have an antenatal contact at Middlemore (6.5%). A small number of women who were Unbooked (n=14) were seen during the antenatal period at Middlemore.

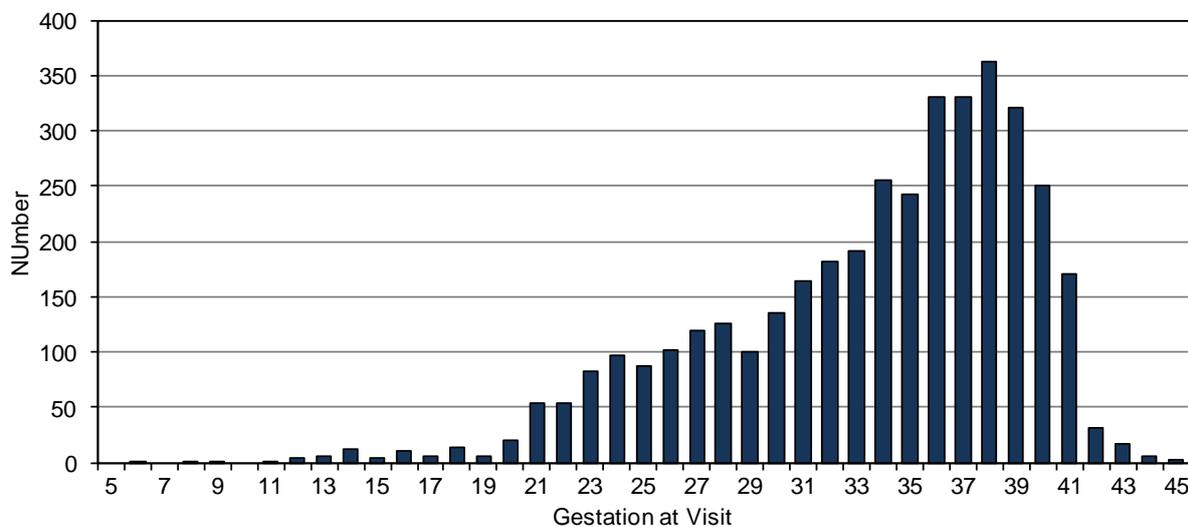
Of the women who had an antenatal contact at Middlemore, most only had one (72.1%) or two (16.5%), while 5.9% had three visits and 5.9% had four or more visits. Most of the visits took place at the Assessment, Labour, and Birthing Unit (50.5%) or on the maternity ward (44.6%). Very few contacts occurred in early pregnancy, 0.7% in women with a gestation of <15 weeks, while 16.8% occurred at a gestation of 15-28 weeks, and 79.3% occurred after 28 weeks (Figure 28). Just over half (52.9%) of all Middlemore antenatal contact occurred after 34 weeks gestation.

**Figure 27: Proportion of CMDHB Resident Women who Received an Antenatal Contact at Middlemore Hospital by Year and Maternity Provider, 2007-2009**



Source: Healthware. Note: Only includes data for CMDHB resident women who delivered in CMDHB. Does not include hospital admissions.

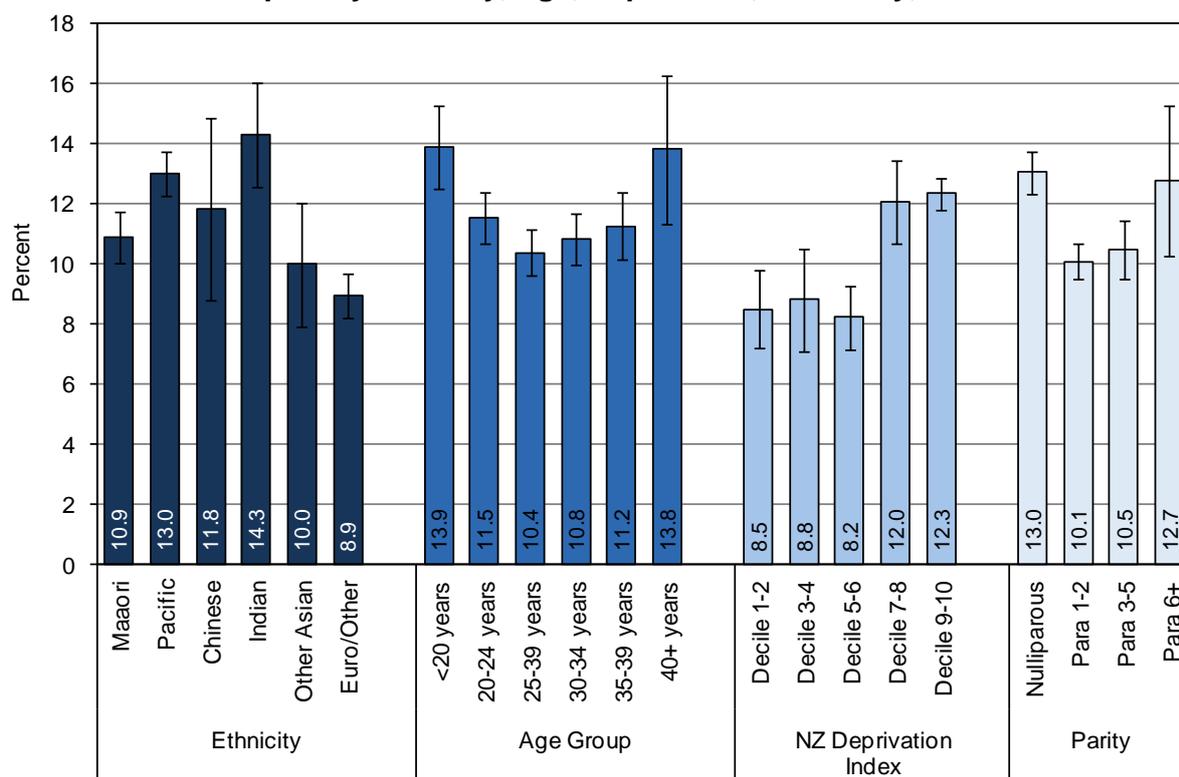
**Figure 28: Antenatal Contacts at Middlemore Hospital for CMDHB Residents by the Gestation on the Visit Date, 2007-2009**



Source: Healthware. Note: Only includes data for CMDHB resident women who delivered in CMDHB. Does not include hospital admissions.

Figure 29 shows that CMDHB resident Indian (14%), Maaori (13%), and Pacific (11%) women were more likely to have an antenatal contact at Middlemore Hospital than European/Other women (9%). Women aged <20 years or ≥40 years had the highest rate of a Middlemore antenatal contact, 14% for both, of any age group examined. CMDHB women living in the most deprived areas (decile 7-10) had a significantly higher rate of Middlemore antenatal contact (12%) than women living in decile 1-6 areas (8-9%). Nulliparous women (13%) and women with a parity of 6 or more (13%) most frequently had a Middlemore antenatal contact.

**Figure 29: Proportion of CMDHB Resident Women who Received an Antenatal Contact at Middlemore Hospital by Ethnicity, Age, Deprivation, and Parity, 2007-2009**



Source: Healthware. Note: Only includes data for CMDHB resident women who delivered in CMDHB. Does not include hospital admissions. Ethnicity is preferred

### 5.2.5 Shared Care

The Shared Care provided in CMDHB is a unique arrangement between CMDHB and general practice and was described in section 4.1. On being booked for Shared Care, a woman will be sent a visit schedule that describes the usual antenatal visits that will be offered by the DHB and her GP (see Appendix 7). This schedule includes 3 antenatal visits with a CMDHB midwife or doctor at 18, 28, and 36 weeks gestation and 8 antenatal visits with her Shared Care GP for a 40 week pregnancy. CMDHB provided visits are goal-oriented with specific issues covered at each time point. A woman whose pregnancy goes beyond 40 weeks is asked to see her GP at 41 weeks for an appointment to be arranged with an Obstetric Consultant at 41 weeks and 3 days with a view to induction. Additional visits may be provided by CMDHB or a woman's GP if needed. Only antenatal contacts provided by CMDHB are recorded on Healthware and described here.

During 2007-09, nearly one in four CMDHB resident women delivering in CMDHB used Shared Care for their antenatal care. During this time, the women using shared care were most frequently Pacific (56%) and Maaori (24%); 40% were aged <25 years old, 14% were 35 years and older; 81% lived in the most deprived areas (decile 9-10); and 72% lived in Otara, Mangere, or Manurewa (Table 36). A high proportion of the women using Shared Care were nulliparous (37%), and 24% had a parity of 3 or more. CMDHB women using Shared Care generally book earlier than women using other maternity providers (see Section 5.1.3), and 74% had booked by 18 weeks gestation. Most women using Shared Care delivery at Middlemore Hospital (93%), 8% delivered preterm, and 20% delivered at 41 weeks or later.

**Table 36: Profile of CMDHB Women Using Shared Care, 2007-2009**

<b>Ethnicity</b>	<b>Num</b>	<b>Percent</b>	<b>Deprivation</b>	<b>Num</b>	<b>Percent</b>
Maaori	1,273	23.6	Decile 1-2	138	2.6
Pacific	3,019	56.0	Decile 3-4	109	2.0
Chinese	33	0.6	Decile 5-6	242	4.5
Indian	429	8.0	Decile 7-8	513	9.5
Other Asian	146	2.7	Decile 9-10	4,388	81.4
Euro/Other	453	8.4	<b>Suburb</b>	<b>Num</b>	<b>Percent</b>
<b>Age Group</b>	<b>Num</b>	<b>Percent</b>	Howick	346	6.4
<20 years	679	12.6	Otara	1,366	25.3
20-24 years	1,490	27.6	Papatoetoe	758	14.1
25-29 years	1,423	26.4	Mangere	1,211	22.5
30-34 years	1,050	19.5	Manurewa	1,302	24.2
35-39 years	574	10.7	Papakura	344	6.4
40+ years	175	3.3	Franklin	64	1.2
<b>Parity</b>	<b>Num</b>	<b>Percent</b>	<b>Booking Gestation</b>	<b>Num</b>	<b>Percent</b>
Nulliparous	1,971	36.6	<10 weeks	1,837	34.1
Para 1-2	2,094	38.8	10-18 weeks	2,171	40.3
Para 3-5	1,122	20.8	19-28 weeks	1,035	19.2
Para 6+	204	3.8	>28 weeks	348	6.5
<b>Delivered</b>	<b>Num</b>	<b>Percent</b>	<b>Delivery Gestation</b>	<b>Num</b>	<b>Percent</b>
Botany	180	3.3	<28 weeks	53	1.0
MMH	5,027	93.3	29-36 weeks	378	7.0
Papakura	170	3.2	37-40 weeks	3,897	72.3
Pukekohe	14	0.3	41+ weeks.	1,063	19.7

Source: Healthware. Note: Only includes data for CMDHB resident women who delivered in CMDHB. Ethnicity is preferred.

During 2007-09, 5,391 women with Shared Care had 16,464 scheduled antenatal contacts with CMDHB staff. In total, 13,738 of the scheduled contacts were attended (83.4%) by 4,597 women. This amounted to 94.8% of women with Shared Care having at least one scheduled antenatal contacts, and 85.3% of women with Shared Care receiving at least one CMDHB provided antenatal contact.

**Table 37: Shared Care Antenatal Contacts with CMDHB Resident Women by Location, 2007-2009**

<b>Location</b>	<b>Number Scheduled</b>	<b>Number Attended</b>	<b>Attendance Rate</b>	<b>Percent of Total Attended</b>
Community MW Clinic	10,519	8,422	80.1	61.3
SuperClinic	1,993	1,684	84.5	12.3
Papakura	1,399	1,222	87.3	8.9
Botany	644	631	98.0	4.6
Pukekohe	134	114	85.1	0.8
Middlemore	1,179	1,176	99.7	8.6
Home	527	449	85.2	3.3
Phone	69	40	58.0	0.3
<b>Total</b>	<b>16,464</b>	<b>13,738</b>	<b>83.4</b>	<b>100.0</b>

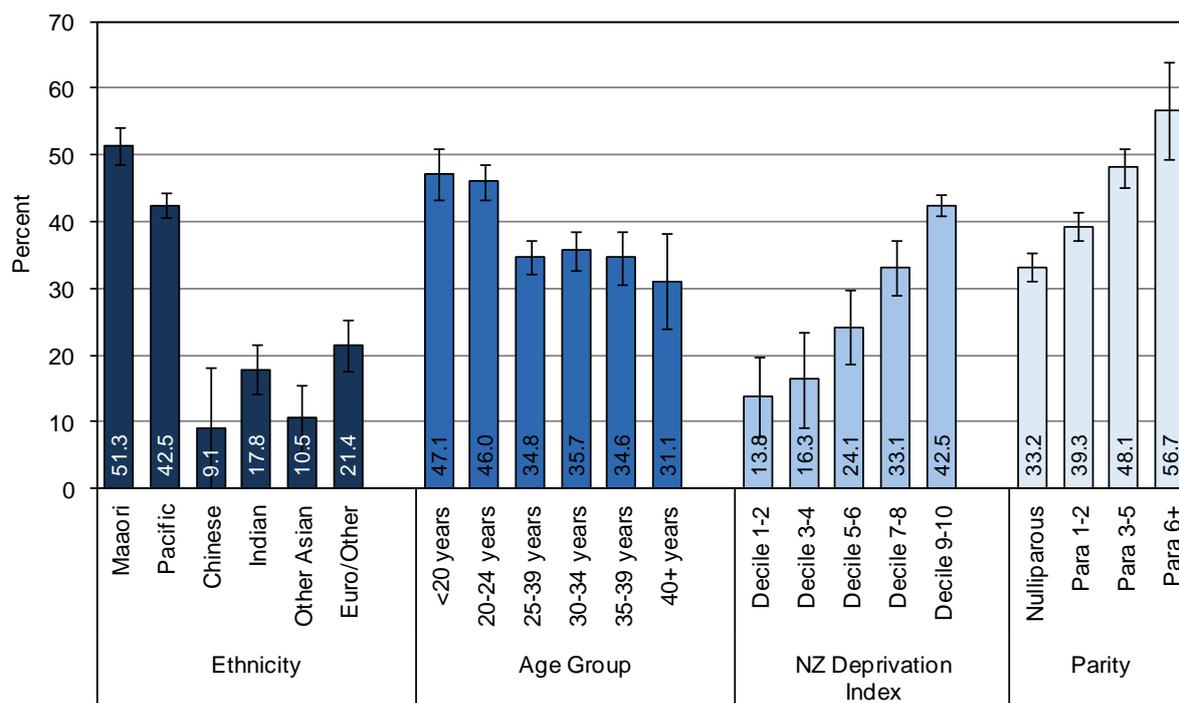
Source: Healthware. Note: MW: midwife. Only includes data for CMDHB resident women who delivered in CMDHB.

The types of antenatal contacts women with Shared Care had scheduled during 2007-09 were face to face appointments in a clinic (89%) or hospital setting (7%), home visits (3%), or phone consultations (<1%) (Table 37). Of clinic and hospital contacts, assessments at Middlemore Hospital had the highest attendance rate (99.7%) followed by those at Botany Clinic (98.0%) while those at a Community Midwife Clinic had the lowest attendance rate (80.1%). Home visiting was successful for 85.2% of visits, whereas phone consultations were only successful in making contact 58% of the time for Shared Care women.

### 5.2.5.1 Non-Attendance of CMDHB Provided Shared Care Clinic Appointments

Of the CMDHB women using Shared Care during 2007-09, 95% had at least one scheduled antenatal clinic appointment, and 85% attended at least one clinic appointment. During the period examined, non-attendance of scheduled visits was a significant issue. While 16.4% of all the scheduled appointments were not attended, 39.5% of women missed one or more clinic appointments (31.0% missed one and 8.4% missed two or more). Some groups of women missed an appointment more frequently. Non-attendance of one or more clinic appointments occurred most frequently for Maaori (51%) and Pacific (43%), women aged less than 25 years (46-47%), women living in the most deprived areas (decile 7-8: 33%; decile 9-10: 43%) and women with high parity (para 3-5: 48%; para 6+: 57%) (Figure 30).

**Figure 30: Proportion of CMDHB Resident Women who Missed at least One CMDHB Scheduled Shared Care Antenatal Clinic Visit, 2007-2009**



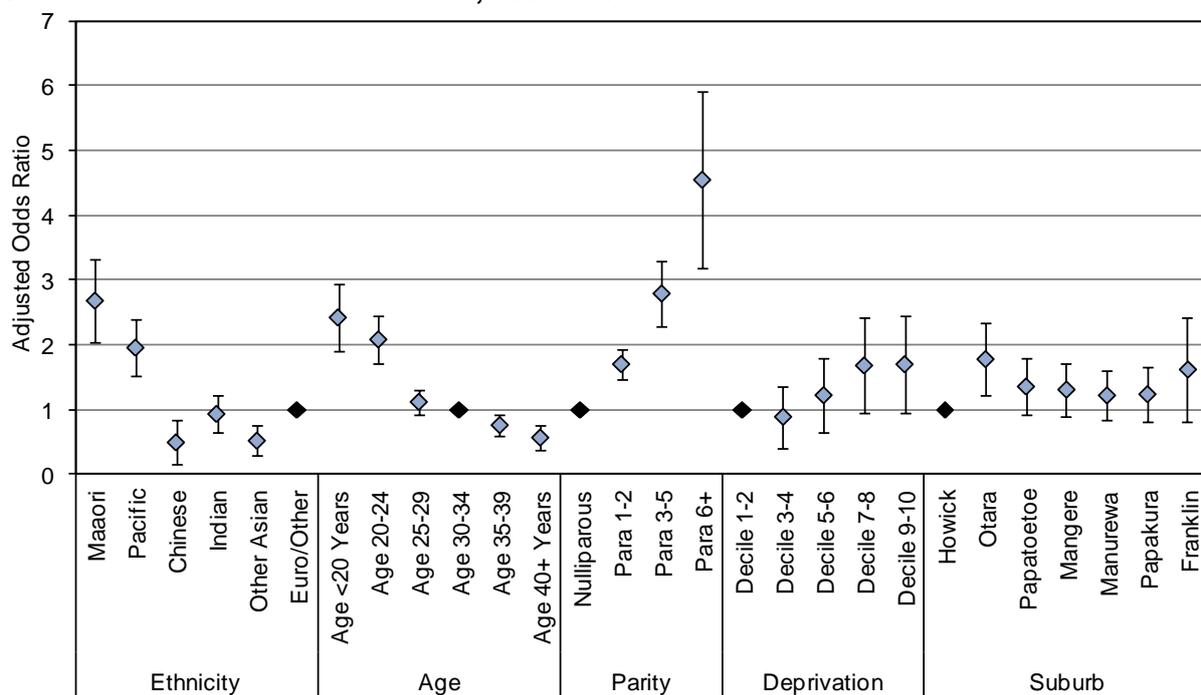
Source: Healthware. Note: Only includes data for CMDHB resident women who delivered in CMDHB, used Shared Care, and had at least one scheduled appointment. Proportions are unadjusted. Ethnicity is preferred.

In addition, 50% of women living in Otago, 41% of those living in Mangere, 37% of those living in Manurewa, 34% of those living in Papakura, and 29% of those living in Franklin missed at least one visit compared to 18% of those living in Howick.

In a multivariate analysis examining the odds of missing a scheduled Shared Care visit after adjusting for the effects of ethnicity, age group, deprivation, residential suburb, and parity, only ethnicity, age group, residential suburb, and parity remained independently associated (Figure 31). After controlling for the effects of the other factors the following observations were made:

- Maaori women had 2.7 times, and Pacific 2.0 times the odds of missing a scheduled Shared Care visit compared to European/Other women. There was no difference in the odds of missing an appointment between European/Other women and Chinese or Indian women. Other Asian women continued to have lower odds of missing a visit compared to European/Other women.
- Compared with women aged 30-34 years old, women aged <20 years had 2.4 times, and women aged 20-24 had 2.0 times, the odds of missing a scheduled Shared Care clinic visit. Women aged 25-29 years had the same odds, and women aged 35 years and older had lower odds of missing an appointment than women aged 30-34 years.
- Women living in Otara had 1.7 time higher odds of missing an appointment than women living in Howick. Women living in Mangere, Manurewa, Papakura, Papatoetoe, and Franklin had the same odds of missing a scheduled Shared Care antenatal clinic visit as women living in Howick.
- Compared with nulliparous women, women with a parity of 1-2, 3-5, and 6 or more had 1.7, 2.8, and 4.5 times higher odds of missing a scheduled Shared Care clinic visit respectively.
- After adjusting for the effects of ethnicity, age group, suburb, and parity on the odds of missing an appointment, no significant difference was observed by NZ deprivation index decile.

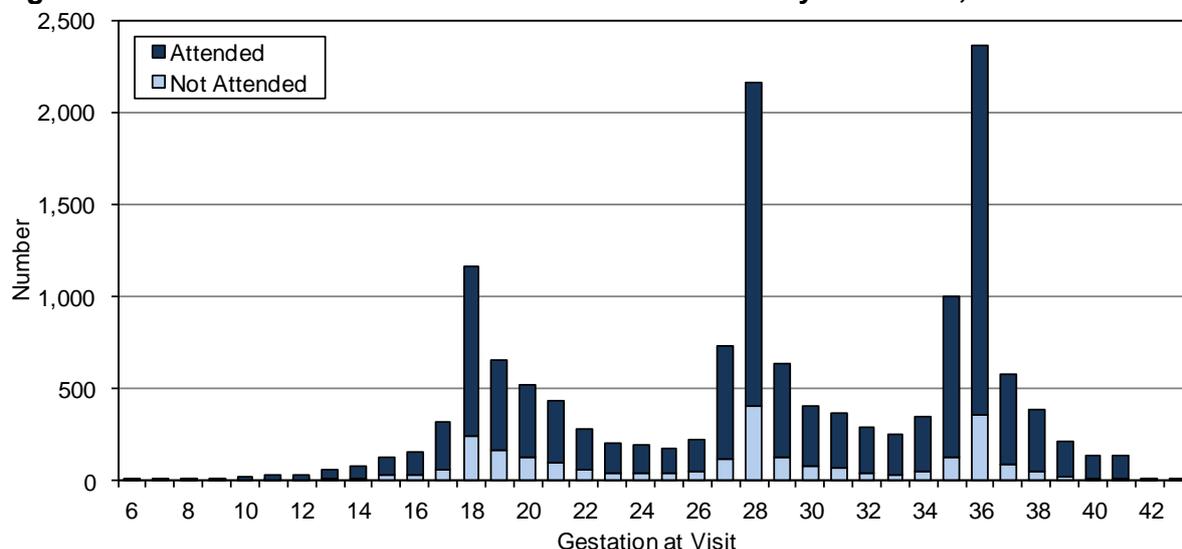
**Figure 31: Adjusted Odds Ratios for Having Missed at Least One CMDHB Scheduled Shared Care Antenatal Clinic Visit, 2007-2009**



Source: Healthware. Only includes data for CMDHB resident women who delivered in CMDHB, used Shared Care, and had at least one scheduled appointment. Odds ratios are adjusted for ethnicity, age, parity, deprivation, and suburb. Black diamonds indicate the reference group. Ethnicity is preferred.

CMDHB Shared Care clinic visits occurred most frequently at 18, 28, and 36 weeks gestation, consistent with the usual visits offered (Figure 32). The attendance rate improved with increasing gestation and was 78% for visits scheduled before 24 weeks, 81% for visits at 24-31 weeks, 86% for visits at 32-39 weeks, and 91% for visits from 40 weeks gestation.

**Figure 32: Number of CMDHB Shared Care Clinic Visits by Gestation, 2007-2009**



Source: Healthware. Note: Only includes data for CMDHB resident women who delivered in CMDHB and used Shared Care.

### 5.2.5.2 Expected vs. Actual Attendance of CMDHB Provided Shared Care Clinic Visits

Ideally, all women with Shared care would attend three CMDHB provided antenatal clinic. During 2007-2009, only 40% of women with Shared Care attended at least three appointments, while 24% attended two, 19% attended one, and 17% attended none.

The likelihood of a woman using Shared Care attending all three CMDHB provided antenatal visits is influenced by her gestation at booking and delivery. If a woman is booked at 24 weeks and delivers at 35 weeks then she could only be expected to attend one Shared Care clinic visit. Based on the booking and delivery gestations recorded in Healthware, a small number of women were expected to attend no CMDHB visits (<1%), 8.2% to attend one visit, 21.1% to attend two visits, and 70.4% to attend three visits (Table 38). During 2007-2009, 52% of the CMDHB women using Shared Care attended their expected number of CMDHB provided antenatal clinic visits or more.

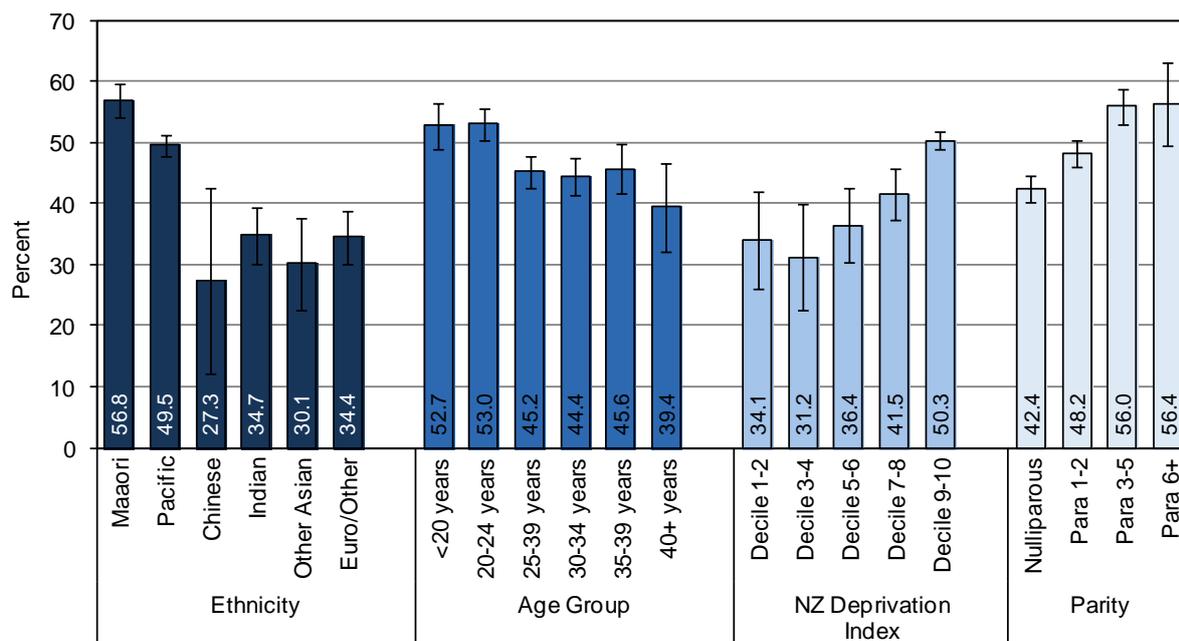
**Table 38: Expected and Actual CMDHB Visits Attended in CMDHB Resident Women Using Shared Care, 2007-09**

Expected Visits	Women		Actual Visits				% Attended Expected or More Visits
	Number	Percent	None	One	Two	Three+	
None	16	0.3	12	4	0	0	100.0
One	443	8.2	197	182	39	25	55.5
Two	1,138	21.1	231	303	410	194	53.1
Three	3,794	70.4	462	526	869	1,937	51.1
<b>Total</b>	<b>5,391</b>	<b>100.0</b>	<b>902</b>	<b>1,015</b>	<b>1,318</b>	<b>2,156</b>	<b>52.0</b>

Source: Healthware. Note: MW: midwife. Only includes data for CMDHB resident women who delivered in CMDHB. Highlighted numbers reflect women who attended the expected number of visits (or more).

Whether a woman attended her expected number of CMDHB provided Shared Care antenatal clinic appointments or not was influenced by her ethnicity, age group, NZ Deprivation Index 2006 decile, suburb of residence, and parity (Figure 33). Non-attendance of Shared Care clinic visits occurred most frequently in Maaori and Pacific women, women aged <25 years, women living in the most deprived areas, and women with higher parity. Women living in Otara were least likely to attend all of their expected Shared Care visits (56%), followed by women living in Manurewa (49%), Mangere (48%), Papatoetoe (44%), Papakura (38%), Franklin (38%) and Howick (34%).

**Figure 33: Proportion of CMDHB Resident Women who Did Not Attend their Expected Number of CMDHB Provided Shared Care Antenatal Clinic Visits, 2007-2009**



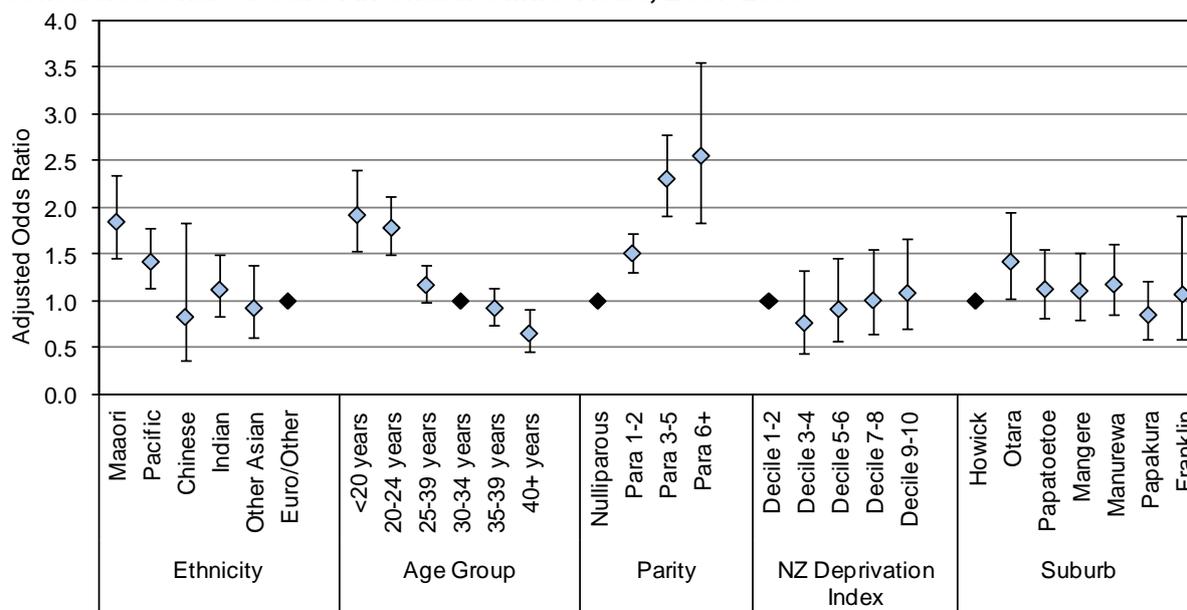
Source: Healthware. Note: Only includes data for CMDHB resident women who delivered in CMDHB and used Shared Care. Expected number of visits based on booking and delivery gestation. Ethnicity is preferred.

In order to determine whether these characteristics affected completing the expected number of Shared Care visits independently of each other, a multivariate logistic regression analysis was performed adjusting for the effects of ethnicity, age group, deprivation, residential suburb, and parity. After adjusting for the effects of the other factors, only ethnicity, age group, parity and suburb independently influenced completion of the expected number of Shared Care antenatal visits, and the following observations were made (Figure 34):

- The odds of not completing the expected number of Shared Care visits was 1.8 times higher for Maaori women and 1.4 times higher for Pacific women compared with European/Other women. The odds of not completing the expected number of visits was no different for Asian and European other women.
- Compared with women aged 30-34 years old, younger women had higher odds of not completing their expected number of visits (1.9 and 1.8 times higher for women aged <20 and 20-24 years old respectively). Women aged 40 years and older had lower odds of not completing her expected number of visits compared with 30-34 year olds.
- A woman's odds of not completing the expected number of visits increased significantly with increasing parity, and was highest in women with a parity of 6 or more (2.6 times higher than for nulliparous women).

- Women living in Otara had 1.4 times higher odds of not attending all her expected number of visits than women living in Howick. Women living in Mangere, Manurewa, Papakura, Papatoetoe, and Franklin had the same odds as women living in Howick.
- The odds of not completing the expected number of antenatal visits was not associated with deprivation, once ethnicity, age group, parity, and suburb were taken into account.

**Figure 34: Adjusted Odds Ratios for Not Completing the Expected Number of CMDHB Scheduled Shared Care Antenatal Clinic Visits, 2007-2009**



Source: Healthware. Note: Only includes data for CMDHB resident women who delivered in CMDHB and used Shared Care. Expected number of visits based on booking and delivery gestation. Odds ratios are adjusted for ethnicity, age, parity, deprivation, and suburb. Black diamonds indicate reference groups. Ethnicity is preferred.

Women who missed one or more scheduled Shared Care antenatal clinic visits could still complete their expected number of visits. Of the women who completed their expected number of visits, 18.1% had missed one or more appointments. However, missing visits decreased the likelihood that the expected number of visits would be achieved. Of women who did not miss any antenatal clinic appointments, 68.0% attended their expected number of visits, but of women who missed one or more antenatal clinic visits only 25% attended their expected number of visits.

### 5.2.5.3 Post Term Antenatal Contacts

Shared Care GPs of women who have not delivered by their due date are asked to refer these women to see a CMDHB doctor for a post-dates assessment at 41 weeks and three days. During 2007-2009, 1,063 CMDHB resident women with Shared Care had not delivered by their due date. Of these women, 377 (35%) had at least one antenatal contact scheduled at or after 40 weeks and prior to delivery, and 301 (28%) completed at least one post-dates antenatal contact. Most of these contacts were scheduled to occur in a clinic setting (61%) or at Middlemore (36%), although 3% were home visits or phone consultations.

## 5.2.6 Closed Unit Care

Closed Unit antenatal care is provided by CMDHB employed community midwives, with clinics held at Middlemore Hospital, Manukau or Botany SuperClinic, or in the community (see map in Appendix 5). On being booked for Closed Unit, a woman will be sent a visit schedule that describes the usual antenatal visits that will be offered by the DHB (see Appendix 7). This schedule includes 6 antenatal visits with a CMDHB midwife or doctor at 15-18, 24-28, 31, 36, 38 and 40 weeks gestation for a 40 week pregnancy. CMDHB provided visits are goal-oriented with specific issues covered at each time point. A woman whose pregnancy goes beyond 40 weeks seen again at 41 weeks for an appointment to be arranged with an Obstetric Consultant at 41 weeks and 3 days with a view to induction. Additional visits may be provided if needed.

During 2007-09, nearly one in five CMDHB resident women delivering in CMDHB used Closed Unit for their antenatal care. Of the women using Closed Unit care, 36% were Pacific, 26% Maaori, and 18% Asian; 36% were aged <25 years and 19% were aged 35 years and older; 65% lived in the most deprived areas (decile 9-10) (Table 39). While 53% booked for care before 18 weeks gestation, 19% did not book until after 28 weeks. Most of the women using Shared care lived in Manurewa, Mangere, and Howick; most (90%) delivered at Middlemore Hospital, with 9.2% born preterm and 16.6% born after 40 weeks.

**Table 39: Profile of CMDHB Women Using Closed Unit Care, 2007-2009**

<b>Ethnicity</b>	<b>Num</b>	<b>Percent</b>	<b>Deprivation</b>	<b>Num</b>	<b>Percent</b>
Maaori	1,114	25.2	Decile 1-2	370	8.4
Pacific	1,589	35.9	Decile 3-4	222	5.0
Chinese	255	5.8	Decile 5-6	512	11.6
Indian	275	6.2	Decile 7-8	410	9.3
Other Asian	236	5.3	Decile 9-10	2,910	65.8
Euro/Other	904	20.4	<b>Suburb</b>	<b>Num</b>	<b>Percent</b>
<b>Age Group</b>	<b>Num</b>	<b>Percent</b>	Howick	719	16.3
<20 years	574	13.0	Otara	352	8.0
20-24 years	1,034	23.4	Papatoetoe	626	14.2
25-29 years	1,063	24.0	Mangere	886	20.0
30-34 years	914	20.7	Manurewa	940	21.2
35-39 years	639	14.4	Papakura	533	12.1
40+ years	201	4.5	Franklin	369	8.3
<b>Parity</b>	<b>Num</b>	<b>Percent</b>	<b>Booking Gestation</b>	<b>Num</b>	<b>Percent</b>
Nulliparous	1,633	36.9	<10 weeks	368	8.3
Para 1-2	1,863	42.1	10-18 weeks	1,995	45.1
Para 3-5	762	17.2	19-28 weeks	1,210	27.4
Para 6+	167	3.8	>28 weeks	852	19.3
<b>Delivered</b>	<b>Num</b>	<b>Percent</b>	<b>Delivery Gestation</b>	<b>Num</b>	<b>Percent</b>
Botany	165	3.7	<28 weeks	57	1.3
MMH	3,963	89.6	29-36 weeks	351	7.9
Papakura	214	4.8	37-40 weeks	3,284	74.2
Pukekohe	83	1.9	41+ weeks.	733	16.6

Source: Healthware. Note: Only includes data for CMDHB resident women who delivered in CMDHB. Ethnicity is preferred.

During this time, 4,425 women with Closed Unit care had 29,072 scheduled antenatal contacts with CMDHB staff. In total, 26,291 of the scheduled contacts were attended (90.4%) by 4,177 women. This amounted to 95.7% of women with Closed Unit care having at least one scheduled antenatal contacts, and 94.4% of women with Closed Unit care completing at least one CMDHB provided antenatal contact.

The types of antenatal contacts women with Closed Unit care had scheduled during 2007-09 were face to face appointments in a clinic (90%) or hospital setting (5%), home visits (5%), or phone consultations (<1%) (Table 37). Of clinic and hospital contacts, assessments at Middlemore had the highest attendance rate (99.7%) followed by those at Botany Clinic (99.4%) while those at a SuperClinic (87.5%) or a Community Midwife Clinic had the lowest attendance rates (87.7%). Home visiting was successful for 86.0% of visits and phone consultations were successful in making contact 78.1% of the time.

**Table 40: Closed Unit Antenatal Contacts by Location, 2007-2009**

Location	Number Scheduled	Number Attended	Attendance Rate	Percent of Total Attended
Community MW Clinic	13,179	11,559	87.7	44.0
Papakura	4,409	4,005	90.8	15.2
Botany	4,001	3,978	99.4	15.1
SuperClinic	2,850	2,493	87.5	9.5
Pukekohe	1,737	1,610	92.7	6.1
Home	1,594	1,371	86.0	5.2
Middlemore	1,197	1,193	99.7	4.5
Phone	105	82	78.1	0.3
Total	29,072	26,291	90.4	100.0

Source: Healthware. Note: MW: midwife. Only includes data for CMDHB resident women who delivered in CMDHB and used Closed Unit care.

### 5.2.6.1 Non-Attendance of Closed Unit Antenatal Clinic Appointments

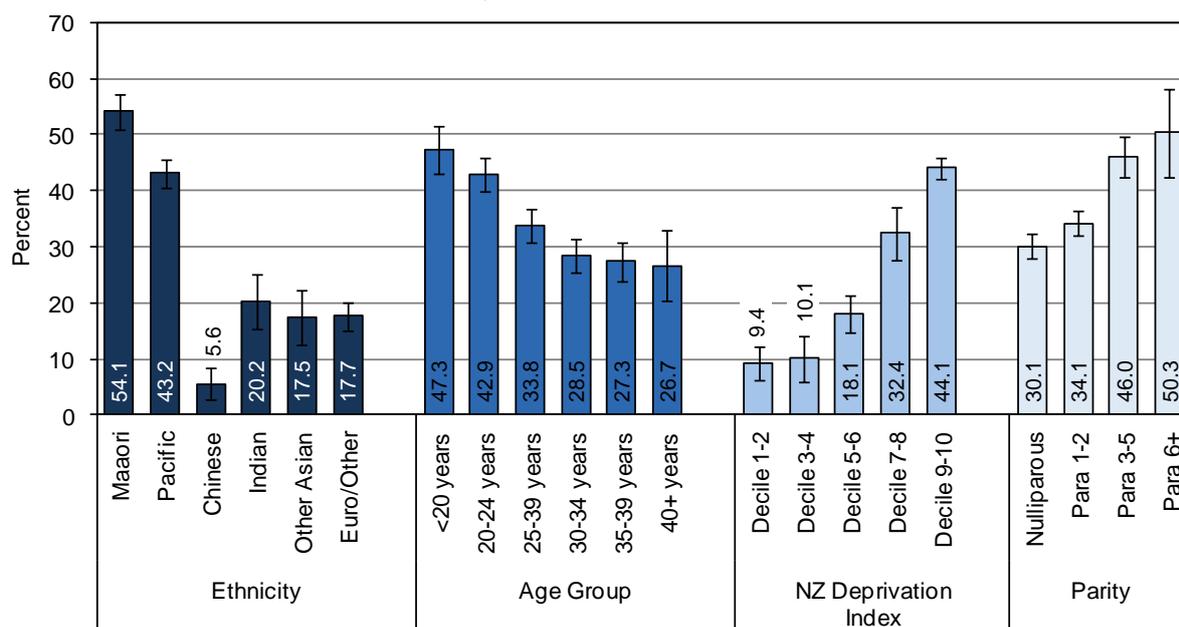
Of the CMDHB women using Closed Unit care during 2007-09, 94.4% had at least one scheduled antenatal clinic appointment, and 91.7% attended at least one clinic appointment. In this time, while only 9.6% of scheduled visits were not attended, 35.3% of women using Closed Unit care missed at least one antenatal clinic appointment (21.1% missed one, 8.0% missed two, and 6.2% missed three or more). The proportion of women who missed a Closed Unit clinic visit each year did not change significantly over the time period examined.

During 2007-09, non-attendance of a Closed Unit appointment varied by ethnicity, age group, NZ Deprivation Index 2006 decile, suburb of residence, and parity (Figure 35). Maaori and Pacific women most frequently missed one or more antenatal clinic appointments, as did women less than 29 years old, women who lived in the more deprived areas (decile 7-8 and 9-10) and women with a parity of 3 or more.

The suburb with the highest proportion of women who missed a visit was Otara (50.0%), followed by Mangere (45.7%), Manurewa (41.3%), Papakura (39.5%), and Papatoetoe (39.1%). Less women living in Franklin (24.0%) missed a Closed Unit appointment, and few of those women living in Howick (7.6%).

In order to determine whether these factors were associated with missing one or more scheduled clinic visit independently of each other, a multivariate analysis was performed with ethnicity, age group, deprivation, residential suburb, and parity and the explanatory variables. After adjusting for the effects of these variables, all those examined were found to be independently associated with missing a visit (Figure 36).

**Figure 35: Proportion of CMDHB Resident Women who Missed One or More CMDHB Closed Unit Antenatal Clinic Visits, 2007-2009**



Source: Healthware. Note: Only includes data for CMDHB resident women who delivered in CMDHB, used Closed Unit care, and had at least one scheduled appointment. Proportions are unadjusted.

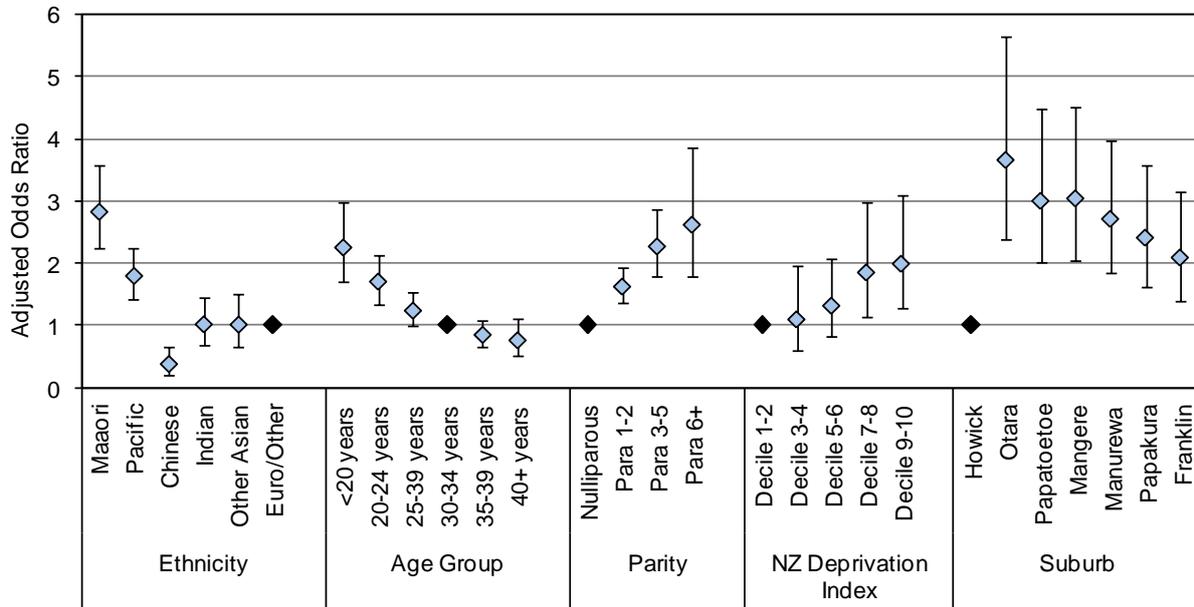
The following observations were made:

- Maaori women had 2.8 times, and Pacific women had 1.8 times, greater odds of missing a Closed unit antenatal clinic visits compared with European/Other women. Chinese women had significantly lower odds of missing an appointment than European/Other women.
- In comparison with women aged 30-34 years old, women aged <20 years had 2.2 times greater odds and women aged 20-24 years had 1.7 times greater odds, of missing a Closed Unit antenatal clinic appointment. There was no significant difference in the odds of missing an appointment in women aged 25-29 years, 30-34 years, 35-39 years, and 40 years and older.
- A woman's odds of missing a scheduled antenatal clinic appointment increased significantly with increasing parity, and were highest in women with a parity of 6 or more at 2.6 times that of nulliparous women.
- The odds of missing a scheduled Closed Unit antenatal clinic appoint was significantly higher in women living in decile 9-10 areas (2.6 times) and decile 7-8 areas (2.3 times) compared to women living in decile 1-2 areas.
- Compared with women living in Howick, women living in all other areas had higher odds of missing a Closed Unit appointment. An additional analysis with Otara as the reference group revealed that compared with women living in Otara, those living in Papatoetoe and Mangere had the same odds of missing an antenatal clinic visit, but women living in Manurewa, Papakura, Franklin, and Howick had lower odds of missing an appointment.

Closed Unit clinic visits increased in number with increasing gestation, and were most frequent around the planned visit times (24, 28, 31, 34, 38, 38 weeks), but infrequent at 15-18 weeks (Figure 37). Closed unit care is often the care of last resort, with women using Closed Unit care booking later than found with all other maternity providers. During 2007-09,

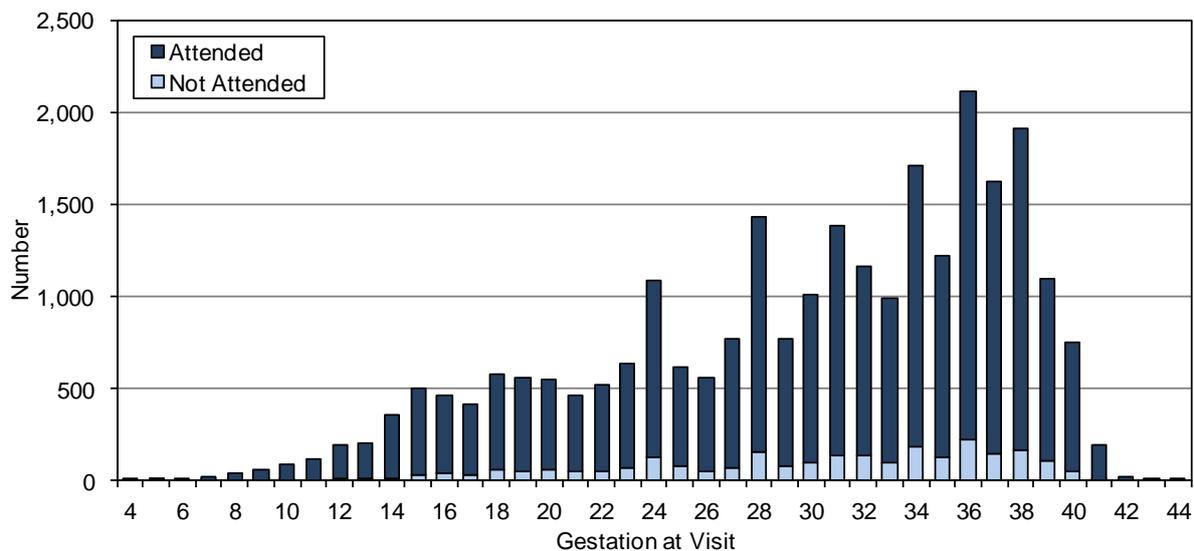
10% of women using Closed Unit care had not yet booked by 32 weeks gestation. The attendance rate averaged 90% for all visits scheduled from 18-39 weeks gestation, and was higher for visits both before 18 weeks (93%) and after 39 weeks (94%).

**Figure 36: Adjusted Odds Ratios for Having Missed One or More Closed Unit Antenatal Clinic Visit, 2007-2009**



Source: Healthware. Only includes data for CMDHB resident women who delivered in CMDHB, used Closed Unit care, and had at least one scheduled appointment. Odds ratios are adjusted for ethnicity, age, parity, deprivation, and suburb. Black diamonds indicate the reference group. Ethnicity is preferred.

**Figure 37: Number of Closed Unit Clinic Visits by Gestation, 2007-2009**



Source: Healthware. Only includes data for CMDHB resident women who delivered in CMDHB, used Closed Unit care, and had at least one scheduled appointment.

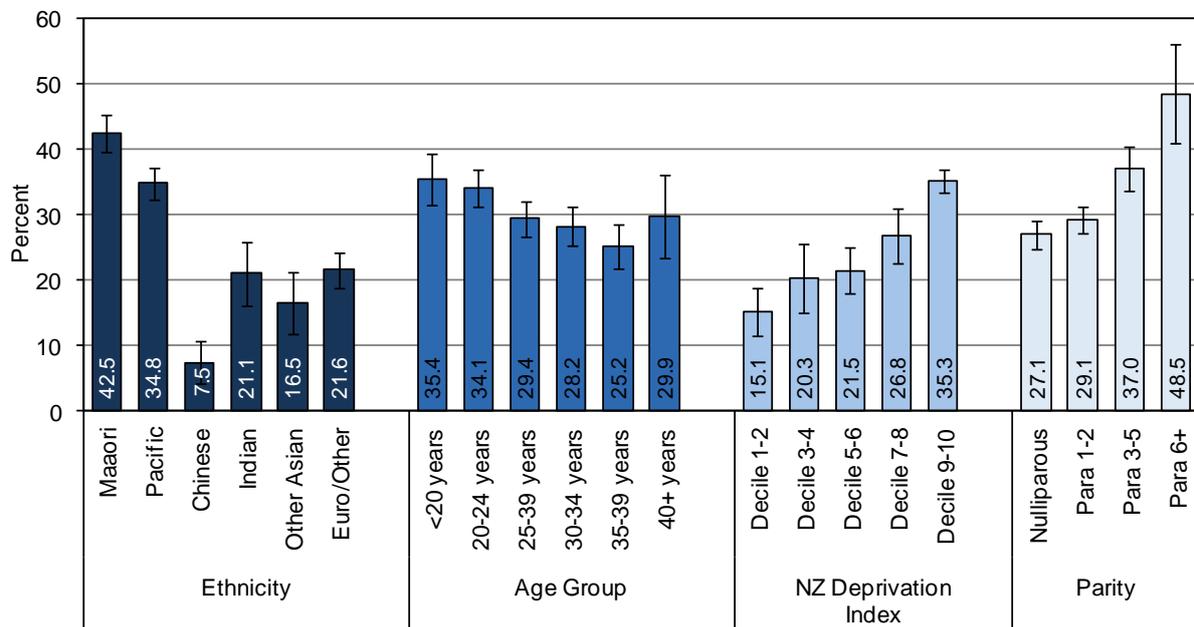
### 5.2.6.2 Expected vs. Actual Closed Unit Antenatal Clinic Visits

The likelihood of a woman using Closed Unit care attending all six CMDHB provided antenatal visits (up to and including the 40 week visit) is influenced by her gestation at booking and delivery. If a woman is booked at 24 weeks and delivers at 35 weeks then she could be expected to attend only two Closed Unit clinic visits. Women who deliver after 40 weeks gestation can be expected to attend 1-3 additional visits depending on when delivery ultimately occurs.

Based on the booking and delivery gestations recorded in Healthware, a small number of women were expected to attend no Closed Unit visits (<1%), 11.2% to attend 1-2 visits, 31.1% to attend 3-4 visits, and 48.3% to attend 5-6 visits (Table 41). Some women (8.7%) that delivered post term were expected to attend seven or more visits depending on their booking gestation. During 2007-2009, 69.5% of the CMDHB women using Closed Unit care attended their expected number of CMDHB provided antenatal clinic visits or more.

Whether a woman attended her expected number of Closed Unit antenatal appointments was influenced by her ethnicity, age group, NZ Deprivation Index 2006 decile, suburb of residence, and parity. Not attending the expected number of antenatal visits occurred most frequently for Maaori (43%) and Pacific (35%) women, young women aged <25 years (34-35%), women living in the most deprived areas (35%), and women with a parity of 6 or more (49%) (Figure 38, Figure 33). Women living in Otara were least likely to attend all of their expected Closed Unit visits (45%), followed by women living in Manurewa (37%), Mangere (36%), Franklin (31%), Papatoetoe (28%), Papakura (25%) and Howick (13%).

**Figure 38: Proportion of CMDHB Resident Women who Did Not Attend their Expected Number of Closed Unit Antenatal Clinic Visits, 2007-2009**



Source: Healthware. Note: Only includes data for CMDHB resident women who delivered in CMDHB and used Closed Unit care. Expected number of visits based on booking and delivery gestation. Ethnicity is preferred.

**Table 41: Expected and Actual Antenatal Clinic Visits for CMDHB Resident Women Using Closed Unit Care, 2007-09**

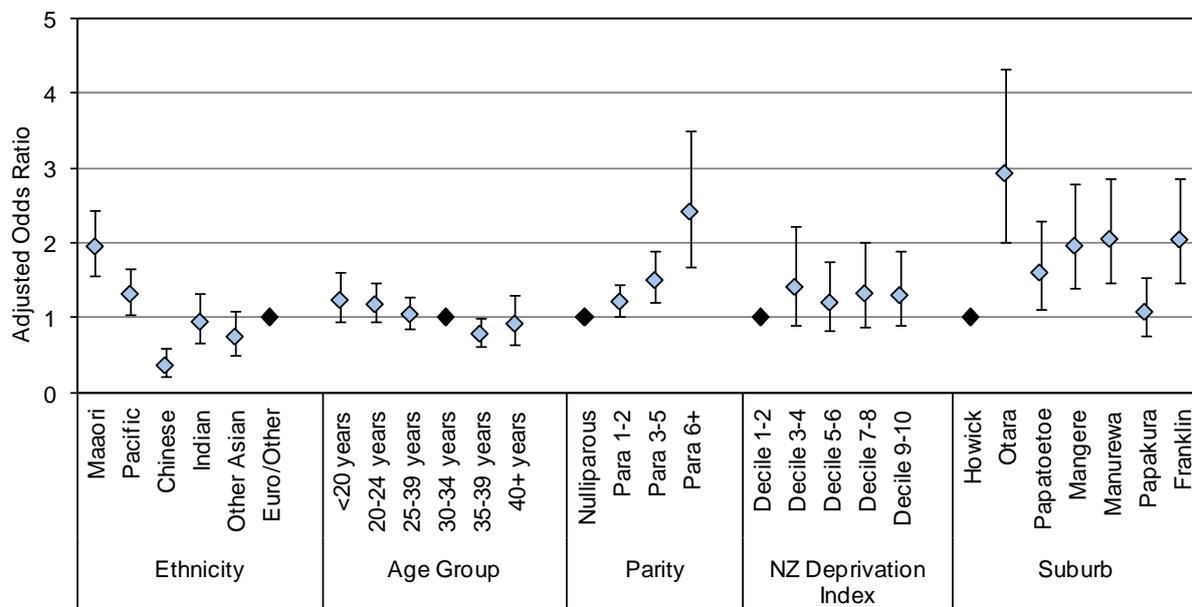
Expected Number of Visits			Actual Number of Visits Attended										% Attended Expected or More Visits
Women	%		None	One	Two	Three	Four	Five	Six	Seven	Eight	Nine+	
<b>None</b>	35	0.8	16	15	4	0	0	0	0	0	0	0	100.0
<b>One</b>	179	4.1	86	52	27	9	3	1	0	1	0	0	52.0
<b>Two</b>	315	7.1	52	64	75	58	33	21	10	2	0	0	63.2
<b>Three</b>	475	10.7	57	56	65	82	77	55	40	20	11	12	62.5
<b>Four</b>	899	20.3	52	57	74	79	105	151	141	116	68	56	70.9
<b>Five</b>	1,426	32.2	60	63	78	79	100	126	193	240	181	306	73.4
<b>Six</b>	713	16.1	22	30	29	36	38	46	72	98	102	240	71.8
<b>Seven</b>	300	6.8	15	10	8	11	9	16	18	31	40	142	71.0
<b>Eight</b>	67	1.5	3	3	1	5	0	4	3	4	8	36	65.7
<b>Nine</b>	16	0.4	5	0	2	1	2	0	1	0	4	1	6.3
<b>Total</b>	4,425	100	368	350	363	360	367	420	478	512	414	793	69.5

Source: Healthware. Note: Only includes data for CMDHB resident women who delivered in CMDHB and used Closed Unit care. Expected number of visits based on booking and delivery gestation.

In order to determine whether these characteristics affected completing the expected number of Closed Unit visits independently of each other, a multivariate logistic regression analysis was performed adjusting for the effects of ethnicity, age group, deprivation, residential suburb, and parity. After adjusting for the effects of the other factors, only ethnicity ( $p < 0.0001$ ), age group ( $p = 0.04$ ), parity ( $p < 0.0001$ ) and suburb ( $p < 0.0001$ ) were independently associated with not completing the expected number of Closed Unit clinic visits. The following observations were made (Table 41):

- Maaori women had 2.0 times, and Pacific had 1.3 times, the odds of not completing their expected number of visits compared with European/Other women. The odds of not completing the expected number of visits was no different for, Indian, and Other Asian women than for European/Other women, whereas Chinese women had lower odds
- Compared with women aged 30-34 years, 35-39 year olds had lower odds of not completing the expected number of Closed Unit visits, however, no other differences were observed.
- A woman's odds of not completing her expected number of visits increased significantly with increasing parity, and was highest in women with a parity of 6 or more (2.4 times higher odds than for nulliparous women).
- The odds of not completing the expected number of antenatal visits was not associated with deprivation after ethnicity, age group, parity, and suburb were taken into account.
- The odds of not completing her expected number of antenatal clinic visits was 3 times higher for women living in Otara, 2 times higher for women living in Manurewa, Franklin, and Mangere, and 1.6 times higher for women living in Papatoetoe than for women living in Howick. No difference in the odds of completing the expected number of visits was observed for women living in Papakura compared to Howick women.

**Figure 39: Adjusted Odds Ratios for Not Completing the Expected Number of Closed Unit Antenatal Clinic Visits, 2007-2009**



Source: Healthware. Note: Only includes data for CMDHB resident women who delivered in CMDHB and used Closed Unit Care. The expected number of visits is based on booking and delivery gestation. Odds ratios are adjusted for ethnicity, age, parity, deprivation, and suburb. Black diamonds indicate reference groups. Ethnicity is preferred.

Women who missed one or more scheduled Closed Unit antenatal clinic visits could still complete their expected number of visits. Of the women who completed their expected number of Closed Unit visits, 29% had missed one or more appointments. However, missing visits decreased the likelihood that the expected number of visits was achieved. Of women who did not miss any antenatal clinic appointments, 74.1% attended their expected number of visits; of women who missed one antenatal clinic visits, 63.9% attended their expected number of visits; and of women who missed two or more appointment only 55.5% completed their expected number of visits.

### 5.2.6.3 Post Term Antenatal Contacts

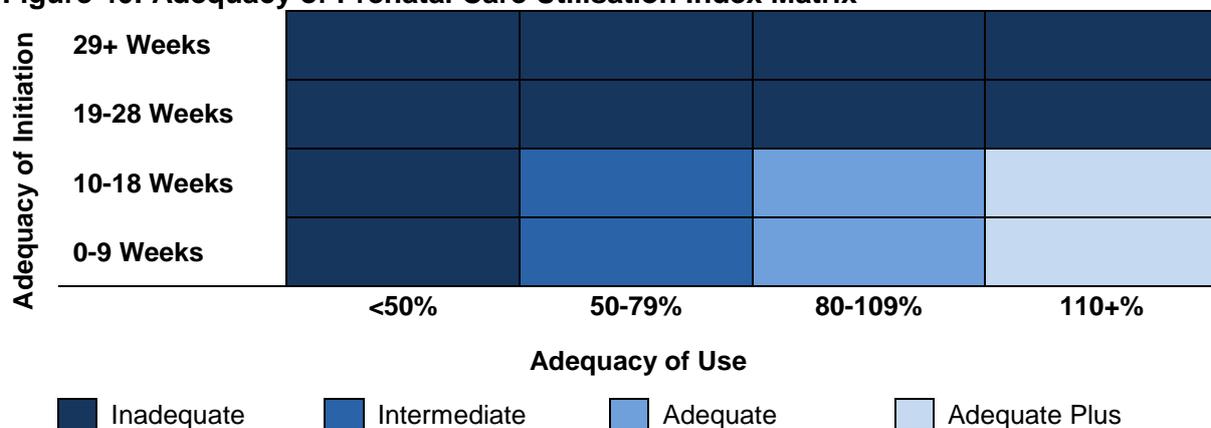
Closed Unit women who have not delivered by their due date are seen at 41 weeks and referred to see a CMDHB doctor for a post-dates assessment at 41 weeks and three days. During 2007-2009, 733 CMDHB resident women with Closed Unit had not delivered by their due date. Of these women, 522 (71%) had at least one antenatal contact scheduled at or after 40 weeks and prior to delivery, and 508 (69%) completed at least one post-dates antenatal contact. Most of these contacts were scheduled to occur in a clinic setting (85%) or at Middlemore (10%), although 5% were home visits or phone consultations.

### 5.2.6.4 Adequacy of Closed Unit Care Utilisation

Attending the expected number of visits does not necessarily mean a woman had adequate antenatal care. A woman that booked at 35 weeks and attended all her visits before delivering at 40 weeks gestation would not generally be considered to have adequately accessed antenatal care.

Several measures of adequacy of antenatal care have been developed, and each has strengths and limitations. Reported here is the Adequacy of Prenatal Care Utilization (APNCU) Index that contains the two dimensions of adequacy of initiation of care and adequacy of use (i.e. the proportion of expected visits that were attended).<sup>55</sup> In this analysis, only antenatal clinic attendance has been included. Using these two dimensions, antenatal care is divided into four categories: Inadequate, Intermediate, Adequate, and Adequate Plus as shown in Figure 40.

**Figure 40: Adequacy of Prenatal Care Utilisation Index Matrix**



Source: Kotelchuck<sup>55</sup> Note: Adequacy of use refers to the proportion of expected antenatal care visits that were attended based on the gestation at initiation of care and delivery.

During 2007-2009, 53.2% of women using Closed Unit had inadequate antenatal care utilisation based on the APNCU index, most of which was due to inadequate initiation (46.6%) rather than inadequate use once care had been initiated (6.6%). In addition, 3.6% had Intermediate, 7.4% had Adequate, and 35.8% had Adequate Plus care. Adequate Plus care occurs when a woman has more than her expected number of antenatal care visits, which can occur due to necessity (i.e. complications of pregnancy, high risk pregnancy) or excessive use.

Adequacy of Closed Unit antenatal care utilisation as measured by the APNCU Index varied in CMDHB by ethnicity, age group, parity, deprivation, and suburb (Table 42, Table 43). During 2007-09, 66% of Maaori and 64% of Pacific women had Inadequate utilisation, compared to 36% of Asian women and 33% of European/Other women. The proportion of women who had Inadequate utilisation was highest for young women aged <25 years (61%) and generally declined with increasing age. The proportion of women with Inadequate utilisation increased with increasing parity and increased with increasing deprivation of the area a woman lived in. Women living in Otara, Mangere, and Manurewa have the highest proportion of Inadequate utilisation.

The groups with the highest proportion of Adequate Plus utilisation were Asian and European/Other women, aged 30-39 years (43-44%), were nulliparous (38%) or para 1-2 (40%), lived in the least deprived areas (60%), or lived in Howick (58%).

In order to determine whether these characteristics affected adequacy of Closed Unit antenatal care utilisation independently of each other, a multivariate logistic regression analysis was performed adjusting for the effects of ethnicity, age group, deprivation, residential suburb, and parity to investigate both Inadequate and Adequate Plus utilisation.

The odds of Inadequate Closed Unit utilisation were independently associated with ethnicity, age group, parity, and suburb ( $p < 0.0001$  for each) and not with deprivation ( $p = 0.09$ ). The following observations were made (Figure 41):

- Maaori and Pacific women had 2.5 times, and Other Asian women had 1.5 times, the odds of Inadequate antenatal Closed Unit use compared with European/Other women. The odds were no different for Indian and Chinese women than for European/Other women.
- Compared with women aged 30-34 years, those aged <20 years (1.9 times), 20-24 years (1.8 times) and 25-29 years (1.4 times) had significantly higher odds of Inadequate Closed Unit antenatal care use. Older women (35+ years) had the same odds of inadequate utilisation as 30-34 year olds.
- Women with a parity of 6 or more had the highest odds of Inadequate Closed unit utilisation (3.6 times), followed by para 3-5 women (1.9), compared with nulliparous women. The odds were no difference for para 1-2 and nulliparous women.
- The odds of Inadequate Closed Unit utilisation was not associated with deprivation after ethnicity, age group, parity, and suburb were taken into account.
- Women living in Otara (2.1 times), Manurewa (1.9 times), Mangere (1.6 times) and Papatoetoe (1.5 times) had higher odds of Inadequate Closed Unit utilisation compared with women living in Howick. The odds were not significantly different for women living in Howick, Papakura, and Franklin.

**Table 42. Adequacy of Prenatal Care Utilisation for CMDHB Resident Women using Closed unit Care by Ethnicity, Age Group, and Parity, 2007-09**

	Number of Women	Inadequate Initiation % (95% CI)	Inadequate Use % (95% CI)	Intermediate % (95% CI)	Adequate % (95% CI)	Adequate Plus % (95% CI)
<b>Ethnicity</b>						
Maaori	1,114	57.5 (54.5-60.4)	8.3 (6.6-9.9)	4.0 (2.9-5.2)	7.3 (5.7-8.8)	23.0 (20.5-25.5)
Pacific	1,589	57.9 (55.5-60.3)	6.2 (5.0-7.4)	3.3 (2.4-4.1)	7.0 (5.8-8.3)	25.6 (23.4-27.7)
Chinese	255	25.5 (20.1-30.8)	2.0 (0.3-3.7)	2.7 (0.7-4.8)	8.2 (4.9-11.6)	61.6 (55.6-67.5)
Indian	275	31.3 (25.8-36.8)	7.6 (4.5-10.8)	5.1 (2.5-7.7)	7.6 (4.5-10.8)	48.4 (42.5-54.3)
Other Asian	236	37.7 (31.5-43.9)	5.5 (2.6-8.4)	1.7 (0.0-3.3)	6.4 (3.2-9.5)	48.7 (42.3-55.1)
Euro/Other	904	26.9 (24.0-29.8)	6.4 (4.8-8.0)	4.1 (2.8-5.4)	8.1 (6.3-9.9)	54.5 (51.3-57.8)
<b>Age Group</b>						
<20 years	574	54.0 (49.9-58.1)	7.7 (5.5-9.8)	3.5 (2.0-5.0)	8.4 (6.1-10.6)	26.5 (22.9-30.1)
20-24 years	1,034	54.6 (51.6-57.7)	6.6 (5.1-8.1)	2.9 (1.9-3.9)	7.4 (5.8-9.0)	28.4 (25.7-31.2)
25-29 years	1,063	48.2 (45.2-51.2)	5.7 (4.3-7.1)	4.0 (2.8-5.1)	6.6 (5.1-8.1)	35.6 (32.7-38.4)
30-34 years	914	38.6 (35.5-41.8)	6.9 (5.2-8.5)	3.7 (2.5-4.9)	7.4 (5.7-9.1)	43.3 (40.1-46.5)
35-39 years	639	37.9 (34.1-41.6)	5.9 (4.1-7.8)	3.9 (2.4-5.4)	7.8 (5.7-9.9)	44.4 (40.6-48.3)
40+ years	201	39.8 (33.0-46.6)	8.0 (4.2-11.7)	5.0 (2.0-8.0)	6.5 (3.1-9.9)	40.8 (34.0-47.6)
<b>Parity</b>						
Nulliparous	1,633	45.1 (42.7-47.5)	5.8 (4.7-7.0)	3.9 (2.9-4.8)	7.4 (6.1-8.7)	37.8 (35.5-40.2)
Para 1-2	1,863	41.7 (39.4-43.9)	7.2 (6.0-8.4)	3.5 (2.7-4.4)	8.1 (6.8-9.3)	39.6 (37.3-41.8)
Para 3-5	762	57.5 (54.0-61.0)	6.0 (4.3-7.7)	3.4 (2.1-4.7)	6.3 (4.6-8.0)	26.8 (23.6-29.9)
Para 6+	167	67.1 (59.9-74.2)	9.0 (4.6-13.3)	3.6 (0.8-6.4)	4.2 (1.2-7.2)	16.2 (10.6-21.8)

Source: Healthware. Note: Only includes data for CMDHB resident women who delivered in CMDHB and used Closed Unit Care. Ethnicity is preferred.

**Table 43. Adequacy of Prenatal Care Utilisation for CMDHB Resident Women using Closed unit Care by Deprivation and Suburb, 2007-09**

	Number of Women	Inadequate Initiation % (95% CI)	Inadequate Use % (95% CI)	Intermediate % (95% CI)	Adequate % (95% CI)	Adequate Plus % (95% CI)
<b>NZ Deprivation Index Decile</b>						
1-2	370	23.2 (18.9-27.5)	4.3 (2.3-6.4)	3.2 (1.4-5.0)	8.9 (6.0-11.8)	60.3 (55.3-65.3)
3-4	222	35.1 (28.9-41.4)	3.6 (1.2-6.1)	3.6 (1.2-6.1)	4.1 (1.5-6.6)	53.6 (47.0-60.2)
5-6	512	36.3 (32.2-40.5)	5.9 (3.8-7.9)	2.5 (1.2-3.9)	7.8 (5.5-10.1)	47.5 (43.1-51.8)
7-8	410	47.1 (42.2-51.9)	5.4 (3.2-7.5)	4.1 (2.2-6.1)	7.8 (5.2-10.4)	35.6 (31.0-40.2)
9-10	2,910	52.2 (50.3-54.0)	7.4 (6.4-8.3)	3.8 (3.1-4.5)	7.3 (6.3-8.2)	29.4 (27.7-31.0)
<b>Suburb</b>						
Howick	719	28.8 (25.5-32.1)	3.2 (1.9-4.5)	2.8 (1.6-4.0)	7.4 (5.5-9.3)	57.9 (54.2-61.5)
Otara	352	58.0 (52.8-63.1)	9.9 (6.8-13.1)	4.3 (2.2-6.4)	7.1 (4.4-9.8)	20.7 (16.5-25.0)
Papatoetoe	626	48.9 (45.0-52.8)	4.5 (2.9-6.1)	4.5 (2.9-6.1)	8.6 (6.4-10.8)	33.5 (29.8-37.2)
Mangere	886	54.4 (51.1-57.7)	7.2 (5.5-8.9)	4.4 (3.1-5.8)	7.3 (5.6-9.1)	26.6 (23.7-29.5)
Manurewa	940	53.8 (50.6-57.0)	8.3 (6.5-10.1)	3.4 (2.2-4.6)	7.3 (5.7-9.0)	27.1 (24.3-30.0)
Papakura	533	45.8 (41.5-50.0)	6.2 (4.1-8.2)	2.1 (0.9-3.3)	4.7 (2.9-6.5)	41.3 (37.1-45.5)
Franklin	369	30.6 (25.9-35.3)	7.9 (5.1-10.6)	4.3 (2.3-6.4)	9.5 (6.5-12.5)	47.7 (42.6-52.8)

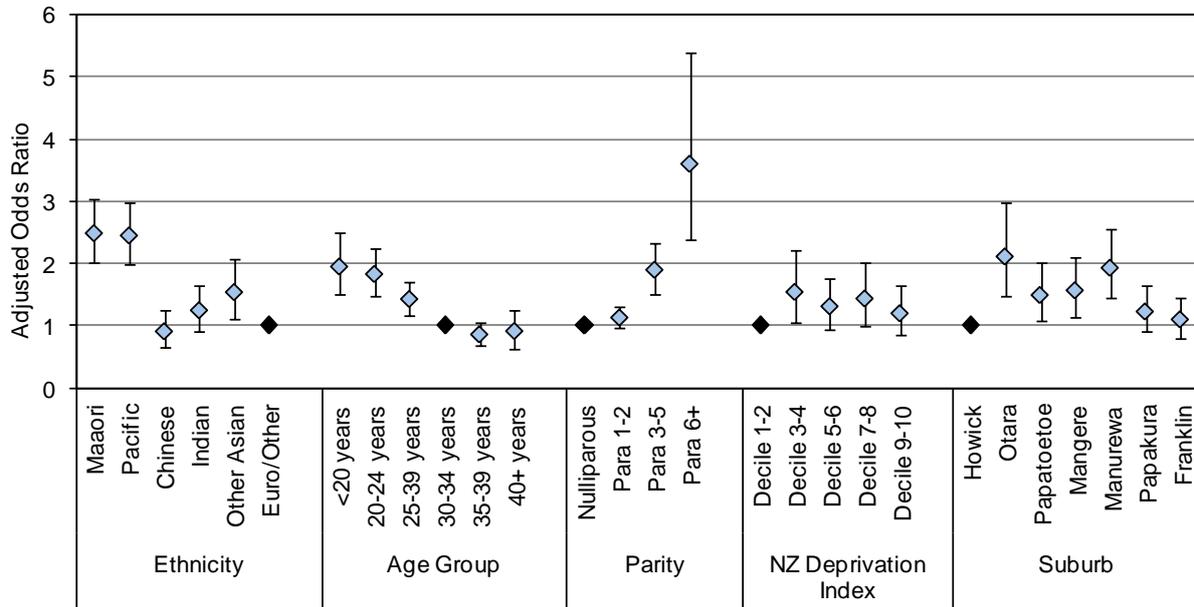
Source: Healthware. Note: Only includes data for CMDHB resident women who delivered in CMDHB and used Closed Unit Care.

The odds of Adequate Plus Closed Unit utilisation were independently associated with ethnicity, age group, parity, and suburb ( $p < 0.0001$  for each) and not with deprivation ( $p = 0.28$ ). The following observations were made (Figure 41):

- Maaori and Pacific women had 60% lower odds of Adequate Plus Closed Unit use than European/Other women. The odds were no different Asian and European/Other women.
- Compared with women aged 30-34 years, those odds of Adequate Plus utilisation decreased with decreasing age group and was 50% lower in women aged <20 years. Older women (35+ years) had the same odds of Adequate Plus use as 30-34 year olds.
- The odds of Adequate Plus Closed Unit use was 40% lower in para 3-5 women and 70% lower in women with a parity of 6 or more compared to nulliparous women. The odds were no difference for para 1-2 and nulliparous women.
- The odds of Adequate Plus Closed Unit utilisation was not associated with deprivation after ethnicity, age group, parity, and suburb were taken into account.

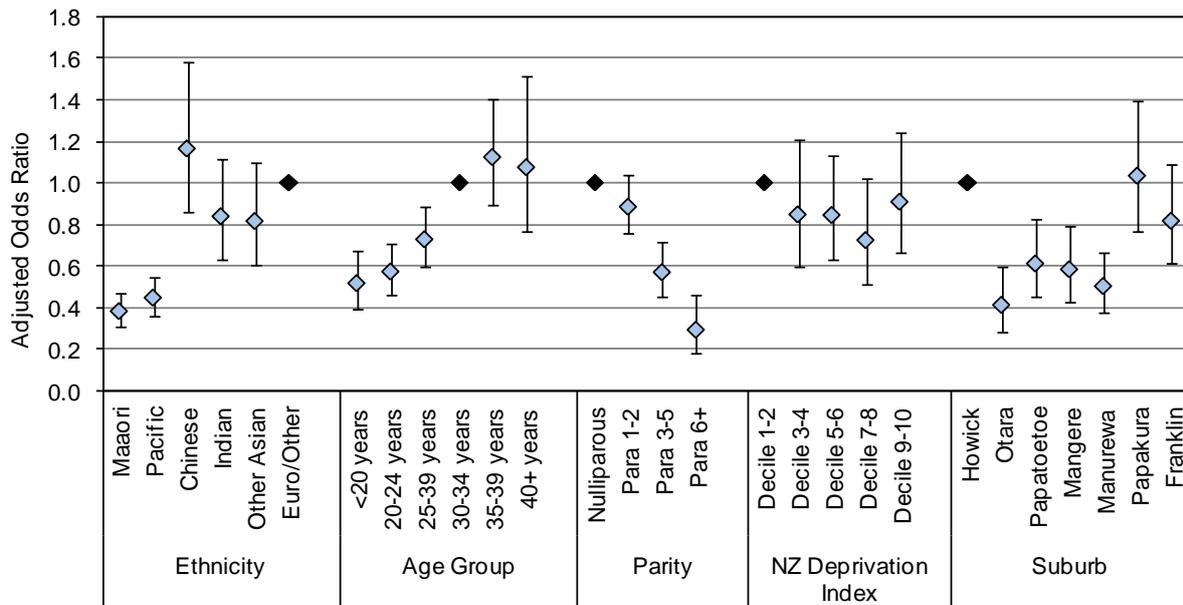
- Compared with women living in Howick, those living in Papatoetoe and Mangere (40% lower), Manurewa (50% lower) and Otara (60% lower), had lower odds of Adequate Plus utilisation of Closed Unit antenatal care. The odds of Adequate plus use were not significantly different for women living in Howick, Papakura, and Franklin.

**Figure 41: Adjusted Odds Ratios for Inadequate Antenatal Closed Unit Utilisation, 2007-2009**



Source: Healthware. Note: Only includes data for CMDHB resident women who delivered in CMDHB and used Closed Unit Care. Adequacy determined using the Adequacy of Prenatal Care Utilisation Index<sup>55</sup>. Odds ratios are adjusted for ethnicity, age, parity, deprivation, and suburb. Black diamonds indicate reference groups. Ethnicity is preferred.

**Figure 42: Adjusted Odds Ratios for Adequate Plus Antenatal Closed Unit Utilisation, 2007-2009**



Source: Healthware. Note: Only includes data for CMDHB resident women who delivered in CMDHB and used Closed Unit Care. Adequacy determined using the Adequacy of Prenatal Care Utilisation Index<sup>55</sup>. Odds ratios are adjusted for ethnicity, age, parity, deprivation, and suburb. Black diamonds indicate reference groups. Ethnicity is preferred.

### 5.2.7 Section Summary

During 2007-2009, 52% of CMDHB resident women who delivered in CMDHB had at least one scheduled CMDHB provided antenatal contact captured in Healthware, and 89% of these scheduled contacts were attended. The degree to which antenatal contacts provided by CMDHB are captured in Healthware is unknown, however it appears that Healthware underestimates the number of contacts provided by CMDHB staff and more frequently records visits/contacts with midwives than doctors.

Women who have Shared Care are offered three CMDHB provided antenatal contacts with a community midwife. Of the CMDHB women using Shared Care during 2007-09, 95% had at least one scheduled antenatal clinic appointment, and 85% attended at least one clinic appointment. Non-attendance of was significant with 39.5% of women missing one or more appointments. The attendance rate improved with increasing gestation and was 78% for visits scheduled before 24 weeks, 81% for visits at 24-31 weeks, 86% for visits at 32-39 weeks, and 91% for visits from 40 weeks gestation. Women with the highest odds of non-attendance of one or more visits were Maaori, Pacific, aged <25 years, had a parity of 3 or more, or lived in Otara.

Ideally, women with Shared Care would attend three midwife clinics, however, the likelihood of this occurring depends on a women's gestation at both booking and delivery. Based on these factors, a small number of women with Shared Care during 2007-09 were expected to attend no visits (<1%), 8.2% to attend one visit, 21.1% to attend two visits, and 70.4% to attend three visits. However, only 52% of those using Shared Care actually attended their expected number midwife clinic visits. Women with the highest odds of not completing their expected number of Shared Care visits were Maaori, Pacific, aged <25 years, had a parity of 3 or more, or lived in Otara.

For women with Closed Unit care, the standard antenatal visit schedule is for six visits. Of CMDHB women using Closed Unit care during 2007-09, 94% had at least one scheduled antenatal clinic appointment, and 92% attended at least one clinic. The likelihood of a woman using Closed Unit care attending all six CMDHB provided antenatal visits (up to and including the 40 week visit) is influenced by her gestation at booking and delivery. During 2007-2009, 70% of the CMDHB women using Closed Unit care attended their expected number of CMDHB provided antenatal clinic visits or more. Women who missed one or more scheduled Closed Unit antenatal clinic visits could still complete their expected number of visits. Of the women who completed their expected number of Closed Unit visits, 29% had missed one or more appointments. However, missing visits decreased the likelihood that the expected number of visits was achieved.

Attending the expected number of visits does not necessarily mean a woman had adequate antenatal care. A woman that booked at 35 weeks and attended all her visits before delivering at 40 weeks gestation would not generally be considered to have adequately accessed antenatal care. The Adequacy of Prenatal Care Utilization (APNCU) Index that contains the two dimensions of adequacy of initiation of care and adequacy of use (i.e. the proportion of expected visits that were attended) was used to explore adequacy of care for women using Closed Unit care. During 2007-2009, 53.2% of women using Closed Unit had inadequate antenatal care utilisation, most of which was due to inadequate initiation (46.6%) rather than inadequate use once care had been initiated (6.6%). In addition, 3.6% had Intermediate, 7.4% had Adequate, and 35.8% had Adequate Plus care. Adequate Plus care occurs when a woman has more than her expected number of antenatal care visits, which can occur due to necessity (i.e. complications of pregnancy, high risk pregnancy) or excessive use.

## 5.3 Chapter Summary

### Booking

During 2007-2009, 16.8% of CMDHB women who delivered at CMDHB were booked by 10 weeks gestation, 44.8% of women booked late at 10-18 weeks gestation, whilst 38.4% either booked very late (after 18 weeks) or did not book at all. This analysis suggests that only a small proportion of CMDHB meet NICE guidelines of initiating antenatal care before they are 10 weeks gestation. For most CMDHB women, the degree to which booking date reflects the onset of antenatal care is unknown. However, for those with Closed Unit Care and Caseloading care, there is a reasonably strong relationship between booking gestation and the gestation at first antenatal contact. In these two groups, 8.2% and 12.3% booked early, by 10 weeks gestation, respectively. Women with Shared Care had the highest odds of an early booking, which may be a result of the contractual relationship between the GP and the DHB incentivising the GP to complete the booking process earlier.

Just over a third (36%) of CMDHB women booked very late (after 18 weeks gestation). Women with the highest odds of very late booking were Pacific and Maaori, aged <25 years, and with a parity of 3 or more. These same factors were independently associated with increased odds of being Unbooked. In addition, women with Closed Unit care had higher odds of booking late. This could be a reflection of Closed Unit care as care of last resource, or late referral of higher risk women to CMDHB services and warrants further investigation.

### CMDHB Provided Antenatal Care

During 2007-2009, 52% of CMDHB resident women who delivered in CMDHB had at least one scheduled CMDHB provided antenatal contact captured in Healthware, and 89% of these scheduled contacts were attended. The degree to which antenatal contacts provided by CMDHB are captured in Healthware is unknown. Healthware data appears to underestimate the number of contacts provided by CMDHB staff and visits/contacts with midwives are recorded more frequently than doctor's visits.

Women who have Shared Care are offered three antenatal visits with a community midwife. During 2007-09, 39.5% of women with Shared Care missed one or more of their scheduled visits. The attendance rate improved with increasing gestation and was 78% for visits scheduled before 24 weeks and 91% for visits from 40 weeks gestation. The likelihood of attending all three visits is influenced by a woman's gestation at booking and delivery. During 2007-09, some women with Shared Care were expected to attend no visits (<1%), 8.2% to attend one, 21.1% to attend two, and 70.4% to attend three visits. During this time only 52% actually attended their expected number of antenatal clinic appointment. Women with the highest odds of not completing their expected number of Shared Care visits were Maaori, Pacific, aged <25 years, had a parity of 3 or more, or lived in Otara.

The standard antenatal visit schedule for women with Closed Unit care includes six visits. The likelihood of a woman using Closed Unit care attending all six CMDHB provided antenatal visits depends on her gestation at booking and delivery. During 2007-2009, 70% of attended their expected number, or more, of Closed Unit antenatal clinic visits.

Attending the expected number of visits does not necessarily mean a woman had adequate antenatal care. The adequacy of antenatal care was assessed using the APNCU Index that has two dimensions: adequate initiation of care and adequate utilisation (i.e. the proportion of expected visits that were attended). It does not measure quality of care. During 2007-2009, 53.2% of women using Closed Unit had inadequate antenatal care, most of which was due to inadequate initiation (46.6%) rather than inadequate use once care had been initiated (6.6%). In addition, 35.8% had Adequate Plus care which occurs when a woman has more than her expected number of antenatal care visits. This can occur due to necessity (i.e. complications of pregnancy, high risk pregnancy) or excessive use.

# Chapter 6. Literature Review: Antenatal Care Models

This Chapter reviews the antenatal care literature, concentrating on the rationale for providing antenatal care, recommendations on the provision and organisation of antenatal care including supporting evidence, and recommendations regarding the early initiation of antenatal care and risk assessment in pregnancy are discussed. The barriers to initiating and sustaining antenatal care are reviewed, and the evidence for alternative models of antenatal care provision in vulnerable populations are described.

## 6.1 Rationale for Antenatal Care

In most women pregnancy is a normal physiological process. The World Health Organisation suggests that the aim of antenatal care is to assist a pregnant woman to remain healthy, to find and correct adverse conditions, to aid the health of the child, and to help the woman and her partner and family in the transition to parenthood.<sup>59</sup> Antenatal care has a number of components including education, counselling, screening, and treatment aimed at optimising the potential for a healthy mother and healthy baby.<sup>59</sup> NICE guidelines suggest that “*both the individual components and composite package of antenatal care should conform to the criteria for a successful screening programme*”.<sup>21</sup> In New Zealand, these criteria have been established by the National Health Committee as follows:<sup>60</sup>

1. The condition is a suitable candidate for screening.
2. There is a suitable test.
3. There is an effective and accessible treatment or intervention for the condition identified through early detection.
4. There is high quality evidence, ideally from randomised controlled trials, that a screening programme is effective in reducing mortality or morbidity.
5. The potential benefit from the screening programme should outweigh the potential physical and psychological harm (caused by the test, diagnostic procedures and treatment).
6. The health care system will be capable of supporting all necessary elements of the screening pathway, including diagnosis, follow-up and programme evaluation.
7. There is consideration of social and ethical issues.
8. There is consideration of cost-benefit issues.

Systematic reviews examining the evidence for antenatal care, including those undertaken by the WHO<sup>59</sup> and the UK’s National Institute for Health and Clinical Excellence (NICE)<sup>21</sup>, provide excellent resources for considering the individual components of antenatal care. Many of these components have been assessed for their effectiveness (see examples in Table 44). However, in a recent Cochrane review of antenatal care packages Dowsell made the following observation “...*few of the procedures commonly undertaken within antenatal care have been shown to have a major impact on maternal and perinatal morbidity and mortality, and some may have no effect*”.<sup>28</sup>

Evaluating the effectiveness of antenatal care as a complete package remains both controversial and challenging as the effectiveness of such a programme of care is a function of its content, utilisation, and quality.<sup>10</sup> In addition, as maternal and perinatal mortality have become less frequent events, proving the effectiveness of a new intervention or programme has become increasingly difficult for several reasons - the gains to be had are less, proving that small changes are statistically significant requires large numbers, large randomised controlled trials are expensive, and observational trials are prone to bias and may show no difference even if one really exists. In addition, randomised controlled trials (RCTs) investigating features of antenatal care provision (e.g. midwife vs obstetrician provision,

number of antenatal visits) are generally undertaken in low risk populations in which poor outcomes are even rarer; therefore while equivalence may be proved demonstrating a benefit is more difficult.

Nevertheless, several observational studies have demonstrated an association between little or no antenatal care and increased odds of preterm birth, low birth weight, and maternal, fetal and neonatal death in both high-income and developing countries.<sup>11-20</sup> Under-utilisation (or inadequate engagement) of antenatal care has also been associated with decreased use of preventive care during infancy including immunisations and well-child checks.<sup>61-65</sup>

In summary, antenatal care is generally purported to be necessary, but not sufficient, for optimising outcomes for mothers and infants, and is the vehicle via which components of antenatal care with proven effectiveness are delivered to pregnant women. A different vehicle is required for interventions that are best implemented prior to pregnancy occurring, for example pre-pregnancy planning, smoking cessation, weight loss, folic acid, glucose control in women with diabetes.

**Table 44: Examples of Antenatal Interventions Assessed for Effectiveness**

<b>Evidence Based Effective Antenatal Interventions</b>	
<b>Outcome</b>	<b>Intervention</b>
↓ Neural tube defects	Folic acid supplementation pre-conception to 12 weeks gestation <sup>66</sup>
↓ Low birth weight	Smoking cessation <sup>67</sup>
↓ Preterm delivery	Smoking cessation <sup>67</sup> Screening and treatment of lower genital tract infection <sup>68</sup>
Pre-eclampsia prevention	Antiplatelet agents (low-dose aspirin) <sup>69</sup>
↓ Hepatitis B transmission	Hepatitis B screening for all pregnant women and delivery of hepatitis B vaccine and immunoglobulin to babies of infected mothers <sup>21</sup>
↓ HIV transmission	Screening for HIV in early pregnancy, a short course of antiretroviral drugs, and caesarean section at 38 weeks, to reduce vertical transmission <sup>70, 71</sup>
↓ Hydrops fetalis	Screening for Rh-negative women and use of anti-D <sup>72</sup>
↓ Breech delivery	External cephalic version at term (36 weeks) for women who have an uncomplicated singleton breech pregnancy <sup>73</sup>
↓ Inductions	Routine ultrasound early in pregnancy (10-12 weeks) reduces inductions for post-term pregnancy <sup>22</sup>
↓ Prelabour ROM	Prophylactic antibiotics in the second and third trimester <sup>74</sup>
↓ Perinatal mortality	Corticosteroids given to women at risk of preterm delivery <sup>75</sup> Induction of labour after 41 weeks gestation <sup>76</sup>
<b>Antenatal Interventions not Supported by Systematic Review of the Current Evidence</b>	
<b>Intervention</b>	<b>Review Conclusion</b>
Routine screening ultrasound beyond 24 weeks	Based on existing evidence, routine late pregnancy ultrasound in low risk or unselected populations does not confer benefit on mother or baby <sup>77</sup>
Treatment of periodontal disease with scaling and root planning to improve pregnancy outcomes	No significant effect on the rate of preterm birth, low birthweight, spontaneous abortions/stillbirths, or overall adverse pregnancy outcome (preterm births <37 weeks and spontaneous abortions/stillbirths) <sup>78</sup>
Continuous CTG monitoring during labour	Continuous CTG during labour is associated with a reduction in neonatal seizures, but no significant differences in cerebral palsy, infant mortality or other measures of neonatal well-being. Continuous CTG was associated with increased caesareans and instrumental vaginal births <sup>79</sup>

Note: ROM: Rupture of membranes. CTG: cardiotocography.

## 6.2 Provision and Organisation of Antenatal Care

Five key NICE antenatal guideline recommendations regarding the provision and organisation of antenatal care are summarised in this section, including a brief description of the evidence supporting these.<sup>21</sup> Following these two additional features of antenatal care provision are explored; early initiation of care and risk assessment in pregnancy.

### 6.2.1 Five Key NICE Recommendations

- **Midwife- and GP-led models of care should be offered for women with an uncomplicated pregnancy**

A meta-analysis of three RCTs found no differences between midwife/GP led care and obstetrician/gynaecologist led shared care for preterm birth, caesarean section, anaemia, urinary tract infections, antepartum haemorrhage and perinatal mortality.<sup>80</sup> However, a lower rate of pregnancy-induced hypertension and pre-eclampsia was observed in the midwife/GP group which could be due to either decreased incidence or decreased detection.

- **Antenatal care should be provided by a small group of carers with whom the woman feels comfortable. There should be continuity of care throughout the antenatal period**

Two systematic reviews and four RCTs not included in the reviews informed this recommendation. The beneficial effects reported by these studies included lower odds of long clinic waiting times<sup>81, 82</sup>, failure to attend antenatal classes<sup>81</sup>, being unable to discuss worries<sup>81</sup>, feeling unprepared for labour<sup>81</sup>, augmentation of labour<sup>83, 84</sup>, and electronic fetal monitoring<sup>83</sup> and increased odds of being satisfied with the care provided<sup>82, 83, 85</sup> and the information given<sup>83</sup>, and feeling more involved in decision making<sup>83</sup>. Outcomes for which no difference was reported by at least one study included stillbirth<sup>81, 84</sup>, neonatal death<sup>81, 84</sup>, preterm birth<sup>81</sup>, neonatal unit admission<sup>81, 83</sup>, birthweight <2500g<sup>81</sup>, postnatal haemorrhage<sup>83</sup>, and duration of labour<sup>83</sup>.

Outcomes for which results varied between studies for women randomised to continuity of care included the odds of induction of labour (lower in two studies<sup>83, 86</sup>, no difference in one study<sup>81</sup>), antenatal hospital admission (lower in one study<sup>81</sup>, no difference in one study<sup>83</sup>), and caesarean section (lower in one RCT<sup>82</sup>, no difference in systematic reviews<sup>81, 83</sup>).

- **For a woman who is nulliparous with an uncomplicated pregnancy, a schedule of ten appointments should be adequate. For a woman who is parous with an uncomplicated pregnancy, a schedule of seven appointments should be adequate**

Antenatal guidelines for high-income countries are diverse and particularly differ with respect to the number of antenatal care visits recommended, ranging from a minimum of six in the Netherlands to 14 in the United States and Finland.<sup>11</sup> NICE guidelines state “*the evidence to date on the optimum number of antenatal appointments is inconclusive*”.<sup>21</sup> However, the 2008 NICE guidelines conclude that “*a moderate reduction in the traditional number of antenatal visits is not associated with an increase in adverse maternal or perinatal outcomes. However, a reduced number of appointments may be associated with a reduction in women’s satisfaction with their antenatal care*”.<sup>21</sup>

Two systematic reviews have examined the effectiveness of a reduced number of antenatal visits and both included the same RCTs set in both developed and developing countries. No difference was observed between a reduced and the traditional schedule of visits with respect to preterm delivery, preeclampsia, caesarean section, induction of labour, antenatal haemorrhage, postnatal haemorrhage, low birth weight, small-for-gestational-age, postpartum anaemia, admission to neonatal intensive care unit, perinatal mortality, or

maternal mortality.<sup>80, 87</sup> Reduced visit schedules were associated with reduced maternal satisfaction in all settings.<sup>28</sup>

In the RCTS performed in developed countries, the actual difference in the number of visits between the groups was small (average of two visits less).<sup>21</sup> In the context of routine antenatal care in developed countries where 10-14 visits are routine, a difference of two visits is unlikely to result in a measurable difference in relatively rare pregnancy outcomes. In contrast, early trials in developing countries comparing a 4 versus 6 visit schedule (a proportionately greater difference) found no adverse impact on maternal or perinatal outcomes. A recent (2010) meta-analysis that included one additional 2007 study found a 15% (95% CI: 1%-30%) increase in perinatal mortality in the reduced visit group (four visits) in low and middle income countries, with no differences observed for other outcomes.<sup>28</sup> The authors recommended caution with respect to reducing the number of visits below six in resource poor settings where the number of visits is already low.<sup>28</sup>

- **Antenatal appointment schedules should be determined by appointment function**

NICE and WHO guidelines both recommend the development of 'goal oriented' antenatal care for women with low-risk pregnancies, the components of which inform the visit schedule as some components are time sensitive.<sup>21, 59</sup> This was the approach taken by the WHO in developing a package of antenatal care with a reduced schedule of four visits based on the inclusion of components which were proven to improve maternal, perinatal, and neonatal outcomes.<sup>88</sup>

- **Pregnant women should be offered an early ultrasound scan between 10+0 and 13+6 weeks to determine gestational age and to detect multiple pregnancies. This will ensure consistency of gestational age assessment and reduce the incidence of induction of labour for prolonged pregnancy.**

A review of the literature in presented in the NICE guideline concluded that ultrasound is a more accurate predictor of gestational age than the Last Menstrual Period (LMP), and that an estimated delivery date (EDD) based on the LMP is subject to significant error, particularly in some populations of women.<sup>21</sup> For example, a Canadian study (~46,500 women) found that LMP underestimated the EDD more frequently in multiparous women, those with diabetes, small stature or high pre-pregnancy BMI compared with an early USS.<sup>89</sup>

The results of a recent Cochrane review<sup>22</sup>, and several additional studies<sup>90-92</sup>, have concluded that ultrasound early in pregnancy is effective in reducing rates of induction of labour for prolonged pregnancy.

## **6.2.2 Early Initiation and Organisation of Antenatal Care Visits**

NICE guidelines recommend that antenatal be started in the first trimester and preferably before 10 weeks.<sup>21</sup> Early initiation of antenatal care is recommended in a number of other guidelines including those from the USA, Hong Kong, British Columbia (Canada), and Victoria (Australia).<sup>55, 93-95</sup> Since 2009, the PMMRC has recommended that women book with a LMC before 10 weeks gestation to enable timely prenatal advice and screening and to facilitate referral to specialist care if indicated.<sup>1, 2</sup> This advice is not explicit in current Ministry of Health publications aimed at pregnant women, such as *Your Pregnancy - To Haputanga*.<sup>96</sup>

The rationale for the NICE recommendation for early initiation of antenatal care are not explicitly stated, however this recommendation appears to be based on the time sensitive nature of some screening activities, the evidence for the benefits of an early antenatal scan for improving pregnancy dating, and an opportunity for providing early lifestyle advice in

pregnancy regarding smoking, nutrition, and alcohol. The following activities are recommended for the first antenatal visit (also called the booking visit) which should take place by 10 weeks<sup>21</sup>:

- Information giving and discussion - e.g. lifestyle, maternity services/care, screening
- Risk Assessment - identification of women who may need additional care
- Care Planning - agree the pattern of care for this pregnancy
- Screening
  - Screen for depression, genital mutilation, gestational diabetes using risk factors
  - Offer screening for haemoglobinopathies, anaemia, red cell alloantibodies, hepatitis B virus, HIV, rubella susceptibility, syphilis, chlamydia, asymptomatic bacteriuria, Down's syndrome
- Investigations
  - Blood group and rhesus D status
  - Early ultrasound scan for gestational age assessment
  - Offer ultrasound screening for structural anomalies (18 weeks 0 days to 20 weeks 6 days)
  - Measure BMI, blood pressure (BP) and test urine for proteinuria

The NICE schedule of antenatal care visits healthy women with no complications includes ten visits for nulliparous women and seven visits for multiparous women (Table 45).<sup>21</sup> In the guidelines the activities for each visit are described. Additional visits are recommended for all women who have not delivered before 41 weeks gestation.

The current schedule suggested for CMDHB women with Shared Care includes eight visits with her GP and three visits with a CMDHB midwife for all women. The first visit is expected to be undertaken prior to 15 weeks gestation, and the activities are similar to those described in the NICE guidelines although an early scan is not currently recommended (see Appendix 7). Adopting a recommendation for this first visit to occur earlier in pregnancy should not significantly impact the current Shared Care visit schedule.

In contrast for CMDHB women with Closed Unit care, any visits required in the first trimester are expected to be undertaken with the woman's GP and then six visits with a CMDHB midwife are recommended. The first midwife visit is not scheduled until 15-18 weeks gestation, and the activities are similar to those described in the NICE guidelines although an early scan is not currently recommended. Adopting a recommendation for this visit to occur earlier may necessitate a change in the current schedule.

The activities suggested for each CMDHB recommended visit are shown in Appendix 7. CMDHB also recommends additional visits for women who have not delivered by 41 weeks gestation.

**Table 45: Antenatal Care Schedules**

	Gestation																			
	10	15	16	18	20	22	24	25	26	28	30	31	32	34	36	37	38	39	40	(41)
<b>NICE</b>																				
Nulliparous	+		+	+				+		+		+		+	+		+		+	(+)
Parous	+		+	+						+				+	+		+			(+)
<b>CMDHB</b>																				
Shared Care		G		M			G			M			G	G	M	G	G	G	G	(+)
Closed Unit		G		M			M					M			M		M		M	(+)

Source: NICE: National Institute for Health and Clinical Excellence<sup>21</sup>. Note: G: visit with GP; M: visit with Midwife.

### 6.2.3 Risk Assessment in Pregnancy

Antenatal risk assessment has been identified as a core component of antenatal care.<sup>97</sup> It involves identifying women who may require additional care during their pregnancy due to maternal or fetal conditions associated with an increase risk of death or morbidity and should take place at the first antenatal visit and at each subsequent contact throughout pregnancy.<sup>21</sup> Risk assessment is a screening tool and should comply with usual criteria for screening programmes. In addition to these criteria, Carroli and colleagues al postulated that for risk assessment to be effective as a public health strategy, additional conditions should be met:

- *“the whole population must be screened,*
- *conditions screened for must include the important causes of maternal and perinatal morbidity and mortality,*
- *when increased risk is detected, appropriate referral or other action must be taken,*
- *adequate services must exist at the referral level,*
- *women at risk must be able to reach the referral level facility and be motivated to do so,*
- *all care providers must be motivated to implement the system,*
- *the strategy must show proof of reducing morbidity and/or mortality”.*<sup>98</sup>

For risk assessment to be effective in reducing adverse outcomes at a population level there must be effective interventions for mitigating risk once it has been identified. For example, risk assessment for identifying women at risk of preterm delivery and providing these women with additional levels of care is unlikely to reduce the rates of preterm birth at a population level. A recent review demonstrated that medical interventions aimed at preventing preterm birth are not effective at a population level.<sup>99</sup> A systematic review of the evidence of the effectiveness of prenatal care for preventing low birth weight concluded that risk assessment will fail to identify the majority of pregnancies at risk for preterm delivery or fetal growth restriction and that neither preterm birth nor fetal growth restriction could be effectively prevented by antenatal care.<sup>100</sup> Another recent systematic review found a dearth of rigorous evidence that antenatal screening or monitoring interventions aimed at identifying women at risk of experiencing a stillbirth had any impact on stillbirth incidence.<sup>101</sup> This lack of evidence was thought to be in part due to a lack of well designed trials, but also due to the failure to assess the impact of interventions following positive screening results.<sup>101</sup>

In New Zealand, risk assessment is guided by Referral Guidelines (see Appendix 1) that were developed based on expert opinion and current evidence using a consensus process.<sup>102</sup> These guidelines identify specific conditions for mothers and infants and the level of referral action for each. Comparable guidelines have been developed using a similar approach in the Netherlands<sup>103</sup>, the UK<sup>21</sup>, Germany<sup>104</sup>.

The 2008 NICE antenatal guidelines include a chapter on the development of an antenatal assessment tool for the UK (not yet completed), and included a systematic review of the literature that considered both psychosocial assessment and assessment for obstetric and medical risk.<sup>21</sup> The systematic literature review did not identify an ideal risk assessment tool, and the ultimate approach taken for development of the new UK tool was similar to the NZ approach for developing referral guidelines. The results of this systematic review are summarised here.

#### **Psychosocial Risk Assessment**

The systematic review concentrated on screening pregnant women for intimate partner violence and concluded that there was some evidence that a simple screening tool improves identification of intimate partner / family abuse, and that women find questioning acceptable as part of an antenatal consultation.<sup>21</sup> Partner violence during pregnancy has been

associated with increased risk of perinatal death and low birth weight, with risk increasing with increasing exposure.<sup>105</sup>

National guidelines for family violence interventions were published in 2002 by the Ministry of Health.<sup>106</sup> The 2010 PMMRC examined screening for family violence among women who had experienced a perinatal death during 2008. Data on screening were known for 75% of women (n=520). Of the 520 women who data were available for, 43.5% had not been screened. Of screened women (n=294), 24 had experienced family violence (8.2%).

### **Obstetric and Medical Risk Assessment**

The NICE guidelines concluded that there was evidence (fair to low quality) that antenatal risk assessment tools have high specificity (i.e. good at identifying true negatives - women who were low risk and had no adverse outcome) but low sensitivity (i.e. there are many false positives - women assessed as high risk who had no adverse events).<sup>21</sup> In addition, there was no evidence of the effectiveness of carrying out antenatal risk assessment with respect to maternal and neonatal outcomes.

These conclusions were informed by two systematic reviews and two studies that examined risk assessment for predicting preterm labour, low birthweight, or adverse perinatal or maternal outcomes.<sup>98, 100, 107, 108</sup> The first systematic review (15 studies) examined risk assessment for predicting preterm birth, and found that none of the risk scoring systems reviewed predicted more than 66% of preterm births, with most predicting less than 50%.<sup>100</sup> One of the most comprehensive tools that have been developed arose out of the US Preterm Prediction Study which developed a graded risk assessment system using over 100 clinical risk factors. Despite being comprehensive, the system had a low sensitivity with <25% of the women classified as high risk for preterm birth actually had a preterm birth, and a low positive predictive value with approximately 30% of preterm births predicted by the system.<sup>109</sup>

The second systematic review of seven studies examined risk assessment for predicting poor maternal outcome and concluded that formal risk-scoring is poor at discriminating between low and high risk women.<sup>98</sup> Five of the studies included in the review found that only 10-30% of the women allocated to the high risk group experienced the outcome that they had been predicted to be at high risk of experiencing.<sup>98</sup>

One of the two additional studies examined compared a new weighted risk scoring system for predicting very low birth weight to an existing tool.<sup>108</sup> Although study authors reported that the new tool performed better, NICE guideline authors concluded that neither were good predictors of very low birth weight.<sup>21, 108</sup>

The final study included in the NICE review examined the applicability of a Risk Index (scoring system) based on 63 antepartum characteristics for predicting adverse perinatal outcomes which were defined as low birth weight, low apgar score, or caesarean deliver.<sup>107</sup> For low birth weight and low apgar, the Risk Index was good at predicting those that would not experience these outcomes (negative predictive value (NPV) of 95% and 99% respectively), but less good at predicting those that would not have a Caesarean (NPV 77%). Predicting those that would have an adverse outcome was less successful, with 13% of low birth weight infants, 3% of infants with a low apgar, and 51% of Caesarean deliveries, correctly predicted by the Risk Index. As a consequence, a significant number of women were identified as high risk and did not experience a poor outcome.

## 6.2.4 Section Summary

Most of the five key recommendations in the NICE antenatal care guidelines are in place in CMDHB. The primary exception is the recommendation for an early ultrasound scan for all women for the purposes of accurate dating. Given the findings of a Canadian study which found that the LMP underestimated the EDD in multiparous women, those with diabetes, and those with high pre-pregnancy BMI compared with an early USS, the CMDHB population would likely benefit from implementing this recommendation. For ultrasound scans in pregnancy to be funded, a written referral is required and the indication must be on the approved clinical indications list (see Appendix 8).<sup>33</sup> The dating and early evaluation for chromosomal abnormality scan indication (NT: Nuchal translucency assessment at 11-13+6 weeks, assessment for gestational age, diagnosis of multiple pregnancy). could potentially be used for this purpose. A scan at 10-12 weeks does not replace the recommendation for an 18 week anatomy scan.

There is poor evidence regarding the initiation of antenatal care in New Zealand women. Although Healthware data provides some indication for CMDHB resident women who deliver in a CMDHB facility, the accuracy of these data are unknown, and the degree to which booking date reflects the onset of antenatal care is unknown. Antenatal care is the vehicle by which proven pregnancy interventions are delivered. In particular for the CMDHB population, early engagement with antenatal care would allow greater opportunity for health promotion regarding smoking, alcohol, and nutrition, early screening for time sensitive issues including family violence, and early dating scans for a population that would likely benefit from improved accuracy in dating.

Risk assessment is an important part of antenatal care, and should be an ongoing activity throughout pregnancy. The risk assessment tools that have been developed to date do not appear to be superior to the current process that informs the New Zealand referral guideline, although evidence is scarce.

## 6.3 Barriers to Initiating and Sustaining Antenatal Care

In most developed countries there are reports of pregnant women who have no or little antenatal care. During 2007-09, 7.4% of women who resided in CMDHB and delivered in a Counties facility had no antenatal care or started their antenatal care in the last 4 weeks of their pregnancy. PMMRC guidelines recommend that antenatal care be initiated early in pregnancy (<10 weeks). In CMDHB during 2007-09, only 17% of women booked before 10 weeks, however the extent to which this finding reflects antenatal care onset is unknown. In a recent UK study, only 56% of women had completed a booking appointment by 12 weeks, whilst in the United States 71% of women start antenatal care before 13 weeks.<sup>110, 111</sup>

This section reviews the literature and describes both the populations at risk of inadequate antenatal care and the barriers to initiating and having adequate antenatal care. Facilitators (things that make it easier) and motivators (things that make a woman want to go) for antenatal care were also identified.

### 6.3.1 Populations at Risk of Inadequate Antenatal Care

Descriptions of population characteristics associated with higher odds of having inadequate antenatal care (no or little antenatal care or late initiation of care) are similar across countries, however only two New Zealand publications were identified describing such populations, one of which included only Pacific women.<sup>41, 42</sup>

The characteristics associated with an increased odds of no or little antenatal care are shown in Table 46 and include ethnic minority groups or non-citizens, teenagers,

unemployed and low income women, unmarried/unpartnered women, women with high parity, and women with a history of substance abuse. Pregnancy features associated with higher odds of inadequate care were an unwanted/unplanned pregnancy and delayed recognition of pregnancy.

**Table 46: Characteristics Associated with No or Little Antenatal Care**

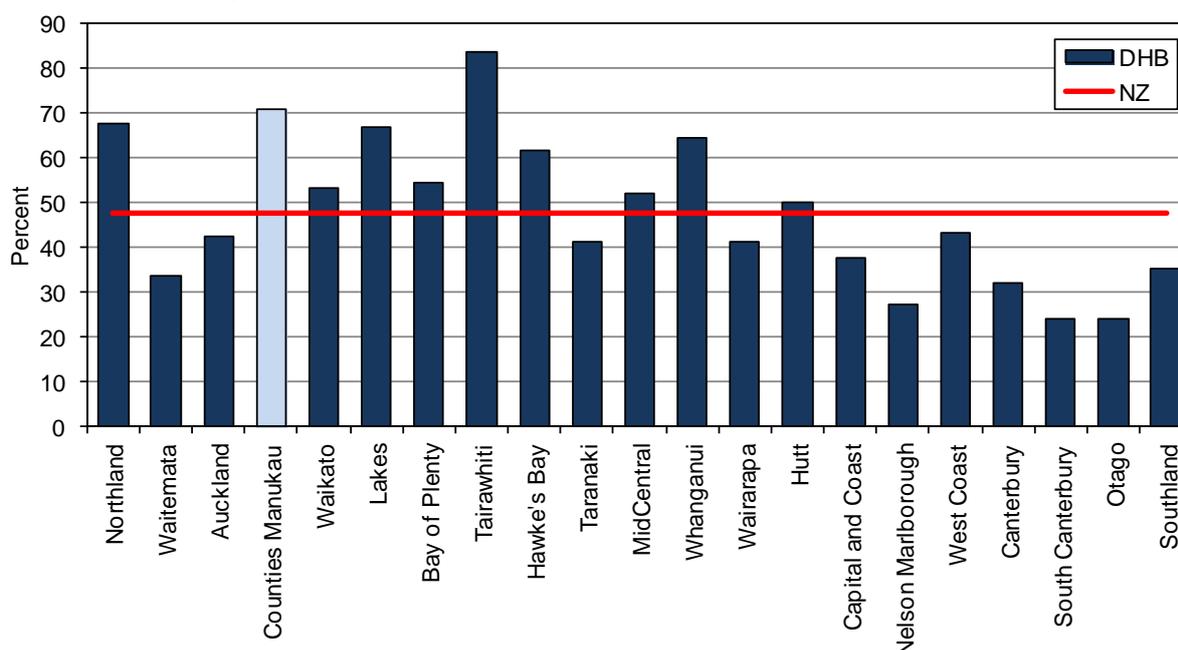
Characteristic	New Zealand Studies	Other Studies
Minority ethnic groups		Black (US) <sup>64</sup> Asian (UK) <sup>112</sup> Non-European (E) <sup>44</sup> Non-citizen (E) <sup>44</sup>
No English fluency	In Pacific women <sup>42</sup>	
Age		<20 years (E) <sup>44</sup> <18 years (B) <sup>113</sup>
Employment / SES	Unemployed women <sup>42</sup>	Unemployed woman (T) <sup>114</sup> Unemployed partner (UK) <sup>112</sup> Manual labour (UK) <sup>112</sup> No regular income (E) <sup>44</sup> Low income household (B) <sup>113</sup>
Maternal Education		Low education (T) <sup>114</sup> None or primary (E) <sup>44</sup> <9 years (B) <sup>113</sup> No qualification (E) <sup>44</sup>
Marital Status / Social Circumstances	Non-partnered <sup>42</sup>	Unmarried (E) <sup>44</sup> No partner (B) <sup>113</sup> No familial social support (T) <sup>114</sup>
Substance Use		Alcohol (US) <sup>23</sup> Drugs (US) <sup>23</sup> Smoking (US, B) <sup>23, 113</sup>
Pregnancy Intent	Unplanned <sup>42</sup> Unhappy about pregnancy <sup>42</sup>	Unplanned $\geq$ (E) <sup>44</sup>
Pregnancy History		Multiparous (T, E, B) <sup>44, 113, 114</sup> Parity $\geq$ 4 (E) <sup>44</sup>

Note: New Zealand study only included Pacific women<sup>42</sup>. US: United States of America; UK: United Kingdom; M: Mexico; T: Turkey; E: 10 European Countries; B: Brazil. SES: Socio-economic status.

Using data recorded in the Birth Registration Dataset, the number of women at increased risk of little or no antenatal care in New Zealand can be grossly estimated using the following demographic features: Maaori or Pacific women, women aged <20 years, women living in deprived areas (decile 9-10 based on the New Zealand Deprivation Index), and women with a parity of 3 or more. Using this crude methodology, 48% of New Zealand women were at increased risk of having little or no antenatal care during 2007-09, with Tairāwhiti DHB having the highest prevalence of women at increased risk followed by CMDHB (Figure 43).

For CMDHB, an estimated 6,260 women (71% of those that delivered) were at risk of having little or no antenatal care each year during this time. However, during 2007-09 in CMDHB an annual average of only 191 women (2.5%) had no antenatal care and an additional 361 women (4.9%) booked in the last 4 weeks of pregnancy. This finding suggests that using the presence of demographic features associated with increased odds of inadequate care may not be the best approach for addressing this issue for CMDHB women, as most women identified will in fact access care. Therefore, a population based approach aimed at improving initiation and maintenance of antenatal care for all CMDHB women is likely to be more useful than a high risk approach.

**Figure 43: Proportion of Women with One or More Risk Factors for No or Little Antenatal Care by District Health Board, 2007-09**



Source: Birth Registration dataset. Risk factors only include Maori or Pacific women, age <20 years, living in deprived areas (decile 9-10 based on the New Zealand Deprivation Index), and a parity of 3 or more.

**Table 47: Characteristics Associated with Late Initiation of Antenatal Care**

Characteristic	New Zealand Studies	Other Studies
Indigenous women	Māori <sup>41</sup>	Aboriginal/Torres Strait (AUS) <sup>115</sup>
Minority ethnic groups	Pacific <sup>41</sup> , Asian <sup>41</sup>	Asian (UK) <sup>112</sup> Black (US) <sup>116</sup> Asian (US) <sup>116</sup> Hispanic (US) <sup>116, 117</sup>
Age group	<20 years and 20-24 years <sup>41</sup>	<20 years (AUS) <sup>115</sup> <25 years (US) <sup>117</sup> 30+ years (US) <sup>24</sup>
Employment and SES	Unemployed women <sup>41, 42</sup>	Unemployed woman (US, T) <sup>24, 114</sup> Unemployed partner (UK) <sup>112</sup> Manual labour (UK) <sup>112</sup> No insurance (US) <sup>116</sup>
Maternal Education	<11 years <sup>41</sup> No formal qualification <sup>42</sup>	<High school (US) <sup>116, 117</sup>
Marital Status	Unmarried <sup>41</sup> Defacto Relationships <sup>41</sup> Non-partnered <sup>42</sup>	Non-partnered (M, US) <sup>25, 117</sup> Unmarried (US) <sup>116</sup>
Substance Use		Alcohol use (US) <sup>24</sup> Drug use (US) <sup>24</sup> Smoking (AUS) <sup>115</sup>
Pregnancy intent	Unplanned <sup>42</sup> Unhappy about pregnancy <sup>42</sup>	Unplanned (M, US) <sup>24, 25, 117</sup> Unhappy about pregnancy (M) <sup>25</sup> Unwanted (T) <sup>114</sup>
Pregnancy history	↓access with ↑parity <sup>41</sup> Multiparous <sup>42</sup> First pregnancy <sup>42</sup>	↓access with ↑parity (AUS) <sup>115</sup> Multiparous (US) <sup>116</sup> Late pregnancy recognition (US) <sup>116</sup>

Note: One New Zealand study only included Pacific women<sup>42</sup>. AUS: Australia; US: United States of America; UK: United Kingdom; M: Mexico; T: Turkey; SES: Socio-economic status

The other demographic features associated with an increased odds of late initiation of antenatal care are shown in Table 47 and are similar to those identified for women with an increased odds of no or little care. During 2007-09, approximately 40% of CMDHB women who delivered in a CMDHB facility booked their pregnancy very late, after 18 weeks gestation. Being Maaori or Pacific, aged <25 years old, and having a parity of 3 or more were independently associated with very late booking in CMDHB women.

The Pacific Island Families (PIF) study that enrolled Pacific women who delivered at Middlemore Hospital during 2000 reported that 26% initiated their pregnancy care after 15 weeks gestation.<sup>42</sup> This is much lower than the 55% of Pacific women who booked their pregnancy after 15 weeks as recorded in Healthware. In the PIF study high parity, first pregnancy, Cook Island Maaori ethnicity, and not being employed were independently associated with late initiation of antenatal care in Pacific women.<sup>42</sup>

In addition to demographic style profiles of women at risk of little or no antenatal care, or late initiation of care, other vulnerable populations have been identified. These include women with substance abuse issues<sup>118</sup>, homeless women<sup>118</sup>, minority groups<sup>112</sup>, migrant women<sup>42, 44, 115</sup>, non-native language speakers<sup>42</sup>, teenagers, victims of abuse<sup>119</sup>, women with mental illness / mental health problems<sup>120</sup>.

### **6.3.2 Barriers to Accessing Antenatal Care**

Qualitative and semi-qualitative studies undertaken in recent years in various settings have explored barriers, motivators, and facilitators of antenatal. Qualitative studies generally involve interviews with women or focus groups, and while they identify important issues and themes, they don't necessarily allow the identification of the barriers/facilitators that are having the greatest impact. In contrast, semi-quantitative studies used structured interviews and standardised questionnaires better identify those barriers/facilitators that have the greatest impact and allow controlling for confounding demographic characteristics. The main disadvantage of semi-quantitative studies is the potential to miss important barriers or facilitators that were not identified by the researcher and therefore not included in the questionnaire. A combination of both approaches is recommended.

#### **Recognition and Attitude to Pregnancy**

In order to seek antenatal care a woman must first recognise that she is pregnant. Early recognition of pregnancy is associated with earlier onset of antenatal care.<sup>116</sup> In a study of American women, those that recognised they were pregnant by 6 weeks had six times higher odds of initiating care within the first trimester (after controlling for the effects of demographic and pregnancy features) than women who recognised their pregnancy after this gestation, even though most of the women in the study recognised they were pregnant during the first trimester. Later recognition of pregnancy has been associated with unintended pregnancy, either mistimed or unwanted.<sup>121</sup>

As reported in the previous section, women with unwanted or unplanned pregnancies have higher odds of late initiation of or inadequate access to antenatal care.<sup>24, 25, 42, 44, 117</sup> In the Growing up in New Zealand Study, 40% of pregnancies were unplanned.<sup>8</sup> The proportion of women in this study with an unplanned pregnancy declined with increasing levels of maternal education from 75% in women with no secondary qualification, to 49% in women with a NCEA level 1-4, to 18% in women with a Masters degree or higher qualification.<sup>8</sup>

Having negative feelings towards being pregnant have been reported in qualitative and semi-qualitative studies as being associated with late initiation or inadequate antenatal care, and likely to be more common among women with unwanted or unplanned pregnancies.<sup>23, 24, 119, 122-125</sup> Two studies of African-American women found that '*Thinking of having an*

*abortion* was the most important factor influencing the initiation of antenatal care, and was also significantly associated with inadequate antenatal care.<sup>23, 24</sup> In a Mexican study using the same study instrument, a negative attitude toward the pregnancy was the strongest variable predicting late initiation of antenatal care.<sup>25</sup>

Women with an unwanted or unplanned pregnancy have reported delaying accessing care while time was spent contemplating their options, fears of disclosing pregnancy to partners, families or friends, concerns regarding being stigmatised, and persisting denial in the face of overwhelming evidence of pregnancy.<sup>123, 124, 126</sup>

Fear was identified as a barrier for a wide range of vulnerable UK women including teenagers, ethnic minority groups, homeless women, and women with substance abuse problems.<sup>124</sup> These included fear of being judged, disapproval, standing out, confidentiality being breached (e.g. parents being told, being reported to immigration), discrimination, and intervention from social services.

### **Chaotic or Stressful Lives**

A review of barriers to antenatal care in high-income countries concluded that for women with chaotic lifestyles, the motivation to attend antenatal care was overwhelmed by basic survival requirements.<sup>125</sup> This finding was particularly relevant for homeless women, women who moved house frequently, and women with drug and alcohol problems.<sup>25, 118, 124</sup>

This finding was supported by a study in Mexican women, in which a significantly higher proportion of those with late initiation of antenatal care reported that they had other responsibilities that were more important.<sup>25</sup> Similarly, significant family responsibilities posing a barrier have been reported in the UK<sup>124</sup>, and African-American women who had difficulty getting childcare had lower odds of having adequate antenatal care.<sup>23</sup>

African-American women who reported psycho-social problems (e.g. personal problems, feeling stressed, family problems, not thinking straight, not feeling good about themselves) had higher odds of inadequate antenatal care and late initiation of antenatal care.<sup>23, 24</sup> Mexican women with late initiation of prenatal care were also more likely to report these psycho-social barriers.<sup>25</sup>

### **Perception that Antenatal Care Offers No Clear Benefits**

In studies in the US and Mexico, the belief that antenatal care was unnecessary was evident in four studies.<sup>23-25, 122</sup> Late initiation of antenatal care in Mexico was associated with a belief that antenatal care was not needed, that you just went to the emergency room if you thought you had a problem, and that you can take care of yourself during pregnancy.<sup>25</sup> The belief that you can take care of yourself was also a prominent finding in African-American women with inadequate antenatal care, although an association with late initiation was not found.<sup>23, 24</sup> In one US qualitative study, a respondent reported having gone for care and having a poor outcome but knowing other women who had no care and had a healthy baby resulting in an ambivalence towards the benefits of care.<sup>122</sup>

In addition, a UK study identified the importance of traditional and cultural pregnancy beliefs and practices for some groups of women who made them reluctant to access a Western model of antenatal care.<sup>124</sup> Some of the examples cited included, the inappropriateness of having male health professionals, strong beliefs that the pregnancy outcome would be determined by God or fate and any intervention was inappropriate, expressed preferences for traditional treatments, and the importance of relying on the experience of the community including relatives, other women, and respected elders.<sup>44, 124</sup> The extent to which this is relevant for Maaori, Pacific, or immigrant women in New Zealand is unknown.

## **Constrained Resources**

In the UK, like in New Zealand, antenatal care is free, however in both settings women have reported personal costs related to accessing antenatal care.<sup>7, 124</sup> These costs include both out-of-pocket costs directly related to pregnancy care (e.g. pregnancy tests, ultrasounds), transport and parking costs, and unpaid time off work needed for appointments. In addition, there was evidence from the UK that some groups of women avoided care because they *thought* they would have to pay, even though they would not, therefore lack of knowledge regarding eligibility for free care was a barrier.<sup>124</sup>

Studies from the USA and Mexico reported that having no money to pay for antenatal care or no insurance posed significant barriers to initiating antenatal care or having adequate care.<sup>23, 24, 119</sup> In addition, multiparous Mexican women on a low income reported more perceived barriers to initiating antenatal care than their high income counterparts.<sup>119</sup>

## **Issues Specific to Antenatal Care Health Professionals**

In studies that used focus groups to examine barriers to antenatal care several characteristics and behaviours of health care providers were identified that women reported posed a barrier to accessing care. These could broadly be grouped as follows:

*Lack of caring / patient-centeredness* - women reported feeling rushed, unable to ask questions or understand information that was given, dismissed without concerns being acknowledged or addressed, and judged or treated disrespectfully.<sup>122, 124, 127, 128</sup>

*Lack of credibility* - lack of experiential knowledge in maternity providers, failing to model expected behaviours (e.g. smokers giving cessation advice, obese carers giving nutrition and weight advice), and recommending interventions that were felt to be inappropriate by the woman<sup>127</sup>

*Unprofessionalism* - breaches of confidentiality and being talked about in front of other people<sup>129</sup>, inability to communicate effectively with patients e.g. via use of inaccessible medical terminology<sup>127</sup>, and being kept waiting<sup>122</sup>

Women reported that these attitudes and behaviours from antenatal health providers and administrative staff resulted in a reluctance to access care.

Only a few studies examined characteristics of antenatal care providers that posed a barrier to antenatal care quantitatively. Mexican women who initiated antenatal care late were significantly more likely to report attitude issues with their health provider than women who initiated care early.<sup>25</sup> In contrast, these issues were not observed in a study using the same interview instrument in African-American women.<sup>24</sup>

## **Health Service Organisation**

Studies in Europe, the US, and the UK reported aspects of the way in which antenatal services were organised and provided that posed a barrier to accessing care. These included having to make appointments in advance<sup>44</sup>, no walk-in clinics<sup>44</sup>, difficulty making appointments that suited<sup>124</sup>, difficulty getting to clinics due to distances and location of clinics<sup>44</sup> or transport issues<sup>124</sup>, and long waiting times at clinics<sup>122</sup>. Authors of a UK study that investigating barriers in 'hard to reach' and vulnerable women concluded that there was a need to provide more flexible services that catered to the needs of these women.<sup>124</sup>

## **Language Barriers and Health Literacy**

Women reported that not being able to understand what was happening and information provided in antenatal care appointments and being too scared to ask questions made them reluctant to attend antenatal care.<sup>124</sup> Two issues were identified that contributed to this, language barriers and literacy.<sup>124</sup>

Studies have reported lower participation in antenatal care in settings where language barriers are an issue. New Zealand Pacific women who were not fluent in English had higher odds late initiation of antenatal care.<sup>42</sup> Similarly, in a study across European countries, cultural barriers (primarily language) were reported more frequently in foreign nationals with inadequate antenatal care.<sup>44</sup>

UK women have reported that literacy problems posed a barrier to accessing antenatal care, both in finding out how to access care and understanding pregnancy information provided either verbally or in written materials.<sup>124</sup> In a study in low-income African American women, literacy levels were not associated with timing of antenatal care initiation or adequacy of care which were equally poor in both groups.<sup>130</sup> However, in focus groups these women reported that the way in which they were communicated with influenced their use of prenatal care for women in both literacy groups.

### 6.3.3 Motivators and Facilitators for Accessing Antenatal Care

During this literature review, facilitators (things that make it easier) and motivators (things that make a woman want to go) for antenatal care were also identified. Notably, more publications have examined and reported barriers to antenatal care than motivating or facilitating factors that could be capitalised on in order to improve access to antenatal care. Three studies were identified that examined barriers, motivators, and facilitators in a similar way, and concluded that barriers were stronger predictors of antenatal care use than motivators or facilitators.<sup>23-25</sup>

In low-income African American women in the US the most common motivators for accessing antenatal care were to have *a healthy baby, to learn better health habits, to learn how to protect their health, and being afraid of having problems without care.*<sup>23, 24</sup> However, these, and other motivators examined, did not significantly influence the odds of inadequate care.<sup>23</sup> In contrast, *learning how to protect health* was a significant motivator for early initiation of early initiation of antenatal care, as was being *encouraged by a family member.*<sup>24</sup> In a Mexican study, women who initiated antenatal care early were more likely to report a perceived benefit of care as a motivator.<sup>25</sup> In these women, the most frequently reported perceived benefits were the same as for the African American women in the previous studies. An increased perception that antenatal care had benefits reduced the odds of late initiation by 30%.

In low-income African American women the most common facilitators of access to antenatal care were *convenient clinic hours, easy to get to appointments by public transport, free transportation, and free childcare.*<sup>23, 24</sup> However, these, and other facilitators examined, did not significantly influence the odds of inadequate care or lower the odds of late initiation of antenatal care.<sup>23, 24</sup> In Mexican women, the most frequent facilitators of antenatal care were *help with payment for antenatal care, help with transport, receiving information about antenatal care, and having someone to go with for care.*<sup>25</sup> Women who initiated antenatal care late were significantly more likely to report that *someone encouraged them seek care,* and less likely to report *receiving information about antenatal care.*<sup>25</sup> However, this study concluded that these facilitators were not a strong predictor of initiation of antenatal care.

Although not listed as a facilitator or motivator of antenatal care, one US study reported that participation in a Food Stamp Program<sup>131</sup> (supplying cheques/debit cards for purchasing specified nutritional foods e.g. milk, fruit and vegetables, tinned fish) reduced the odds of inadequate antenatal care.<sup>23</sup> In addition, a review of antenatal care barriers in high-income countries reported that for some women pregnancy was seen as an opportunity for change and motivation for seeking antenatal care.<sup>125</sup>

### 6.3.4 Section Summary

In reviewing the literature on the barriers to initiating and sustaining antenatal care several conclusions were drawn:

- In several settings the populations of women at risk of having little or no antenatal care included ethnic minority groups or non-citizens, teenagers, unemployed and low income women, unmarried/unpartnered women, women with high parity, and women with a history of substance abuse. Women with unwanted or unplanned pregnancies have a greater risk of having little or no antenatal care.
- Structured interviews using a comparable research instrument allowed the relative contribution of barriers to be assessed while controlling for confounding demographic characteristics. Important findings in populations studied, that may be applicable in CMDHB, were:
  - *Inadequate antenatal care in African American Women*<sup>23</sup>:
    - Factors that independently increased the odds of inadequate antenatal care were: Believe can take care of self (OR 5.88), insurance or financial constraints (OR 2.85), substance use (OR 2.38), considering abortion (OR 2.13), childcare problems (OR 2.00), psychosocial problems (OR 1.54)
    - Participation in a Food Stamp Program reduced the odds of inadequate antenatal care (OR 0.51)
  - *Late initiation of antenatal care in African American women*<sup>24</sup>
    - Considering an abortion was the strongest predictor of late initiation (OR 2.38) followed by having no money to pay for antenatal care (OR 1.89)
    - Being employed outside the home reduced the odds of late initiation (OR 0.44)
  - *Late initiation antenatal care in Mexican women*<sup>25</sup>
    - Negative attitude towards the pregnancy was the strongest predictor (OR 2.25)
    - The perception of barriers increased the odds of late initiation (OR 1.29)
    - Increasing education level, and an increased perception that antenatal care had benefits reduced the odds of late initiation (OR 0.86; OR 0.71 respectively)
- There is less evidence that motivators and facilitators of antenatal care influence access. However, those found to be important in some settings were:
  - Being encouraged by a family member and receiving information about antenatal care significantly increased the chances of early initiation in Mexican women.<sup>24</sup>
  - Mexican women with late initiation of antenatal care more frequently reported that someone encouraged them to seek care<sup>24</sup>, suggesting that family and community attitudes towards antenatal care may influence engagement.

These findings suggest that local CMDHB research is relevant and necessary for identifying significant barriers in specific CMDHB population groups and developing an approach to addressing these. Barriers may differ by ethnic group and age group, and these should be investigated. Such research has been initiated by Sarah Corbett (Obstetric registrar) and Kara Okesene-Gafa (Consultant Obstetrician Gynaecologist). In addition, Ausaga Faasalele Tanuvasa, at Victoria University, has an HRC grant for a study examining the attitudes of Samoan women towards antenatal and midwifery care due to be completed in 2011.

## 6.4 Providing Antenatal Care to Vulnerable Populations

This section summarises reviews that have sought to identify alternative models of care that benefit socio-economically disadvantaged women and other vulnerable populations in high income countries. The focus of this section is interventions to improve initiation of antenatal care and models of care that improve pregnancy outcomes.

### 6.4.1 Interventions to Improve Initiation of Antenatal Care

A 2009 systematic review evaluating the effectiveness of interventions aimed at increasing early initiation of antenatal care in socially disadvantaged and vulnerable women concluded that there was insufficient evidence to make a firm recommendation.<sup>120</sup> The most commonly reported flaw with these studies included in the review was the lack of adjustment for confounding (bias) in analyses of the effect of the intervention on the timing of antenatal care initiation. During the course of this review, 30 potentially relevant interventions were identified but only 16 eligible intervention studies (all observational) which were loosely grouped into two types: outreach or other community-based interventions and alternative models of clinic-based antenatal care (Table 48).<sup>120</sup> One intervention that was considered promising and three strategies were identified as plausibly able to affect the timing of antenatal care although effectiveness was unproven.

**Table 48. Interventions Reviewed for Effectiveness with respect to Antenatal Care Initiation in Socially Disadvantaged and Vulnerable Women**

Setting	Intervention Evaluated	Study Quality	Evidence of Outcome
South Carolina, USA	Resource Mothers Program <sup>132</sup>	Average	Some
UK	Link workers <sup>133</sup>	Poor	None but plausible strategy
California	Women's Health Van <sup>134</sup>	Poor	None but plausible strategy
Australia	Strong Women, Strong Babies, Strong Culture <sup>135</sup>	Poor	None but plausible strategy
Virginia, USA	Resource Mothers Program <sup>136</sup>	Poor	None
Kansas, USA	Healthy Start Home Visiting <sup>137</sup>	Poor	None
Nebraska, USA	Omaha Healthy Start <sup>138</sup>	Poor	None
Oregon, USA	Minority Prenatal Program <sup>139</sup>	Poor	None
California, USA	Black Infant Health <sup>140</sup>	Poor	None
Indiana, USA	Minority Health Coalitions Early Pregnancy Project <sup>141</sup>	Poor	None
Michigan, USA	Maternal Infant Health Advocate Service <sup>142</sup>	Poor	None
Ohio, USA	Teen pregnancy clinic <sup>143</sup>	Poor	None
Texas, USA	Teen pregnancy clinic <sup>144</sup>	Poor	None
New Orleans, USA	Neighbourhood Pregnancy Care <sup>145</sup>	Poor	None
New York, USA	Prenatal Care Assessment Programme <sup>146</sup>	Poor	None
New Jersey, USA	HealthStart Program <sup>147</sup>	Poor	None

Source: Rogers et al.<sup>132</sup> Note: The outcome of interest was earlier initiation of antenatal care.

### Resource Mothers Program

Of the interventions reviewed by Oakley et al, only the Resource Mothers Program (RMP) in South Carolina, USA, was thought to have adequate evidence of effectiveness.<sup>120</sup> This programme used trained lay workers to deliver social support, structured goal-oriented

health promotion/education, and other assistance to pregnancy teenagers in the home during pregnancy and for one year after delivery (Table 49).<sup>132</sup> In this cohort study, two control groups were used for comparison, a contemporaneous control group selected from similar Counties that did not offer the programme and historical controls from the same Counties. RMP participants had higher odds of early initiation of antenatal care (OR 1.5) and of having adequate antenatal care (OR 1.6) than contemporaneous control groups after adjusting for age, marital status, ethnicity, and previous pregnancy. Similar odds ratios were achieved in comparison with historical controls. An evaluation of a second RMP programme offered in Virginia (USA) to pregnant teens (<18 years) with additional risk factors (e.g. African American, low income, less than high-school education) reported similar findings although the quality of the study was poor.<sup>120, 136</sup>

**Table 49: Profile of the Resource Mothers Programme**

Setting	South Carolina, USA
Study Design	Retrospective observational cohort study
Study Population	Pimiparous adolescents (<18 years at delivery)
Target Population	Teenagers
Recruitment	Via outreach activities, peer referral, referral from other agencies, schools, antenatal care clinics, and churches
Resource Mothers	Recruited from the community, provided with three weeks intensive training
Participants	<p><i>Intervention group:</i> 1,901 adolescents residing in study region (16 counties)</p> <p><i>First control group:</i> 4,612 adolescents residing in 16 counties where the intervention was not available. These counties were broadly similar based on sociocultural, perinatal status, and health resource indicators.</p> <p><i>Second control group:</i> 712 adolescents residing in the study region in the pre-intervention period.</p>
Intervention	<p><i>Description:</i> Home visiting by Resource Mothers providing support, goal oriented education and help to use the health system.</p> <p><i>Frequency:</i> Monthly during pregnancy, after delivery in the hospital, and monthly during the infants first year of life.</p>

Source: Rogers et al.<sup>132</sup>

### Additional Plausible Strategies

The Oakley review identified three additional strategies that reviewers thought had some merit, although conclusive evidence of effectiveness was lacking.<sup>120</sup>

1. *Mobile Health Clinics:* Providing free walk-in or appointment services via a mobile van with the capacity for performing private exams, ultrasound and phlebotomy in two setting in the US.<sup>134, 148</sup> Both services provided pregnancy testing, contraception, sexually transmitted disease screening and health education as well as antenatal and postnatal care. Both studies were observational and did not control for potential confounders.<sup>134, 148</sup> However, both reported an increase in the proportion of women who initiated care in the first trimester in women who used the mobile service compared to the control group, with a lower mean gestation at onset of antenatal care. This strategy was considered to be a plausible way of addressing structural barriers such as transportation and the need to negotiate an appointment system.<sup>120</sup>
2. *Linkworkers Located in GP clinics:* The Asian Mother and Baby project in the UK involved Asian linkworkers (8) based across the two main maternity units in the city and four selected GP practices who spoke English and at least one Asian language to act as facilitators of healthcare for the women and to act as interpreters.<sup>133</sup> While the evaluation did not show an effect on initiation of antenatal care, the reviewers thought it was not well designed to evaluate this, and that it could work well for some ethnic groups.<sup>120</sup>

3. *Culturally Appropriate Community-Based Programmes*: These programmes involve lay women encouraging greater use of antenatal care through the integration of traditional beliefs and practices with western care. The evaluation of one such intervention was reviewed, the Strong Women, Strong Babies, Strong Culture programme targeting aboriginal women in the Northern Territories, Australia.<sup>135, 149</sup> This programme had the specific goal of earlier antenatal care initiation, and improved of maternal nutrition, and as a consequence improved infant birthweight. Developed in consultation with the local aboriginal community it involved senior indigenous lay women trained as Strong Women Workers to help young aboriginal women engage with antenatal care, provide health and pregnancy advice (including for traditional practices), and encouraged alcohol and smoking cessation.<sup>135</sup> The programme has been described as fluid with no set protocol.<sup>135</sup> The reviewers suggested that this type of intervention could plausibly influence barriers to care including acceptability, cultural preferences, and attitudes/beliefs.<sup>120</sup>

#### 6.4.2 Antenatal Care Programmes to Improve Perinatal Outcomes

Hollowell and colleagues undertook a systematic review focusing on the delivery and organisation of antenatal care to reduce infant mortality or one of its three main causes, preterm birth, congenital anomalies, and sudden unexpected death in infancy (SUDI).<sup>26</sup> Hollowell found insufficient evidence of adequate quality to conclude that interventions involving alternative models of organising or delivering antenatal care have been demonstrated to be effective in reducing preterm births or infant mortality in socially disadvantaged or vulnerable women compared with standard models of care.<sup>26</sup> However, a small number of interventions were considered promising for reducing preterm birth, although the effects, if any, are likely to be modest.<sup>26</sup>

Interventions that Hollowell concluded were promising for improving outcomes for socioeconomically disadvantaged and vulnerable women are described here with the findings of the Hollowell and other pertinent studies presented.

##### **Programmes Targeting Socio-economically Disadvantaged Women without Specific Clinical Risk Factors**

1. *Group Antenatal Care*: In this model, groups of 8-10 women with similar due dates receive most of their antenatal care in a group setting meeting for approximately two hours every two weeks or so.<sup>150</sup> Sessions typically involve self-directed care (e.g. weight, BP, self-recording), a health check with a midwife or other maternity provider, and a facilitated discussion/education session covering issues related to pregnancy, childbirth, and parenting with an emphasis on skills building and empowerment. Hollowell and others, in reviewing the literature, concluded that group antenatal care appears to be a promising alternative model of antenatal care.<sup>150-152</sup>

The Hollowell review evaluated three studies of group antenatal care and concluded that this model of care may reduce preterm birth in socioeconomically disadvantaged women based on the evidence summarised here.<sup>26</sup> Ickovics and colleagues conducted two studies; an observational study with inconclusive results due to under-powering and confounding<sup>153</sup>, followed by a larger RCT<sup>154</sup>. The RCT reported a significant reduction in preterm birth (adjusted OR 0.67) in the group antenatal care group at no additional cost.<sup>154</sup> A similar programme (*CenteringPregnancy*) developed for teenagers <18 years old in Missouri, USA was evaluated for its effectiveness with respect to preterm birth.<sup>155</sup> Adolescents who self-selected the *CenteringPregnancy* programme had a significantly lower rate of preterm birth (10.5%) when compared to adolescents that declined to participate in the programme (25.7%). However this study had a high risk of selection

bias and the results weren't controlled for confounding and should be treated with caution.<sup>26</sup>

A second published review examining group antenatal care came to the same conclusion regarding the effect of group antenatal care on preterm birth.<sup>151</sup> This review also examined other outcomes and concluded that there is evidence that group antenatal care improves breastfeeding rates, adequacy of antenatal care, participant knowledge and preparedness for labour, and patient satisfaction. These conclusion were echoed in a third literature review examining group antenatal care conducted by Sheeder et al.<sup>152</sup>

A recurring theme in all of these reviews was the paucity of high quality evidence. Of all of the studies included only one, the Ickovics observational study, had neonatal death as an outcome, and no significant reduction was found in women who had group antenatal care; however such events were rare and the study was underpowered.<sup>153</sup>

2. *Comprehensive Multidisciplinary Antenatal Care with Outreach*: Hollowell identified one programme in this category, the Temple Infant Parent Support Services (TIPPS) programme based in Pennsylvania, USA, which was considered promising with respect to reducing preterm birth despite issues of selection bias in the evaluation.<sup>26, 156</sup> This programme was developed to target high infant mortality in a specific locality to address local issues and provides well baby care and health and input from a nutritionist, counsellor, and psychosocial care in addition to antenatal and labour care.<sup>156</sup> Pregnant women are actively sought and supported using a range of outreach nurses and social workers, home visiting, support with transportation and child care during appointments, and follow-up of missed appointments. In an evaluation of this programme, women in the TIPPS programme had a lower rate of preterm birth (4%) compared with matched controls (12%).<sup>156</sup> Other significant outcomes reported were an increased number of antenatal visits, increased maternal weight gain, and reduced neonatal admissions in the TIPPS group.

### **Programmes Targeting Socio-economically Disadvantaged Women with Additional Clinical Risk Factors**

Hollowell identified two trials of preterm birth prevention programmes targeting socioeconomically disadvantaged women who had additional risk factors that suggested that such programmes may be effective in preventing preterm birth, although when taken separately these trial were inconclusive.<sup>157, 158</sup>

The *West Los Angeles Preterm Birth Prevention Project* targeting Hispanic women included more frequent antenatal visits (fortnightly), preterm prevention education (identification of preterm labour, actions if signs/symptoms occur, prevention strategies), as well as psychosocial and nutritional screening and crisis intervention. Women were screened for eligibility for the programme at their first visit and cluster randomised to receive the enhanced care programme or usual care, and those randomised to the intervention were further randomised to receive one of five treatments, control, bed rest, psychological support, oral progesterin, or placebo. An evaluation of this programme reported a non-significant reduction in preterm birth in the intervention group (OR 0.78 (0.58-1.04), with no additional benefit conferred by any of the additional treatments.<sup>157</sup>

A study set in Alabama, USA, enrolled African-American women on Medicaid assessed as high risk of a preterm birth based on having at least one of the following features, a previous preterm birth, pre-pregnancy weight of <50kg, and no car transport and two of the following criteria, a previous low birthweight term infant, smoking, BMI<19.8 if weighing >50kg, and a perceived lack of control in life.<sup>158</sup> Eligible women were randomised to receive augmented care of standard care. Augmented care was provided in a newly created *Mother and Family Specialty Centre*, and consisted of fortnightly antenatal visits including a 40 minute facilitated group session for pregnancy education with topics including nutrition and weight gain,

smoking and substance abuse, stress reduction and control over life-affecting decisions, and labour and delivery (similar to the group antenatal care model). The Centre also provided transportation, healthy snacks, child care, and evening sessions. An evaluation of this programme reported a non-significant reduction in preterm birth; however the study was underpowered.<sup>26, 158</sup>

While taken separately, the results of each of these studies is inconclusive, however Hollowell concluded that together they may indicate a modest beneficial effect of such programmes on preterm birth.<sup>26</sup>

### **Programmes Targeting Socio-economically Disadvantaged or Vulnerable Women provided as an Adjunct to Comprehensive Antenatal Care**

1. *Case Management / Care Coordination*: Two studies were identified that evaluated the provision of case managers / care coordinators alongside standard antenatal care, of which only the evaluation by Buescher and colleagues was of adequate quality.<sup>159, 160</sup> Buescher and colleagues evaluated the effectiveness of the North Carolina Baby Love Program in reducing infant mortality.<sup>159</sup> This programme targeted pregnant and post-partum Medicaid recipients in North Carolina and aimed to help these women access services and to provide social and emotional support. It had a number of elements including outreach to help women apply for Medicaid, assessment (psychosocial, nutritional, medical, education, financial), service planning, coordination and referral, follow-up and monitoring, education, and counselling. The maternity care coordinator acts as an advocate, assisting navigation of the complex service system, and ensuring access to services for which women were eligible for in addition to their antenatal care, e.g. job training, social work, transportation, food stamps, and housing assistance. The antenatal care schedule was determined by the women's needs and may be more frequent than the standard schedule. Buescher reported a non-statistically significant reduction in infant mortality in women than participated in the programme, and Hollowell concluded that the findings were inconclusive but consistent with a possible beneficial effect on infant mortality.<sup>26, 159</sup> A significant reduction in the rate of very low birth weight infants (<1,000g) was reported.<sup>159</sup> The programme was reported to be cost effective, with \$2 dollars saved in medical costs in the infants first 60 days of life for every \$1 spent on maternity care coordination.
2. *Nutritional Programmes*: In addition to the home visiting programme described below that had a strong emphasis on improving nutrition, an evaluation of the *Higgins Nutrition intervention Program* in Montreal adolescents indicated a possible beneficial effect on preterm birth in this population.<sup>161</sup> This programme consisted of an assessment of each pregnant adolescent's risk profile for adverse pregnancy outcomes and an individualized nutritional rehabilitation program based on that profile, with an average increase in daily consumption of 900 kcal energy and 52 g protein.<sup>161</sup> Those in the intervention group had lower odds of low birthweight, very low birthweight, and preterm birth. No effect on perinatal mortality was observed although this outcome was rare.

### **6.4.3 Antenatal Care Models with No Clear or Consistent Benefit Demonstrated**

2. *Home Visiting*: The Hollowell review included three studies evaluating the effect of nurse provided home visiting in addition to usual care which showed different results. An evaluation of the home visiting component of the *Prenatal and Early Childhood Nurse Home Visitation Program* in Tennessee in which women were visited at home and during pregnancy (7 visits) the first two years of life (26 visits) showed no effect on preterm birth or low birth weight rates in the intervention group, although women in the intervention group were less likely to have a second pregnancy during the programme.<sup>162</sup> In a UK

programme offering 24 hour support by telephone and a schedule of three home visits for support and advice, evaluated in a RCT, no effect was found on preterm birth.<sup>163</sup>

Blondel and colleagues reviewed eight RCTs of home visiting during pregnancy, including home visiting for providing social support to high risk women and for providing medical care to women with complications.<sup>164</sup> No effect of home visiting on preterm birth or admission to hospital during pregnancy was found. A recent Cochrane review to assess the effects of programmes offering additional social support compared with routine care, for pregnant women at high risk or a preterm birth or low birthweight baby found no improvement in these perinatal outcomes.<sup>165</sup> A significant reduction in antenatal hospital admission (RR 0.79) and caesarean birth (RR 0.87) were found.<sup>165</sup> A further review of reviews similarly concluded that there was insufficient evidence to suggest that home-visiting programmes can have a beneficial impact on low birth weight or other pregnancy outcomes.<sup>166</sup>

In contrast, a cluster randomised trial evaluating a programme based in an isolated rural area of Greece in which women received fortnightly nurse home visits during pregnancy and for the first 12 months after delivery with a strong emphasis on nutritional counselling, in a setting where low-calorie diets are prevalent, in addition to pregnancy and parenting issues, reported a reduction in preterm birth (with borderline statistical significance  $p=0.04$ ) but no effect on neonatal mortality. Hollowell concluded that the findings of this study were inconclusive but consistent with a benefit; however the transferability of the findings to an urban setting was questioned.<sup>26</sup>

3. *Telephone Support*: A recent Cochrane review of telephone support interventions during pregnancy found no effect on preterm delivery or smoking cessation, although some effectiveness with respect to preventing smoking relapse, reducing low birthweight, increasing breastfeeding duration, and decreasing post-partum depression symptoms was reported.<sup>167</sup>
4. *Preterm Birth Prevention Educational Programmes for High Risk Women*: A systematic review and meta-analysis of the effectiveness of preterm birth educational programmes targeting high-risk women who included 6 RCTs, concluded that these programmes were not effective in preventing preterm birth, neonatal death, or low birthweight, although an increase in the diagnosis of preterm labour was reported (RR 1.71).<sup>168</sup>

#### **6.4.4 Section Summary**

A review of the literature by Hollowell and colleagues identified several promising interventions for improving early initiation of antenatal care, several of which were also shown to increase the odds of a women receiving adequate care. Of these interventions, several had the potential for being transferable to the CMDHB setting, including the Resource Mother Programme, mobile clinics, and the development of culturally appropriate community based programmes that could integrate traditional Maaori or Pacific practices.

Several promising models of providing antenatal care were also identified by Hollowell as being effective in improving pregnancy outcomes, particularly preterm birth although other outcomes were also reported. No models were identified that conferred a clear benefit with respect to reducing perinatal mortality. This finding was not surprising, and is supported by a recent meta-analysis that found the population attributable risk in high income countries of having no antenatal care to stillbirth rates was very low (0.7%).<sup>27, 28</sup> Hollowell reiterated the opinion of other reviewers, that the benefits of alternative models of care in high income settings are likely to be modest.<sup>26</sup>

Of the models of care that were identified, several have the potential for being transferable to the CMDHB setting particularly group antenatal care. Although other enhanced programmes

have proved successful, the multi-faceted nature of these programmes makes it difficult to determine which aspects contributed to improved outcomes, and they may be expensive to implement. The relevance of nutritional programmes reviewed here to the CMDHB population is also unclear, as these programmes only included underweight or normal weight individuals. This review suggests there is little or no benefit with respect to pregnancy outcomes from the following adjuncts to standard antenatal care: home visiting, telephone support, and preterm birth prevention programmes that are only educational with no enhanced care component.

## 6.5 Chapter Summary

Evaluating the effectiveness of antenatal care as a complete package remains both controversial and challenging as the effectiveness of such programmes of care is a function of content, utilisation, and quality.<sup>10</sup> In addition, as maternal and perinatal mortality have become less frequent events, proving the effectiveness of a new intervention or programme becomes increasingly difficult for several reasons - the gains to be had are less, proving that small changes are statistically significant requires large numbers, large randomised controlled trials are expensive, and observational trials are prone to bias and may show no difference even if one really exists. Nevertheless, several observational studies have demonstrated an association between little or no antenatal care and increased odds of preterm birth, low birth weight, and maternal, fetal and neonatal death in both high-income and developing countries.<sup>11-20</sup>

The NICE antenatal care guidelines include five key recommendations for the organisation and provision of antenatal care which are in generally place in CMDHB.<sup>21</sup> The exceptions are the recommendation for an early ultrasound scan at 10-12 weeks, and the recommendation that antenatal care commence by 10 weeks gestation. The latter recommendation is echoed by the PMMRC.<sup>2</sup>

A review of the literature identified a wide range of potential barriers to initiating and maintaining antenatal care, which vary by population group and context. There is less evidence that motivators and facilitators of antenatal care influence access greatly, e.g. wanting to stay healthy, support from family, transport, and childcare. Of note, two studies in socio-economically disadvantaged women in the USA and Mexico reported that a negative attitude towards the pregnancy, including considering an abortion, was the strongest predictor of late initiation of antenatal care, and a belief that one can care of oneself during pregnancy was the strongest predictor of inadequate care.<sup>23-25</sup> An understanding of the barriers to initiating and maintaining antenatal care for CMDHB women is essential to developing strategies for improving antenatal care engagement. A small number of promising interventions were identified that have some evidence supporting their effectiveness in improving engagement with antenatal care. Those with the potential for being transferable to the CMDHB setting include the Resource Mother Programme, mobile clinics, and the development of culturally appropriate community based programmes that could integrate traditional Maaori or Pacific practices.

Aspects of interventions to improve engagement with antenatal care could be integrated into models of providing antenatal care that have been shown to effect modest improvements in pregnancy outcomes in similar populations.<sup>26</sup> Notably, no alternative models of care were identified that reduce perinatal mortality, which is unsurprising as the population attributable risk of stillbirth conferred by having no antenatal care is estimated at <1% in high income countries.<sup>27, 28</sup> Of the alternatives identified, group antenatal care appears to be the most promising and amenable to being enhanced to include aspects of interventions shown to be promising with respect to increasing engagement. In particular, the Resource Mothers Programme providing additional support for teenage mothers during pregnancy and for the

first two years of their infant's life, and culturally appropriate community based programmes that could be tailored to meet the needs of Maaori and Pacific women and their whaanau. No clear evidence of benefit was found for home visiting, telephone support, and preterm birth education programmes as adjuncts to standard care.



## Chapter 7. Discussion and Recommendations

The CMDHB perinatal maternity project was stimulated by a PMMRC report that found that the perinatal mortality rate in CMDHB is significantly higher than the national rate.<sup>1-3</sup> Part of this project was to review antenatal care in CMDHB with the view that actions to improve perinatal mortality are likely to be best implemented via antenatal care. This report has examined the maternity population in CMDHB in comparison to the national maternity population, reviewed CMDHB maternity services with a particular focus on antenatal care, and reviewed the literature on antenatal care models. The main findings are summarised and discussed here and recommendations made.

### 7.1 Summary of Main Findings

#### 7.1.1 Maternity Data Need to be Improved at Both a National and Local Level

There is currently no comprehensive national maternity data collection. Current Ministry of Health reports on maternity use data derived from the National Minimum Dataset which does not contain information on antenatal care.<sup>5, 6</sup> While maternity service consumer surveys are undertaken every 5 years, the last in 2007, these surveys do not provide a good source of information on the access to and utilisation of antenatal care, are not representative of the maternity population, and do not include sufficient numbers for a regional analysis.

CMDHB collects data on women who use the DHB's maternity services in an information system called Healthware, with data available from 2007 onwards. While this data collection is a useful source of local information it has several limitations including the following: it does not collect data for CMDHB resident women who do not use CMDHB services (~13%), private LMCs and Shared Care GPs only submit a limited amount of data to this system via a booking form, data from consultant clinics are limited, there is no consistent method for identifying women who have had no antenatal care, and the date of the first antenatal visit is not recorded. The accuracy of the data contained in Healthware is unknown.

CMDHB has recently rolled out a Primary Maternity Shared Care Information System to East Tamaki Health Care and Mangere Health Care GPs providing Shared Care with CMDHB community midwives. This initiative will allow antenatal clinical information to be shared electronically between providers.

**IMPORTANT CAUTION:** Healthware data have been used in this report to explore maternity provider use, antenatal care booking, and CMDHB provided antenatal care contacts. The accuracy of this data is unknown. These analyses are therefore exploratory, and were performed in order to stimulate discussion, hypothesis generation, further research, and to inform actions to strengthen maternity data collection in CMDHB.

The inadequacy of maternity data both nationally and within CMDHB limits the capacity to examine antenatal care in any great detail. This hampers the development of initiatives for improving engagement with antenatal care and the capacity to evaluate the effectiveness of any initiatives trialled or implemented. Of concern is the inability to assess the quality of antenatal care provided within CMDHB, exacerbated by a significant lack of data from private LMCs and Shared Care GP. Because of a lack of adequate maternity data at a regional and therefore national level, differences in outcomes between DHBs cannot be attributed to quality of care issues because these cannot be appropriately assessed at this time. Encouragingly, recent Ministry of Health initiatives include the development of maternity standards, a quality framework, and the development of a maternity and newborn

information system.<sup>48</sup> These tools should allow better monitoring of the provision and quality of maternity care in New Zealand, and inform the development and evaluation of appropriate and evidenced based strategies to improve maternity outcomes and reduce disparities.

### **7.1.2 The CMDHB Maternity Population Differs from the Rest of New Zealand**

The CMDHB population of child bearing women and the maternity population (those actually giving birth) have a substantially different demographic profile to the New Zealand population. CMDHB mothers are younger on average than mothers across New Zealand and a greater proportion are Maaori, Pacific and Asian, and live in areas of high socioeconomic deprivation.

During 2007-2009 the birth rate in CMDHB was 20% higher than the national birth rate, driven by higher birth rates in Maaori, Pacific and Asian women aged less than 30 years, and in women living in the most socioeconomically deprived areas. Within CMDHB, women living in Papakura, Manurewa, and Otara had the highest birth rates.

These significant population differences pose challenges in making direct comparisons of health outcomes between the CMDHB population and the New Zealand population as a whole, and need to be considered when examining maternity care and outcomes in Counties Manukau.

### **7.1.3 The CMDHB Model of Care has Aspects that Differ from Elsewhere in New Zealand**

CMDHB provides a range of maternity services that are for the most part the same as those provided elsewhere in New Zealand, including hospital midwife care (Closed Unit or Caseloading see section 4.1 for a description), Secondary Care, teen pregnancy services, diabetes in pregnancy and obstetric medical services, maternity hospital facilities and birthing units. As in other parts of New Zealand, CMDHB women can access primary maternity services via a private lead maternity carer (LMC) who can be a self-employed midwife, GP, or private obstetrician, or via CMDHB maternity services. However, CMDHB also has a unique system of Shared Care that developed in response to a Private LMC shortage. Women who choose Shared Care receive most of their antenatal care from a GP who enters into a Shared Care arrangement with the DHB. In addition, these women are offered three antenatal visits with a DHB employed community midwife and are delivered by a DHB employed midwife.

Evidence suggests that a woman's choice of maternity care provider is influenced by her understanding of the system, preferences, past experience, the level of care she requires, and LMC availability.<sup>7-9</sup> CMDHB women are less likely to use a private LMC (50% vs 84% nationally), more likely to use a hospital midwife (24% vs 15% nationally), while 24% of CMDHB women use Shared Care. CMDHB women are also more likely to have no antenatal care, and this project found that 2.5% of CMDHB women who used a CMDHB facility had no evidence of having had antenatal care (referred to here as Unbooked). This is higher than the 1.6% reported in a 2007 national survey of maternity service consumers.<sup>7</sup>

Each year a proportion of CMDHB resident women deliver in a facility located outside of CMDHB. Such outborn deliveries are not unique to CMDHB and during 2007 the proportion of outborn deliveries was similar for the three Auckland Region DHBs (14.6%-15.0%). The potential reasons for a CMDHB resident women delivering outside CMDHB include preference, convenience, availability, medical indication (e.g. specialist neonatal care), and LMC preference.<sup>7</sup> Of the CMDHB resident women who delivered outside the DHB during 2007-09, half were European/Other and 30% were Asian women, while 52% lived in Howick.

During 2007-09, an average of 190 CMDHB women each year delivered in a CMDHB facility having had no structured antenatal care (Unbooked women). Most of these women were Maaori or Pacific (93%), and nearly half were aged <25 years old (45%). After adjusting for the factors that influenced booking in CMDHB women in a univariate analysis (ethnicity, age group, deprivation, suburb, year, delivery location, and parity), only ethnicity, age group, and parity independently influenced the likelihood of being Unbooked (multivariate analysis). In the multivariate analysis, the odds of being Unbooked was 7 times greater in Maaori women and 4 times greater in Pacific women than in European/Other women; the odds of being Unbooked was approximately 2 times higher in women aged <30 compared with those aged 30 years and older, and compared with nulliparous women, para 3-5 women had 2.3 times the odds, and women of a parity of 6 or more had 6.5 times the odds of being Unbooked.

#### 7.1.4 The CMDHB Model is Consistent with Guidelines in Key Areas

For the most part, the CMDHB model of antenatal care is in line with international guidelines. The National Institute for Health and Clinical Excellence (NICE) antenatal care guidelines include five key recommendations for the organisation and provision of antenatal care<sup>21</sup>:

- That midwife- and GP-led models of care should be offered for women with an uncomplicated pregnancy
- That antenatal care be provided by a small group of carers with whom the woman feels comfortable and that there should be continuity of care throughout the antenatal period
- That for a woman who is nulliparous with an uncomplicated pregnancy, a schedule of ten appointments should be adequate. For a woman who is parous with an uncomplicated pregnancy, a schedule of seven appointments should be adequate
- Antenatal appointment schedules should be determined by appointment function
- Pregnant women should be offered an early ultrasound scan between 10+0 and 13+6 weeks to determine gestational age and to detect multiple pregnancies.

In CMDHB, most women receive midwife or GP led care; 95.8% during 2007-09. A meta-analysis of three RCTs found no differences between midwife/GP led care for several outcomes including perinatal mortality.<sup>80</sup> During 2007-09, perinatal mortality for CMDHB infants born in a CMDHB facility during 2007-09 did not differ significantly by primary maternity provider (hospital midwife, private LMC, of Shared Care).<sup>4</sup> The absence of data on risk factors for a poor perinatal outcome meant the appropriateness of the level of care provided (primary vs secondary) could not be assessed.

Private LMC, Shared Care, and Caseloading midwife care is provided by a small group of carers offering continuity of care during pregnancy. During 2007-09, 76% of those CMDHB women who delivered in a CMDHB facility received care from one of these maternity providers. In addition, the teenage pregnancy service and the diabetes in pregnancy service also provide continuity of care from a small group of carers. The main benefits of care being provided by carers with whom the woman feels comfortable and continuity of care were improved engagement with antenatal care and increased satisfaction with the care provided.<sup>81-83, 85</sup> These features of antenatal care provision have no impact on other perinatal outcomes including stillbirth<sup>81, 84</sup>, neonatal death<sup>81, 84</sup>, preterm birth<sup>81</sup>, neonatal unit admission<sup>81, 83</sup>, birthweight <2500g<sup>81</sup>, postnatal haemorrhage<sup>83</sup>, and duration of labour<sup>83</sup>.

International guidelines with respect to number of antenatal care visits recommended range from a minimum of six in the Netherlands to fourteen in the United States and Finland.<sup>11</sup> NICE guidelines state “*the evidence to date on the optimum number of antenatal appointments is inconclusive*”.<sup>21</sup> A 2010 meta-analysis of studies in low and middle income countries reported a 15% (95% CI: 1%-30%) increase in perinatal mortality with a 4 versus 6 visit schedule and the authors recommended caution with respect to reducing the number of visits below six in resource poor settings.<sup>28</sup> The New Zealand *Primary Maternity Services*

*Notice* (Section 88) does not include recommendations for a minimum or optimum schedule of visits.<sup>33</sup> The CMDHB Closed Unit visit schedule includes a minimum of 6 visits up to and including one in the 40<sup>th</sup> week of pregnancy, whereas the Shared Care schedule includes a minimum of 10 visits. Both of these schedules provide for 'goal oriented' antenatal care, with the purpose of each visit explicitly stated for the provider and the woman.

### **Additional Recommendations for CMDHB to Consider**

The recommendation for an early antenatal scan at 10-13 weeks has not been implemented in CMDHB. It is unknown whether this has been implemented elsewhere in New Zealand, however it is not currently included in the *Primary Maternity Services Notice* (Section 88)<sup>33</sup> or in recent PMMRC recommendations<sup>2, 3</sup>. This recommendation is made on the basis that ultrasound is a better predictor of gestational age than the last menstrual period, particularly in multiparous women and those with diabetes or a high pre-pregnancy BMI, and is effective in reducing rates of induction of labour for prolonged pregnancy.<sup>21, 22, 89-92</sup> Among CMDHB women who deliver in a CMDHB facility, the population at greatest risk of inaccurate dating based on this research are Pacific women (86% are overweight or obese and 53% have a parity of 3+); these women also had the DHBs highest rate of post-term delivery at 3.7%.<sup>4</sup> Of concern was the high proportion of term (37-41 weeks) and post-term (42+ weeks) infants that were born small for gestation age as assessed by customised growth charts, rates at these gestations were significantly higher in infants born to Maaori and Pacific women.<sup>4</sup> The PMMRC recommend the use of GROW customised growth charts for identifying fetal growth restriction during pregnancy; the accuracy of growth assessments would be increased with accurate dating allowing appropriate intervention if necessary.<sup>3</sup> The feasibility of implementing this recommendation should be assessed with respect to costs, funding under Section 88, ultrasound provider capacity, and acceptability as overweight or obese women are likely to require a transvaginal ultrasound. As an early antenatal- scan is not currently recommended practice in New Zealand, it would be an appropriate research focus e.g. examining the impacts on pregnancy outcomes such as early detection of fetal growth restriction, induction for post-term delivery, and perinatal mortality in Maaori and Pacific women.

The NICE guidelines recommend that antenatal care commence by 10 weeks gestation, a recommendation echoed by the NZ Perinatal and Maternal Mortality Committee.<sup>2, 3</sup> Local data suggest that initiating antenatal care early in pregnancy occurs infrequently (17% in 2007-09) although the accuracy of these data is unknown. No national data on antenatal care initiation were available for comparison. Improving early initiation of antenatal care in CMDHB would allow greater opportunity for health promotion regarding smoking, alcohol, and nutrition; early screening for time sensitive issues including family violence; and early dating scans for a population that would likely benefit from improved accuracy in dating.

### **7.1.5 Capacity for Antenatal Care to Further Improve Outcomes may be Limited**

Evaluating the effectiveness of antenatal care as a complete package remains both controversial and challenging as the effectiveness antenatal care is a function of content, utilisation, and quality.<sup>10</sup> In addition, as maternal and perinatal mortality have become less frequent, proving the effectiveness of a new intervention or programme has become increasingly difficult for several reasons - the gains to be had are less, proving that small changes are statistically significant requires large numbers, large randomised controlled trials are expensive, and observational trials are prone to bias and may show no difference even if one really exists. Nevertheless, several observational studies have demonstrated an association between little or no antenatal care and increased odds of preterm birth, low birth weight, and maternal, fetal and neonatal death in both high-income and developing countries.<sup>11-20</sup> Therefore, it seems that antenatal care is necessary, but not sufficient, for optimising outcomes for mothers and infants, and is the vehicle via which components of antenatal care with proven effectiveness are delivered to pregnant women.

Antenatal care is not sufficient in itself for improving pregnancy outcomes. In a 2003 systematic review of the effectiveness of antenatal care for preventing low birth weight Lu concluded that antenatal care in its current form will not prevent preterm birth or fetal growth restriction.<sup>100</sup> Instead Lu, and others, suggests that prevention of these and other adverse pregnancy outcomes will require integration of reproductive planning and health promotion into a woman's healthcare throughout her reproductive life-course.<sup>100, 169</sup> This recommendation is supported by a recent review of the major risk factors for stillbirth in high income countries that emphasised the important contribution of risk factors that are best addressed pre-conception.<sup>27, 170</sup> For example, antenatal care is not an appropriate vehicle for interventions that are best implemented prior to pregnancy occurring including prevention of unwanted pregnancy, pre-pregnancy folic acid, smoking cessation, weight loss, and glucose control in women with diabetes. All of these risk factors, and others, are making a contribution to the excess perinatal mortality seen in CMDHB.<sup>4</sup>

### **Risk Assessment Provides a Limited Tool for Improving Outcomes**

The NICE guidelines recommend initial and ongoing risk assessment.<sup>21</sup> Interestingly, a systematic review of risk assessment tools in the same guideline found evidence (fair to low quality) that antenatal risk assessment tools have high specificity (i.e. good at identifying women who were low risk and had no adverse outcome) but low sensitivity (i.e. there are many women assessed as high risk who had no adverse events) and that there was no evidence of the effectiveness of carrying out antenatal risk assessment with respect to maternal and neonatal outcomes.<sup>21</sup> The risk assessment tools reviewed in the NICE guideline do not appear to be superior to the current process that informs the New Zealand referral guideline, although evidence is scarce.<sup>21, 102</sup> However, national and local maternity data are inadequate for auditing the implementation of the New Zealand referral guidelines and for assessing how well these guidelines identify women who go on to have an adverse event.

Carroli postulated that for risk assessment to be effective as a public health strategy, the following conditions should be met<sup>98</sup>:

- *“the whole population must be screened and all care providers must be motivated to implement the system*
- *conditions screened for must include the important causes of maternal and perinatal morbidity and mortality,*
- *when increased risk is detected, appropriate referral or other action must be taken,*
- *adequate services must exist at the referral level,*
- *women at risk must be able to reach the referral level facility and be motivated to do so,*
- *the strategy must show proof of reducing morbidity and/or mortality”.*

These are very similar to the criteria for a screening programme developed by the National Health Committee in New Zealand<sup>60</sup>. For risk assessment to be effective in reducing adverse outcomes at a population level there must be effective interventions for mitigating risk once it has been identified. A recent review demonstrated that medical interventions aimed at preventing preterm birth are not effective at a population level.<sup>99</sup> A systematic review of the evidence of the effectiveness of prenatal care for preventing low birth weight concluded that risk assessment will fail to identify the majority of pregnancies at risk for preterm delivery or fetal growth restriction and that neither preterm birth nor fetal growth restriction could be effectively prevented by antenatal care.<sup>100</sup> Another recent systematic review found a dearth of rigorous evidence that antenatal screening or monitoring interventions aimed at identifying women at risk of experiencing a stillbirth had any impact on stillbirth incidence.<sup>101</sup> These reviews suggest that the capacity for risk assessment to improve perinatal mortality is limited.

The PMMRC recommend identification of vulnerable women at increased risk of perinatal related mortality, including women age <20 years or ≥40 years, obese women, women with multiple pregnancy, women living in socio-economic deprivation, women with maternal mental health problems or medical conditions.<sup>3</sup> There is no guidance for what should be offered to these women beyond flagging them as high risk, or how they should be managed or by whom their care should be provided. The application of a flag based on these characteristics to the CMDHB women who delivered in a CMDHB facility during 2007-09 would have identified 6,075 (81%) as being high risk each year.<sup>4</sup> Not included in this analysis were other important maternal conditions and maternal mental health problems. The CMDHB women flagged as vulnerable during 2007-09 had an average 6,250 infants each year of which 83 died in utero or in the neonatal period; i.e. 98.7% of the infants born to these vulnerable women did not experience a perinatal death. This analysis highlights the limitations of a high risk approach in a population that is predominantly high risk, and illustrates the challenges of potentially providing augmented services to a large high risk population, particularly in the absence of convincing evidence that a different model of care will achieve the desired outcome.

### **7.1.6 Engagement with Antenatal Care by CMDHB Women Could be Improved**

National data for examining the initiation and maintenance of antenatal care are not available for comparison. Local data for CMDHB women who delivered in a CMDHB facility (87% of the CMDHB maternity population) are available but the data quality is unknown. However, the data that is available suggests that use of antenatal care by CMDHB women is sub-optimal.

NICE guidelines, and the PMMRC, recommend that antenatal care be initiated prior to 10 weeks gestation. This was only achieved by a small proportion of CMDHB women during 2007-2009 with only 16.8% booking by 10 weeks. In most CMDHB women, the degree to which booking date reflects the onset of antenatal care is unknown. However, for those with hospital midwife care (Closed Unit and Caseloading see section 4.2 for a description), there is a reasonably strong relationship between booking gestation and the gestation at first antenatal contact. In these two groups, 8.2% and 12.3% booked early, by 10 weeks gestation, respectively. Women with Shared Care had the highest odds of an early booking, which may be a result of the contractual relationship between the GP and the DHB incentivising the GP to complete the booking process earlier.

Just over a third (36%) of CMDHB women booked very late (after 18 weeks gestation) with an additional 2.5% not booking at all (Unbooked). Women with the highest odds of very late booking were Pacific and Maaori, aged <25 years, and those with a parity of 3 or more. These same factors were independently associated with increased odds of being Unbooked. In addition, women with Closed Unit care had higher odds of booking late. This could be a reflection of Closed Unit as care of last resort, or late referral/transfer of higher risk women to CMDHB services and warrants further investigation.

Data on CMDHB provided antenatal visits are recorded in Healthware; although the completeness and accuracy of these data are unknown. It appears that Healthware data underestimate the number of contacts provided by CMDHB staff and visits/contacts with midwives are recorded more frequently than doctor's visits. In addition, antenatal visits with private LMCs and Shared Care GPs are not currently recorded in Healthware.

Women who have Shared Care are offered three antenatal visits with a community midwife. During 2007-09, 39.5% of women with Shared Care missed one or more of their scheduled visits. The attendance rate improved with increasing gestation and was 78% for visits scheduled before 24 weeks and 91% for visits from 40 weeks gestation. The likelihood of attending all three visits is influenced by a woman's gestation at booking and delivery. During 2007-09, some women with Shared Care were expected to attend no visits (<1%),

8.2% to attend one, 21.1% to attend two, and 70.4% to attend three visits. During this time only 52% actually attended their expected number of antenatal clinic appointment. Women with the highest odds of not completing their expected number of Shared Care visits were Maaori, Pacific, aged <25 years, had a parity of 3 or more, or lived in Otara.

The standard antenatal visit schedule for women with Closed Unit care includes six visits. The likelihood of a woman using Closed Unit care attending all six CMDHB provided antenatal visits depends on her gestation at booking and delivery. During 2007-2009, 70% of attended their expected number, or more, of Closed Unit antenatal clinic visits.

Attending the expected number of visits does not necessarily mean a woman had adequate antenatal care. The adequacy of Closed Unit antenatal care was assessed using the APNCU Index (see section 5.2.6.4 for more information) that has two dimensions: adequate initiation of care and adequate utilisation (i.e. the proportion of expected visits that were attended).<sup>55</sup> This index does not measure quality of care. During 2007-2009, 53.2% of those women using Closed Unit had inadequate antenatal care, most of which was due to inadequate initiation (46.6%) rather than inadequate use once care had been initiated (6.6%). In addition, 35.8% had Adequate Plus care which occurs when a woman has more than her expected number of antenatal care visits. This can occur due to necessity (i.e. complications of pregnancy, high risk pregnancy) or excessive use.

The number of women at increased risk of having little or no antenatal care can be grossly estimated by using demographic characteristics associated with an increased risk (Maaori or Pacific women, women aged <20 years, women living in socioeconomically deprived areas (decile 9-10) and women with a parity of 3 or more). Using these characteristics, an estimated 6,260 CMDHB women (71% of those that delivered) were at risk of having little or no antenatal care each year during this time. However, during 2007-09 in CMDHB an annual average of only 191 women (2.5%) had no antenatal care and an additional 361 women (4.9%) booked in the last 4 weeks of pregnancy. This finding suggests that using the presence of demographic features associated with increased odds of inadequate care may not be the best approach for addressing this issue for CMDHB women, as most women identified will in fact access care. Therefore, a population based approach aimed at improving initiation and maintenance of antenatal care for all CMDHB women is likely to be more useful than a high risk approach.

### **Potential Issues and Approaches to Consider for Improving Engagement in CMDHB**

A review of the literature identified a wide range of potential barriers to initiating and maintaining antenatal care, which vary by population group and context. There is less evidence that motivators and facilitators of antenatal care influence access, e.g. wanting to stay healthy, support from family, transport, childcare. Of note, two studies in socio-economically disadvantaged women in the USA and Mexico reported that a negative attitude towards the pregnancy, including considering an abortion, was the strongest predictor of late initiation of antenatal care, and a belief that one can care of oneself during pregnancy was the strongest predictor of inadequate care.<sup>23-25</sup> An understanding of the barriers to initiating and maintaining antenatal care for CMDHB women is essential to developing appropriate strategies for improving antenatal care engagement. If the greatest barrier is a lack of knowledge regarding the benefits of antenatal care and when care should commence, then communication will need to form part of the solution; however, if the greatest barrier is a negative or ambivalent attitude towards being pregnant the approach will be different.

Local research is underway to examine barriers to engaging in antenatal care led by Sarah Corbett (Obstetric Registrar) and Kara Okesene-Gafa (Consultant Obstetrician Gynaecologist). In addition, Ausaga Faasalele Tanuvasa, at Victoria University, has an HRC grant for a study examining the attitudes of Samoan women towards antenatal and midwifery care, that enrolled women in Auckland and Wellington, due to be completed in 2011. The findings of these studies could be enhanced by a survey of maternity providers to identify

barriers inherent within the current system, e.g. provider knowledge of the recommendations, process issues within the current booking system. A small number of promising interventions were identified that have some evidence supporting their effectiveness in improving engagement with antenatal care. Those with the potential for being transferable to the CMDHB setting include the Resource Mother Programme, mobile clinics, and the development of culturally appropriate community based programmes (see section 6.4.1).

Aspects of interventions to improve engagement with antenatal care could be integrated into models of providing antenatal care that have been shown to effect modest improvements in pregnancy outcomes in similar populations.<sup>26</sup> Notably, no alternative models of care were identified that reduce perinatal mortality, which is unsurprising as the population attributable risk of stillbirth conferred by having no antenatal care is estimated at <1% in high income countries.<sup>27, 28</sup> Of the alternatives identified, group antenatal care appears to be the most promising and amenable to being enhanced to include aspects of interventions shown to be promising with respect to increasing engagement, in particular, the Resource Mothers Programme which provides additional support for teenage mothers during pregnancy and for the first two years of their infant's life, and culturally appropriate community based programmes that could be tailored to meet the needs of Maaori and Pacific women and their whaanau. No clear evidence of benefit was found for home visiting, telephone support, and preterm birth education programmes as adjuncts to standard care.

CMDHB has developed several initiatives aimed at improving engagement with CMDHB provided maternity services which are supported by the findings of this literature review. These include a pilot of Maaori and Pacific Community Health Workers as part of the community midwives team for women with Closed Unit care. New models of maternity service provision are also being explored whereby a GP and self-employed LMC or CMDHB midwives / private LMCs work more closely together to facilitate booking, screening, information giving and education, at the earliest opportunity in a multi-disciplinary community setting.

Although young age is not an independent risk factor for perinatal mortality in CMDHB<sup>4</sup>, this population often exhibit high risk behaviours, and pregnancy at this time may impact on a young woman's life course, via restriction of her education, and the life course of her infant.<sup>171</sup> On average, 780 CMDHB teenagers deliver in a CMDHB facility each year, 3% of whom have no antenatal care, and 20% of whom are having their second or subsequent child.<sup>4</sup> CMDHB has plans to improve teen pregnancy services by expanding the current midwifery resource for this group and having a dedicated social work resource. There are also plans to pilot group antenatal care with these young women. Additional areas for consideration include an increased CMDHB focus on programmes for preventing unintended teenage pregnancy<sup>171</sup>, and preventing rapid repeat pregnancy in teenage mothers e.g. via long-term contraception<sup>172, 173</sup> or motivational interventions<sup>174</sup>.

## 7.2 Conclusions

This review of antenatal services in CMDHB was initiated by a need to better understand how antenatal care can contribute to reducing perinatal mortality, and to try to determine whether the current model of care is contributing to perinatal mortality in CMDHB.

During this review, several important conclusions were drawn, all of which have been discussed here. In summary, that:

- Maternity data need improvement at both a national and local level.
- The CMDHB maternity population differs markedly from elsewhere in New Zealand.
- The CMDHB model of antenatal care has some aspects that differ from elsewhere in New Zealand.

- The CMDHB model of antenatal care is consistent with guidelines in key areas.
- The capacity for antenatal care to further improve perinatal outcomes may be limited.
- Engagement of CMDHB women with antenatal care could be improved.

Taking these findings in conjunction with those presented in the companion report, *Perinatal Mortality in Counties Manukau DHB*, three additional conclusions were drawn.

### **1. The current CMDHB model of care is not contributing negatively to the perinatal mortality rate**

While the range of maternity providers in CMDHB is similar to that found elsewhere in New Zealand, a primary point of difference is Shared Care, provided by GPs who are not required to have specific training in antenatal care. The Shared Care option developed as a consequence of a shortage of private LMCs in CMDHB.

Analyses presented in a companion report entitled *Perinatal Mortality in Counties Manukau DHB*, did not find evidence to suggest that the current model of care in CMDHB is contributing to higher perinatal mortality.<sup>4</sup> Perinatal mortality rates did not differ significantly by primary maternity provider in CMDHB (i.e. CMDHB midwife, private LMC or Shared Care led care). Higher rates were observed for women under Secondary Care; however this was expected as these women are under specialist care because they are deemed high risk.

### **2. Improving appropriate engagement with antenatal care may result in modest improvements in pregnancy for CMDHB women and their infants**

There was some evidence from the analysis of CMDHB perinatal mortality data that having no antenatal care was independently associated with stillbirth in very low birth weight infants (<1,500g: adjusted odds ratio 5.1 (95% CI: 1.7-16.1) p=0.0048) after controlling for the effects of ethnicity, maternity provider, being small for gestational age, and gestation at delivery. In contrast, the same association was not found for stillborn infants weighing 1,500g or more at birth, or for neonatal mortality.

In CMDHB, 2.5% of CMDHB women that delivered in a CMDHB facility during 2007-09 had no evidence of antenatal care and did not book to deliver in the DHB. In addition, a third of CMDHB women booked after 18 weeks gestation, missing the opportunity for screening and health promotion early in pregnancy. Few women met the PMMRC recommendation for early initiation of antenatal care prior to 10 weeks gestation. While this recommendation has been made, it is unknown how widely this is known within the CMDHB child-bearing population or by maternity providers in CMDHB.

Increasing appropriate engagement, early initiation and an appropriate number of visits, in conjunction with early ultrasound scan at 10-13 weeks may result in improvements in pregnancy outcomes; however the gains are likely to be modest.

### **3. The capacity for antenatal care to improve perinatal outcomes is limited by the significant contribution of risk factors best addressed prior to pregnancy**

The changes required for improving perinatal mortality in CMDHB are primarily behavioural and include planning pregnancy, weight management, improving nutrition, smoking cessation, engagement in antenatal care. These changes are best made in the childbearing population and not during pregnancy, emphasising the need for a life course approach to women's health. Among the risk factors contributing to increased odds of perinatal mortality in CMDHB women, smoking during pregnancy (most prevalent in CMDHB Maaori women) and obesity (most prevalent in CMDHB Pacific women) remain independently associated.

Careful consideration of initiatives to improve women's health during their child bearing years to improve pregnancy outcomes need to be considered so as not to increase disparities. Growing Up in New Zealand recently reported that 40% of pregnancies are unplanned, and

the prevalence increases with decreasing education suggesting that implementing pre-pregnancy counselling and medical advice via primary care may not target women at high risk of a poor pregnancy outcome.<sup>8</sup> Population level approaches delivered to all women of child bearing age would be more appropriate in CMDHB.

## **7.3 Recommendations**

### **Regarding Maternity Information Systems**

CMDHB is well placed to contribute to the improvement of maternity data collection at a local and national level. The analysis of maternity data for this project was challenging and has informed the following recommendations:

#### Recommendations for the Ministry of Health

- 1) That CMDHB support the development of a national maternity information system.
- 2) That CMDHB support the following recommendations made by the PMMRC in 2010 regarding the collection of birth registration data<sup>2</sup>:
  - a) The current birth registration dataset should be required to henceforth include maternity data (e.g. parity, major complications, mode of birth, history of smoking, and previous obstetric history).
  - b) New legislation should enable Births, Deaths and Marriages to accept National Health Index data for the mother and infant.

#### Recommendations for Counties Manukau District Health Board

- 1) That CMDHB make the following recommendations to the Ministry of Health:
  - a) That submission of maternity data to a national maternity information system be mandatory for all practitioners providing publically funded maternity services.
  - b) That the current birth registration dataset be required to henceforth include antenatal care data, including as a minimum LMC at first registration, LMC at delivery, date of first antenatal scan, gestation as measured by the first antenatal scan, gestation at first antenatal visit, and number of antenatal visits.
- 2) That the development of a web-based maternity information system for CMDHB include the following features:
  - a) Database documentation including a data dictionary to inform staff training, standardise definitions, standardise data entry, and facilitate research.
  - b) The collection of essential information for action only – to inform clinical decision making and quality improvement activities.
  - c) The capacity for Shared Care providers and private LMCs to enter data. Consideration could be given to how this activity could be incentivised, for example via CME recognition, the capacity to self-generate performance reports by provider or provider group.
  - d) Improved inbuilt logic checks to improve data accuracy.
- 3) That the process for collecting ethnicity data in CMDHB be reviewed and that the Maternity Registration Form be amended to include the ethnicity standard question developed for use in the health sector<sup>56</sup>.

## Regarding the CMDHB Model of Antenatal Care

- 1) That CMDHB implement the PMMRC recommendation for the early initiation of antenatal care before 10 weeks gestation.<sup>2</sup> A recommended schedule of activities is as follows:

### *Phase I - Pre-implementation*

- viii) Engagement with maternity providers indicating the intention to implement this recommendation, including the rationale, and to provide an opportunity for consultation.
- ix) Local research to identify barriers to early initiation of antenatal care for CMDHB women and maternity providers, some of which is currently in process. This should include maternity service funding related barriers.
- x) Development of a monitoring framework. This could be achieved by adding the date of the first antenatal visit, and the provider type (e.g. Private, Shared Care GP, other GP, community midwife etc.), to the CMDHB Booking Form and to Healthware, and by developing a Healthware report to enable monitoring. This could be implemented prior to the development of a web-based system, and data collection should commence well in advance of implementation in order to establish an accurate baseline rate of early initiation of care.
- xi) Review of the current schedule of antenatal visits offered to women using Shared Care or Closed unit care.

### *Phase II - Programme Design and Implementation*

- xii) Informed by the activities of Phase I and the findings of this project, a strategy specific to CMDHB can be designed with the aim of increasing the number of women who initiate antenatal care by 10 weeks gestation.
  - xiii) Development of a communication strategy targeting those with the lowest odds of early initiation of antenatal care, Maaori and Pacific women, women aged <25 years old, and women with a parity of three or more.
  - xiv) Evaluation of this strategy using the monitoring framework developed in the pre-implementation phase, with a process of reporting back to key stakeholders and maternity provider groups.
- 2) That CMDHB implement the NICE guidelines recommendation for an early dating ultrasound scan between 10 and 13 weeks, in addition to the 18 week anatomy scan.<sup>21</sup> To monitor implementation the date of the first antenatal scan, and EDD by this scan, could be added to the Booking Form.
  - 3) That CMDHB pilot group antenatal care targeting women who have high odds of inadequate utilisation of antenatal care including Maaori, Pacific, women aged <25 years, and women of high parity. An evaluation framework should be devised to include measures of engagement (date of first visit, screening uptake, date of first antenatal scan, attendance) as well of measures of service quality (e.g. felt I could contribute to group discussions, made to feel included, discussion topics were appropriate, felt listened to and taken seriously, venue was easy to get to etc).
  - 4) That CMDHB consider a focus on programmes for preventing unintended teenage pregnancy<sup>171</sup>, and preventing rapid repeat pregnancy in teenage mothers e.g. via long-term contraception<sup>172, 173</sup> or motivational interventions<sup>174</sup>.

Additional recommendations are made in the companion report, Perinatal Mortality in CMDHB.<sup>4</sup> These include recommendations for community engagement and pre-conception care.



# Appendix 1. Referral Guidelines

## (Guidelines for Consultation with Obstetric and Related Specialist Medical Services)

These guidelines, previously appended to the Section 88 Maternity Services Notice 2002, are to be used in conjunction with the Primary Maternity Services Notice 2007<sup>102</sup>

### 1. Purpose of guidelines

This document provides guidelines for best practice in maternity care based on expert opinion and available evidence. It is the intention that the guidelines be used to facilitate consultation and integration of care, giving confidence to providers, women and their families. For the purpose of these guidelines, referral to specialist services includes both referrals to Secondary Maternity or to a specialist, as defined in the Primary Maternity Services Notice 2007. It is intended that these guidelines should be reviewed at two yearly intervals.

### 2. Circumstances where guidelines may be varied

The guidelines acknowledge that General Practitioners, General Practitioner Obstetricians and Midwives have a different range of skills. The guidelines are not intended to restrict good clinical practice. There may be some flexibility in the use of these guidelines:

- a) The practitioner needs to make clinical judgements depending on each situation and some situations may require a course of action which differs from these guidelines. The practitioner will need to be able to justify her/his actions should s/he be required to do so by their professional body.

It is expected that the principles of informed consent will be followed with regard to these guidelines. If a woman elects not to follow the recommended course of action it is expected that the practitioner will take appropriate actions such as seeking advice, documenting discussions and exercising wise judgement as to the ongoing provision of care.

- b) It is also recognised that there may be some circumstances where the requirement to recommend consultation places an unnecessary restriction on experienced practitioners, particularly where there is no immediate access to specialist services. The individual practitioner can come to an appropriate arrangement with the specialist. It is agreed that, in accordance with good professional practice, a practitioner must record in the notes the reasons for the variation from the guidelines.

### 3. Timing of referrals

Referral to a specialist should occur in a timely manner. The gestational age is defined as the number of completed weeks, as determined by the LMP, ultrasound estimation or clinical assessment. For example, a baby is 24 weeks from 24 weeks 0 days until 24 weeks 6 days.

### 4. Referral process

Referral for most of the criteria will be to an Obstetrician and, for those listed under Services Following Birth, to a Paediatrician. However, in some instances, particularly those criteria involving associated medical conditions, a referral to another Specialist such as a Physician, Anaesthetist, Surgeon, Paediatrician, Infectious Diseases Specialist or Psychiatrist, may also be appropriate or be more appropriate. For some situations a multidisciplinary team will be necessary. Many of the criteria under Labour and Birth Services will require both Obstetrician and Paediatrician. It is recognised that referral to a woman's usual General

Practitioner may be appropriate in some circumstances. However these guidelines refer specifically to Specialists.

There are some particular circumstances, for example twins, where clinically the specialist needs to be responsible for care but the ongoing involvement of the primary practitioner is very important.

## 5. Levels of referral

These guidelines define three levels of referral and consequent action:

### Level 1

The Lead Maternity Carer **may recommend** to the woman (or parents in the case of the baby) **that a consultation with a specialist is warranted** given that her pregnancy, labour, birth or puerperium (or the baby) is or may be affected by the condition. *Where a consultation occurs, the decision regarding ongoing clinical roles/responsibilities must involve a three way discussion between the specialist, the Lead Maternity Carer and the woman concerned. This should include discussion on any need for and timing of specialist review.* The specialist will not automatically assume responsibility for ongoing care. This will depend on the clinical situation and the wishes of the individual woman.

### Level 2

The Lead Maternity Carer **must recommend** to the woman (or parents in the case of the baby) **that a consultation with a specialist is warranted** given that her pregnancy, labour, birth or puerperium (or the baby) is or may be affected by the condition. *Where a consultation occurs, the decision regarding ongoing clinical roles/responsibilities must involve a three way discussion between the specialist, the Lead Maternity Carer and the woman concerned. This should include discussion on any need for and timing of specialist review.* The specialist will not automatically assume responsibility for ongoing care. This will depend on the clinical situation and the wishes of the individual woman.

### Level 3

The Lead Maternity Carer **must recommend** to the woman (or parents in the case of the baby) **that the responsibility for her care be transferred** to a specialist given that her pregnancy, labour, birth or puerperium (or the baby) is or may be affected by the condition. *The decision regarding ongoing clinical roles/responsibilities must involve a three way discussion between the specialist, the Lead Maternity Carer and the woman concerned.* In most circumstances the specialist will assume ongoing responsibility and the role of the primary practitioner will be agreed between those involved. This should include discussion about timing of transfer back to the primary practitioner

CODE	CONDITION	DESCRIPTION	LEVEL
<b>MEDICAL CONDITIONS</b>			
<b>Anaesthetics</b>			
1001	Anaesthetic difficulties	Previous failure or complication (e.g. difficult intubation, failed epidural)	2
1002	Malignant hyperpyrexia or neuromuscular disease		3
<b>Autoimmune / Rheumatology</b>			
1003	SLE	Active, major organ involvement, on medication	3
1004		Inactive, no renal involvement, no hypertension, or only skin / joint problems	2
1005	Primary antiphospholipid syndrome	On warfarin, previous obstetric complications or maternal thrombosis	3
1006		No previous obstetric complications or maternal thrombosis	2

CODE	CONDITION	DESCRIPTION	LEVEL
<b>Cardiac</b>			
1007	Arrhythmia		2
1008	Cardiac valve disease	Mitral / aortic regurgitation	2
1009		Mitral / aortic stenosis	3
1010		Other	2
1011	Cardiac valve replacement		3
1012	Cardiomyopathy		3
1013	Congenital cardiac disease		2
1014	Hypertension	Mild, 140-150/90-100, not on medication	2
1015		Moderate to severe, on medication	3
1016	Ischaemic heart disease		3
1017	Pulmonary hypertension		3
1018	Palpitations	Recurrent, persistent or associated with other symptoms	2
<b>Endocrine</b>			
1019	Diabetes	Pre-existing (insulin dependent or non insulin dependent)	3
1020		Gestational, well controlled on diet	2
1021		Gestational, requiring insulin	3
1022	Thyroid disease		2
1023	Hypopituitarism		2
1024	Prolactinoma		2
<b>Gastroenterology</b>			
1025	Cholelithiasis		2
1026	Cholestasis of pregnancy		3
1027	Inflammatory bowel disease	Active, on medication	3
1028		Inactive	2
1029	Hepatitis	Acute /chronic	2
1030		Chronic active	3
1031	Oesophageal varices		3
<b>Genetic</b>			
1032	Any condition		2
1033	Marfans		3
<b>Haematological</b>			
1034	Anaemia	Hb < 90 g/l, not responding to treatment	2
1035	Haemolytic anaemia		3
1036	Bleeding disorders	Including Von Willebrands	2
1037	Thalassaemia		2
1038	Thrombocytopaenia		2
1039	Sickle cell disease		3
1040	Thromboembolism	E.g. previous DVT, PE	3
1041	Thrombophilia		3
<b>Infectious Diseases</b>			
1042	CMV / toxoplasmosis	Acute	3
1043	Group B strep		1
1044	HIV positive		3
1045	Listeriosis	Acute	3
1046	Rubella		2
1047	Syphilis		2
1048	Tuberculosis		2

CODE	CONDITION	DESCRIPTION	LEVEL
1049	Varicella	Acute or contact	2
<b>Neurological</b>			
1050	AV malformation, CVA, TIAs		3
1051	Epilepsy	Controlled	2
1052		Poor control or multiple medications	3
1053	Multiple sclerosis		2
1054	Myasthenia gravis		3
1055	Spinal cord lesion		3
1056	Muscular Dystrophy or Myotonic Dystrophy		3
1057	Psychiatric		
1058	Alcohol or drug dependency		2
1059	On medication or unstable condition		2
1060	Psychiatric condition		1
<b>Renal Disease</b>			
1061	Glomerulonephritis		3
1062	Proteinuria	Chronic	2
1063	Pyleonephritis		2
1064	Renal failure		3
1065	Renal abnormality or vesico-ureteric reflux		2
<b>Respiratory Disease</b>			
1066	Asthma	Mild	1
1067		Moderate (i.e. oral steroids on two occasions in the last year & maintenance therapy)	2
1068		Severe (i.e. hospitalisation in the last 2 years, any previous admission to intensive care unit, FEV <sub>1</sub> <70% predicted in absence of acute attack, requiring bronchodilator therapy daily, requiring > 1200 mcg budisonide or equivalent inhaled steroids)	3
1069		Other significant disease	2
<b>PREVIOUS GYNAECOLOGICAL CONDITIONS OR SURGERY</b>			
2001	Cervical surgery including cone biopsy, laser excision or LLETZ	Without subsequent vaginal birth	2
2002		With subsequent vaginal birth	1
2003	Congenital abnormalities of the uterus	Without previous normal pregnancy outcome	2
2004		With previous normal pregnancy outcome	1
2005	Infertility	Clomiphene pregnancy or AIH	1
2006		IVF or GIFT	2
2007	Previous uterine surgery	Myomectomy	2
2008		Previous uterine perforation	2
2009	Prolapse	Previous surgery	2
2010	Vaginal Abnormality	E.g. Septum	2
<b>PREVIOUS OBSTETRIC HISTORY</b>			
3001	Previous placental abruption		2
3002	Autoimmune (foetal) thrombocytopaenia		3
3003	Caesarean section		2
3004	Cervical Incompetence		3
3005	Trophoblastic disease	Hydatidiform mole or vesicular mole, without subsequent normal pregnancy	2
3006		With subsequent normal pregnancy	1
3007	Hypertensive disease	Pre-eclampsia	1
3008		Pre-eclampsia with significant IUGR, requiring delivery < 34 weeks or with multi-organ involvement	2

CODE	CONDITION	DESCRIPTION	LEVEL
3009	Infant large for gestational age	> 4500g	1
3010	Intra-uterine growth restriction (IUGR)	Birth weight < 5 <sup>th</sup> percentile	2
3011	Manual removal	With clinically adherent placenta	2
3012	Perinatal death		2
3013	Postpartum haemorrhage	1000 mls, > 1000 mls	2
3014	Preterm birth	< 35 weeks	2
3015	Recurrent miscarriage	3 or more	2
3016	Shoulder dystocia		2
3017	Termination of pregnancy	3 or more	2
<b>CURRENT PREGNANCY</b>			
4001	Acute abdominal pain		2
4002	Abdominal trauma		2
4003	Abnormal CTG	Refer RANZCOG guidelines	2
4004	Antepartum haemorrhage		2
4005	Blood group antibodies		2
4006	Eclampsia		3
4007	Foetal abnormality		2
4008	Gestational proteinuria	> 0.3g / 24 hours	2
4009	Gestational hypertension		2
4010	Intrauterine death		3
4011	IUGR / SGA	AC < 5 <sup>th</sup> percentile, normal liquor	2
4012		AC < 5 <sup>th</sup> percentile, reduced liquor or abnormal umbilical doppler	3
4013	Large for dates	Uterine size > 4 weeks greater than expected, abdominal circumference or estimated foetal weight > 90 <sup>th</sup> percentile	2
4014	Low maternal weight	BMI < 17	1
4015	Malignancy		3
4016	Malpresentation	> 36 weeks; breech, transverse, oblique or unstable lie	2
4017	Morbid obesity		3
4018	Multiple pregnancy	Twins or higher order multiples	3
4019	Oligohydramnios	Pool depth < 2 cms on scan	2
4020	Placenta praevia	At or > 32 weeks	3
4021	Polyhydramnios	Scan pools > 10 cms	3
4022	Pre-eclampsia	BP > 140/90 (or rise of > 30/15) and any of; 1. Proteinuria > 0.3g / 24 hours 2. Platelets < 150 x 10 <sup>9</sup> /l 3. Abnormal renal or liver function 4. Imminent eclampsia / eclampsia	3
4023	Premature rupture of membranes	< 37 weeks and not in labour	2
4024	Prolonged pregnancy	41 weeks, > 41 weeks - assessment, discussion & plan	2
4025	Premature labour	34-36 weeks	2
4026		< 34 weeks	3
4027	Prelabour rupture of membranes at term	Assessment, discussion & plan	2
4028	Reduced foetal movements		1
4029	Herpes genitalis	Active lesions	2
4030	Uncertain dates at term by best estimate		2
4031	Uterine fibroids		2
4032	Urinary Track Infection (UTI)	Recurrent	2
<b>LABOUR &amp; BIRTH - FIRST &amp; SECOND STAGE</b>			
5001	Amniotic fluid embolism		3
5002	Anhydramnios		3

CODE	CONDITION	DESCRIPTION	LEVEL
5003	Cerebral anoxia / cardiac arrest		3
5004	Complications of anaesthetic		3
5005	Complications of other analgesia or sedation		2
5006	Compound presentation		3
5007	Cord prolapse or presentation		3
5008	Deep transverse arrest		3
5009	Epidural		2
5010	Failed instrumental vaginal delivery		3
5011	Foetal heart rate abnormalities		2
5012	Hypertonic uterus		2
5013	Induction of labour		2
5014	Instrumental vaginal delivery	Low (+2 or lower; head easily visible)	2
5015		Head not easily visible, 0 or +1	3
5016	Intrapartum haemorrhage		3
5017	Maternal tachycardia	Sustained	2
5018	Meconium liquor	Moderate or thick	2
5019	Obstetric shock		3
5020	Obstructed labour		3
5021	Prolonged first stage of labour	Nullipara – poor progress after ARM and syntocinon infusion	2
5022		Multipara – poor progress after ARM	2
5023	Prolonged second stage of labour	> 2 hours nullipara or > 1 hour multipara with no progress	2
5024	Pyrexia in labour	> 38 degrees with or without foetal tachycardia	2
5025	Shoulder dystocia		2
<b>LABOUR &amp; BIRTH - THIRD STAGE</b>			
6001	3rd & 4th degree lacerations		3
6002	Cervical laceration		3
6003	Post partum haemorrhage (PPH)	> 600 mls with ongoing bleeding	2
6004	Retained Placenta		2
6005	Shock		3
6006	Vaginal laceration	Complex	2
6007	Vulval and perineal haematoma		3
<b>SERVICES FOLLOWING BIRTH – MOTHER</b>			
7001	Breast abscess	Not settling with antibiotics	2
7002	Neonatal death		2
7003	Post delivery neurological deficit		2
7004	Postnatal depression	Not psychotic	2
7005		Psychotic	3
7006	Puerperal sepsis	Temp > 37.6, maternal tachycardia	3
7007	Pyrexia of unknown origin	With rigors or shock	2
7008	Secondary PPH		2
<b>SERVICES FOLLOWING BIRTH - BABY</b>			
<b>General</b>			
8001	Abnormal neonatal examination	Minor abnormalities not specified elsewhere	2
8002	Foetal ultrasound abnormality	Any	2
8003	Malformations	Congenital anomalies that may require early treatment	2
<b>Cardiovascular</b>			
8004		Heart murmur no symptoms	2
8005		Heart murmur with symptoms	3

CODE	CONDITION	DESCRIPTION	LEVEL
8006		Persistent or recurrent cyanosis	3
<b>CNS</b>			
8007		Microcephaly – head circumference (HC) < 3rd %	2
8008		Convulsions or unresponsiveness	3
8009		Irritability	2
8010		Limpness, lethargy, hypotonia,	2
8011		Severe depression (e.g. apgar 6 or less at 5 minutes with little improvement by 10 minutes)	3
8012		Less severe depression than above Required active resuscitation	2
<b>Growth and Feeding</b>			
8013		Poor suck or feeding not related to gestation	2
8014	Feeding	Dehydration or > 10% weight loss since birth	2
8015		Persistent vomiting without blood or bile	2
8016	Intra-uterine growth restriction	Birthweight < 5th % or asymmetric growth,	2
8017	Low birth weight	Birth weight 2000 - 2500g	2
8018		Birth weight < 2000g	3
8019	Poor weight gain	Birth weight not regained by 14 days	2
8020	Postmaturity	With evidence of growth retardation	2
8021	Preterm	Gestation 35-36 weeks	2
8022		Gestation < 35 weeks	3
<b>Gastrointestinal</b>			
8023		Unable to pass a gastric tube in a mucousy baby	3
8024		Abdominal distension or mass	2
8025		Persistent or bile stained vomiting or fresh blood in stools	3
8026		No passage of meconium by 24 to 36 hours	2
8027		Inguinal hernia	2
<b>Genitourinary</b>			
8028		Failure to pass urine in any 24 to 36 hour period	2
8029		Hypospadias or foreskin abnormality	2
8030		Undescended testes	2
<b>Haematology</b>			
8031		Evidence of a bleeding tendency: haematemesis, melena, haematuria, purpura, generalised petechiae	3
8032		Haemorrhage from cord or other site	3
8033		Maternal isoimmunisation: rhesus or other antibodies. Refer prior to delivery	3
8034		Maternal thrombocytopenia	2
<b>Infection</b>			
8035	Risk factor for sepsis - membrane rupture > 24 hours	Baby well, mother may have received perinatal antibiotics Screening of baby recommended	2
8036	Maternal chorio-amnionitis: foetal tachycardia, maternal pyrexia, offensive liquor	Baby apparently well or unwell	3
8037	Temperature instability	Temp < 36.0 C or > 37.5 C confirmed within one hour following appropriate management	2
<b>Jaundice</b>			
8038		Any in first 24 hours	3
8039		Bilirubin > 250 micromol/l in first 48 hours	2
8040		Bilirubin > 300 micromol/l at any time	2

CODE	CONDITION	DESCRIPTION	LEVEL
8041		Late jaundice: visible or > 150 micromol/l from 2 weeks in term infant and 3 weeks in preterm infant.	2
8042		Significant jaundice in previous infant	2
<b>Maternal Factors</b>			
8043	Infant of a mother with a history of substance or alcohol abuse	E.g. methadone, marijuana, alcohol, codeine, valium	2
8044	Infant of diabetic mother	With any abnormal findings e.g. hypoglycaemia, poor feeding, macrosomic	3
8045		Apparently normal infant	2
8046	Intrauterine infection	Toxoplasmosis, rubella, CMV, other. Referral before delivery often appropriate	2
8047	Maternal request	Anxiety regarding normality	2
8048	Maternal medication with risk to baby:	E.g. carbimazole, antipsychotics, antidepressants, anticonvulsants	2
8049	Maternal/family history with risk factors for baby	E.g. vesico-ureteric reflux, congenital heart disease, deafness, Graves disease, syphilis, severe handicap in parent, bipolar disease, schizophrenia, other psychiatric condition	2
8050	Miscellaneous	Previous neonatal death, SIDS, congenital abnormality	2
<b>Orthopaedics</b>			
8051	Hips	Unstable hips, breech delivery, family history of dislocated hips	2
8052	Feet	Talipes equinovarus or significant positional foot deformity	2
<b>Respiratory</b>			
8053		Any cyanosis, persistent grunting, pallor	2
8054		Apnoea	3
8055		Tachypnoea with respiratory rate greater than 60/min and respiratory distress	3
8056		Stridor, nasal obstruction, or respiratory symptoms not specified elsewhere	2

## Appendix 2. Primary Maternity Services Funding Schedule

New Zealand primary maternity services are funded under *Section 88 of the New Zealand Public Health and Disability Act 2000* (previously Section 51) using a funding model that was introduced in 1996.<sup>33</sup> Payments are made for modules of service provided by a LMC with additional payments available for single service episodes on a fee-for-service basis.<sup>31</sup> Secondary and tertiary maternity services are bulk funded.

**Table 50: Maternity Services Module Payment Schedule**

Mod	Lead Maternity Care	1996 <sup>31</sup>	2002 <sup>32</sup>	2005 <sup>175</sup>	2007 <sup>33</sup>
1	Registration	75.00	75.00	67.00	
2	Second Trimester	165.00	90.00	130.00	300.00
3	Third Trimester	230.00	220.00	260.00	290.00
4	Labour and Birth				
	(a) First Birth	950.00	950.00	950.00	1090.00
	(b) VBAC	X	950.00	950.00	1090.00
	(c) Subsequent Birth	750.00	750.00	750.00	855.00
	Labour and Birth - GP/Obstetrician used hospital MW services				
	(a) First Birth	X	450.00	450.00	470.00
	(b) VBAC	X	450.00	450.00	470.00
	(c) Subsequent Birth	X	350.00	350.00	360.00
	Labour and Birth – hospital MW services				
	(a) First Birth	X	500.00	500.00	X
	(b) VBAC	X	500.00	500.00	X
	(c) Subsequent Birth	X	400.00	400.00	X
	Homebirth Supplies and Services	180.00	400.00	400.00	440.00
	Birthing Unit Services	100.00	250.00	250.00	250.00
	Labour and birth (exceptional circumstances)	X	X	X	310.00
	Labour and birth (rural support)	X	X	X	500.00
5	Services Following Birth				
	(a) Inpatient Postnatal Care	280.00	400.00	400.00	480.00
	(b) No Inpatient Postnatal Care	380.00	500.00	500.00	540.00
	Services following birth - GP/Obstetrician used hospital MW services				
	(a) Inpatient Postnatal Care	X	80.00	80.00	90.00
	(b) No Inpatient Postnatal Care	X	110.00	110.00	120.00
	Services following birth - Hospital MW Services				
	(a) Inpatient Postnatal Care	X	320.00	320.00	X
	(b) No Inpatient Postnatal Care	X	390.00	390.00	X
	Rural Travel				
	(a) Semi rural	200.00	150.00	150.00	150.00
	(b) Rural	200.00	200.00	225.00	225.00
	(c) Remote Rural	350.00	350.00	400.00	400.00
	Additional Home Visits	X	125.00	145.00	X

Source: New Zealand Government<sup>33</sup>. Note: 1996 and 2002 prices are GST inclusive; 2005 and 2007 prices are GST exclusive. Mod: Module.

**Table 51: Maternity Services Single Service Episode Payment Schedule**

<b>Single Service Episodes</b>	<b>1996<sup>31</sup></b>	<b>2002<sup>32</sup></b>	<b>2005<sup>175</sup></b>	<b>2007<sup>33</sup></b>
Assessment Prior to Termination of Pregnancy	X	50.00	44.44	150.00
Information Re: Options of Care	10.00	X	X	X
Pregnancy Care	25.00	32.50	28.29	110.00
Urgent Normal Hours Pregnancy Care	X	X	X	40.00
Urgent Out of Hours Pregnancy Care	45.00	45.00	40.00	60.00
Threatened Miscarriage Services	45.00	45.00	40.00	150.00
Miscarriage Services	75.00	50.00	44.44	150.00
Ultrasound Scans	79.60	80.00	78.00	78.00
Exceptional Circumstances	X	300.00	266.67	X
Non-LMC labour and birth (rural support)	X	X	X	500.00
Postnatal Consultation by Non-LMC	X	32.50	29.89	40.00
Consulting Specialist Obstetrician Services				
First Trimester – First Consultation	83.80	86.00	76.44	80.00
First Trimester – Subsequent Consultation	41.90	43.00	38.22	40.00
Other Than First Trimester – First consultations (incl USS budget for first and subsequent consultations)	108.00	X	X	X
Other Than First Trimester – Subsequent consultations	41.90	X	X	X
Specialist Obstetrician Labour and birth Services	425.00	425.00	377.78	X
Specialist Anaesthetic Services	28.20/u	260.00	231.11	X
Specialist Paediatrician Services				
Consultation	86.00	100.00	88.89	90.00
Further Consultation	43.00	43.00	38.22	40.00
Attendance at delivery	76.80+	165.00	146.67	X
Urgent Paediatrician Attendance	129.70	X	X	X

Note: 1996 and 2002 prices are GST inclusive; 2005 and 2007 prices are GST exclusive.

## Appendix 3. New Zealand Maternity Guidelines

Table 52 summarises publically available documents that provide guidelines for care during pregnancy, delivery, and the early post-natal period for providers of maternity services.

**Table 52: National Guidelines, Consensus Statements, and Standards Informing Maternity Care in New Zealand**

Scope	Title	Source	Year
<b>Antenatal</b>			
Screening	Guidelines for maternity providers offering antenatal screening for Down syndrome and other conditions in New Zealand	NSU <sup>176</sup>	2009
	Immunisation Handbook - Chapter 3: Recommended screening for hepatitis B of women in early pregnancy and management of a baby of a HBsAg positive woman	NZCOM <sup>177</sup>	1996
	NZCOM Consensus Statement: Cervical Screening	NZCOM <sup>178</sup>	2004
	NZCOM Consensus Statement: Group B Streptococcus	NZCOM <sup>179</sup>	2009
Sexually Transmitted Infections	Guidelines for maternity providers offering antenatal HIV screening in New Zealand	NSU <sup>180</sup>	2008
	NZCOM Consensus Statement: HIV Screening	MOH <sup>181</sup>	2006
	NZCOM Consensus Statement: Sexually Transmitted Infections Screening	NZCOM <sup>182</sup>	2008
	Chlamydia Management Guidelines	MOH <sup>183</sup>	2008
Family Violence	NZCOM Consensus Statement: Family Violence	NZCOM <sup>184</sup>	2005
	Family Violence Intervention Guidelines: Child and Partner Abuse	MOH <sup>106</sup>	2002
Oral Health	NZCOM Consensus Statement: Oral Health <sup>185</sup>	NZCOM	2008
Nutrition	Food and Nutrition Guidelines for Healthy Pregnant and Breastfeeding Women	MOH <sup>186</sup>	2006
	Food Safety in Pregnancy	NZFSA <sup>187</sup>	2009
Referral	Guidelines for Consultation with Obstetric and Related Specialist Medical Services (Referral Guidelines)	MOH <sup>102</sup>	2007
	Tertiary maternity services specification	NSFL <sup>36</sup>	2003
	Transfer Guidelines: Transfer of a woman under the care of an LMC midwife to a secondary / tertiary obstetric service or facility within the New Zealand maternity services context	NZCOM <sup>188</sup>	2008
Substance Use	New Zealand Smoking Cessation Guidelines	MOH <sup>189</sup>	2007
	Practice Guidelines for Opioid Substitution Treatment in New Zealand 2008	MOH <sup>190</sup>	2008
	NZCOM Consensus Statement: Alcohol And Pregnancy	NZCOM <sup>191</sup>	2009
Medical Conditions	Gestational Diabetes Mellitus in New Zealand: Technical report from the gestational diabetes mellitus technical working party (draft)	MOH <sup>192</sup>	2007
	NZCOM Consensus Statement: Gestational Diabetes	NZCOM <sup>193</sup>	2009
	Guidelines for the Management of Hypertensive Disorders of Pregnancy 2008	SOMANZ <sup>194</sup>	2008
<b>Labour and Delivery</b>			
Labour	NZCOM Consensus Statement: Foetal monitoring in Labour	NZCOM <sup>195</sup>	2005
	NZCOM Consensus Statement: Artificial Rupture of Membranes	NZCOM <sup>196</sup>	2008
	NZCOM Consensus Statement: Third Stage of Labour	NZCOM <sup>197</sup>	2006
Delivery	NZCOM Consensus Statement: The use of water in labour and birth	NZCOM <sup>198</sup>	2002
	NZCOM Consensus Statement: Vaginal birth after Caesarean Section	NZCOM <sup>199</sup>	1996
	Care of Women with Breech Presentation or Previous Caesarean Birth	NZGG <sup>200</sup>	2004

Scope	Title	Source	Year
<b>Postnatal</b>			
Vitamin K	NZCOM Consensus Statement: Vitamin K	NZCOM <sup>201</sup>	2000
	Vitamin K Prophylaxis in the Newborn Consensus Statement	Medsafe <sup>202</sup>	2001
Screening	Guidelines for practitioners providing services within the Newborn Metabolic Screening Programme in New Zealand	NSU <sup>203</sup>	2010
	Universal Newborn Hearing Screening and Early Intervention Programme: National Policy and Quality Standards	NSU <sup>204</sup>	2010
Breastfeeding	Food and Nutrition Guidelines for Healthy Infants and Toddlers (Aged 0–2)	MOH <sup>205</sup>	2008
	Implementing and Monitoring the International Code of Marketing of Breast-milk Substitutes in New Zealand: The Code in New Zealand	MOH <sup>206</sup>	2007
	WHO / UNICEF Baby Friendly Hospital Initiative: Documents for Aotearoa New Zealand	NZBA <sup>207</sup>	2008
	NZCOM Consensus Statement: Breastfeeding	NZCOM <sup>208</sup>	2008
Immunisation	Immunisation Handbook	MOH <sup>181</sup>	2006
	NZCOM Consensus Statement: Immunisation	NZCOM <sup>209</sup>	2009
Well Child	Well Child/Tamariki Ora Schedule: Birth, to four to six weeks	MOH <sup>210</sup>	2010

Note: MOH: Ministry of Health; NSU: National Screening Unit; NZGGG: New Zealand Guidelines Group; SOMANZ: Society of Obstetric Medicine of Australia and New Zealand; NSFL: Nationwide Service Framework Library; NZCOM: NZ College of Midwives; NZFSA: NZ Food Safety Authority.

# Appendix 4. CMDHB Maternity Registration Form



Affix patient's identification label here or NHI number

NHI No.

## MATERNITY REGISTRATION FORM – Section 1 – Patient Information

<b>Office Use Only:</b>	<b>Old Records Requested:</b> <input type="checkbox"/>
<b>Date received:</b>	<b>1<sup>st</sup> Appointment:</b>
<b>Place of Antenatal Care:</b>	<b>PIMS Referral logged</b> <input type="checkbox"/> <b>Healthware Booked</b> <input type="checkbox"/>
<b>Comment:</b>	

<b>Lead Maternity Carer's Name:</b>	
<b>Self-employed LMC</b>	<b>CMDHB Options of Care</b>
Midwife <input type="checkbox"/>	Closed Unit <input type="checkbox"/> Community Midwife Name:
Obstetrician <input type="checkbox"/>	Caseloading Midwife <input type="checkbox"/> Name:
GP <input type="checkbox"/>	Shared Care <input type="checkbox"/> GP only (ineligible for care) <input type="checkbox"/>
<b>Intended Place of Delivery</b>	

<b>Family Details:</b>	<b>Family Doctor's Name:</b>
Title:	Family Doctor's Address:
Last Name:	
Given Names:	<b>First Contact Details:</b>
Previous Last Name:	Name:
Any other names:	Relationship:
Date of Birth:	Address:
Address:	
	Home Phone No:
	Work Phone No:
Home Phone No:	Mobile Phone No:
Work Phone No:	<b>Second Contact Details:</b>
Mobile Phone No:	Name:
Marital Status:	Relationship:
Country of Birth:	Address:
Spoken Language:	
Interpreter required YES <input type="checkbox"/> NO <input type="checkbox"/>	Home Phone No:
Resident <input type="checkbox"/> Non-Resident <input type="checkbox"/>	Work Phone No:
Date of entry to NZ	Mobile Phone No:

<b>Father of Baby:</b>	<b>Mother's Ethnicity:</b> <small>What ethnic group does the baby's mother belong to?</small>	<b>Baby's Ethnicity:</b> <small>What ethnic group will the baby belong to?</small>
Last Name:	New Zealand European <input type="checkbox"/>	New Zealand European <input type="checkbox"/>
First Name:	Maori <input type="checkbox"/>	Maori <input type="checkbox"/>
Given Names:	Samoan <input type="checkbox"/>	Samoan <input type="checkbox"/>
Address:	Cook Island Maori <input type="checkbox"/>	Cook Island Maori <input type="checkbox"/>
	Tongan <input type="checkbox"/>	Tongan <input type="checkbox"/>
	Niuean <input type="checkbox"/>	Niuean <input type="checkbox"/>
Country of Birth	Chinese <input type="checkbox"/>	Chinese <input type="checkbox"/>
Resident <input type="checkbox"/> Non-Resident <input type="checkbox"/>	Indian <input type="checkbox"/>	Indian <input type="checkbox"/>
Date of entry to NZ	Fijian <input type="checkbox"/>	Fijian <input type="checkbox"/>
<b>Additional Comments:</b>	Other <input type="checkbox"/>	Other <input type="checkbox"/>
	Patient does not know <input type="checkbox"/>	Patient does not know <input type="checkbox"/>
	Patient refused to answer <input type="checkbox"/>	Patient refused to answer <input type="checkbox"/>
	Question not asked <input type="checkbox"/>	Question not asked <input type="checkbox"/>
	Response unidentifiable <input type="checkbox"/>	Response unidentifiable <input type="checkbox"/>

<b>Completed by:</b>	
Name:	Designation:
Signature:	Date:

Re-Order No. OBST9 Revised October 2009

MATERNITY REGISTRATION FORM – Section 1 – Patient Information

Affix patient's identification label here or NHI number

**MATERNITY REGISTRATION FORM – Section 2 – Clinical Information**

<b>Family Details:</b>	
Last Name:	Given Names:
Address:	Date of Birth:

Menstrual Cycle:	LMP:	Gravida:	Height:
Regular: <input type="checkbox"/>	EDD by date:	Parity:	Weight:
Irregular: <input type="checkbox"/>	EDD by scan:	Blood Group:	Amnio Required: <b>Yes / No</b>

**Previous Pregnancies:**

Date	Place of Delivery	Duration (wks)	Complications Antenatal, postnatal, Intrapartum	Delivery Type	Length of Labour	Induced Yes/No	Sex & name of baby	Weight	No months BF	Alive NND SB
/ /										
/ /										
/ /										
/ /										
/ /										
/ /										
/ /										
/ /										
/ /										
/ /										

**Woman's Medical History:**

Medical History	Significant Gynae History	Family History	Sexual Health/HIV
Rheumatic Fever <input type="checkbox"/>	Ectopic pregnancy <input type="checkbox"/>	Adopted <input type="checkbox"/>	HIV screening offered Yes <input type="checkbox"/> No <input type="checkbox"/>
Cardiac Disease <input type="checkbox"/>	Molar Pregnancy <input type="checkbox"/>	Hypertension <input type="checkbox"/>	HIV screening completed Yes <input type="checkbox"/> No <input type="checkbox"/>
Hypertension <input type="checkbox"/>	Laparotomy <input type="checkbox"/>	Multi-pregnancy <input type="checkbox"/>	STI _____
Epilepsy <input type="checkbox"/> Asthma <input type="checkbox"/>	Myomectomy <input type="checkbox"/>	Deafness <input type="checkbox"/>	Treatment _____
Diabetes <input type="checkbox"/> Coagulation <input type="checkbox"/>	Tubal ligation <input type="checkbox"/>	Diabetes <input type="checkbox"/>	TB _____
Thyroid <input type="checkbox"/> UTI/Renal <input type="checkbox"/>		Asthma <input type="checkbox"/>	Date _____
Hepatitis B <input type="checkbox"/> Mental Health <input type="checkbox"/>	<b>Smear History:</b>	Other – state: _____	<b>Contraceptive History:</b>
Hepatitis C <input type="checkbox"/> Autoimmune <input type="checkbox"/>	Date of last smear: _____		
Other/Surgery – state: _____	Previous abnormal smears <input type="checkbox"/>		
	Date: _____		
	Treatment: _____		
	Cone biopsy: _____		

Alcohol	Smoking Status	Other Substances	Drug/Med Allergies	Blood Transfusion	Current Medication
Yes <input type="checkbox"/>	Never smoked <input type="checkbox"/>	Yes <input type="checkbox"/>	Yes <input type="checkbox"/>	Yes <input type="checkbox"/>	Yes <input type="checkbox"/>
Amount _____	Current smoker <input type="checkbox"/>	No <input type="checkbox"/>	No <input type="checkbox"/>	State when: _____	State: _____
No <input type="checkbox"/>	Past smoker <input type="checkbox"/>	IV User <input type="checkbox"/>	Not known <input type="checkbox"/>	No <input type="checkbox"/>	No <input type="checkbox"/>
	Less than 12 months ago <input type="checkbox"/>	Not known <input type="checkbox"/>	State: _____		Not known <input type="checkbox"/>
	More than 12 months ago <input type="checkbox"/>	State: _____			
	Smokefree environment Yes <input type="checkbox"/> No <input type="checkbox"/>				

**Completed by:**

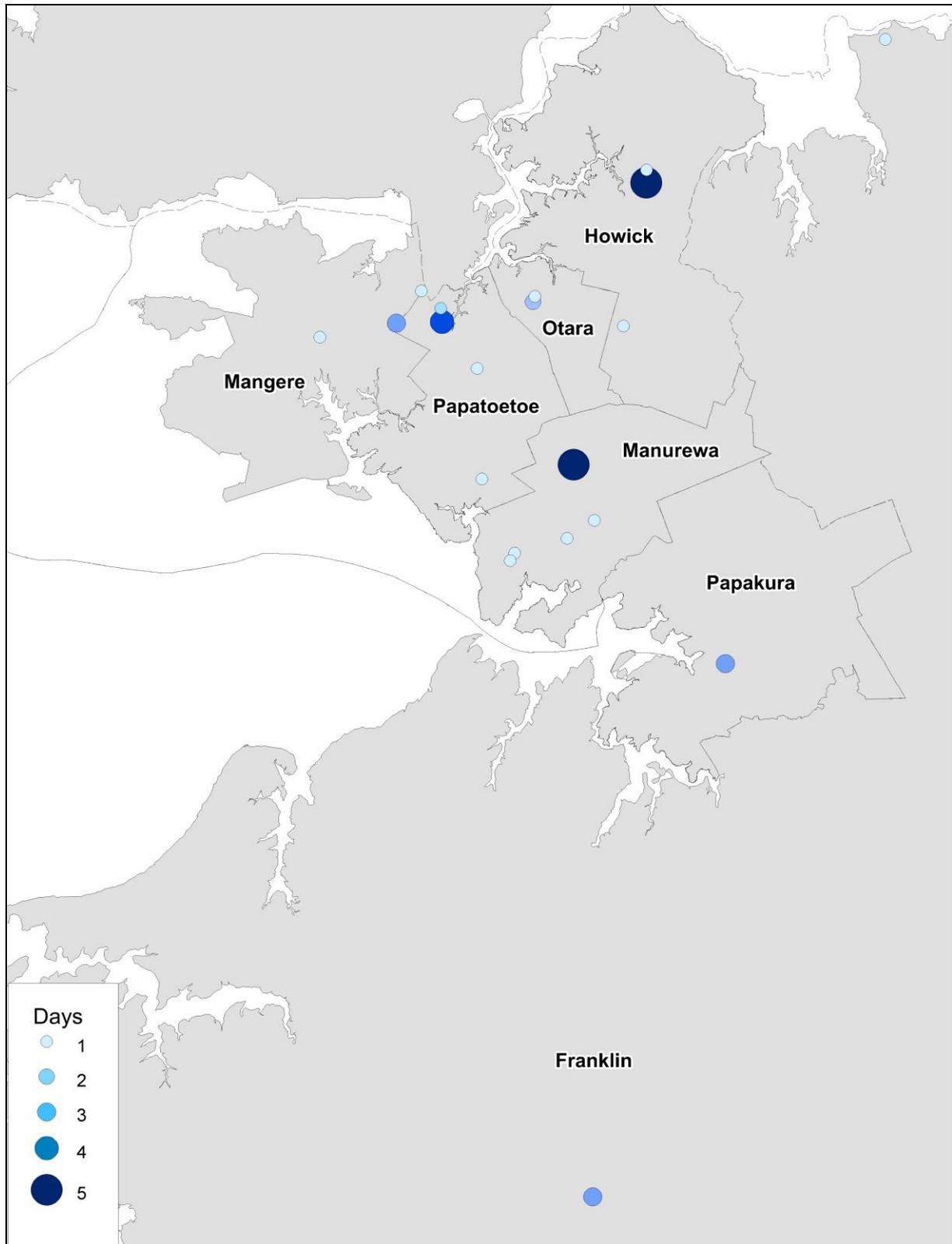
Name:	Designation:
Signature:	Date:

I certify that the information Sections 1 and 2 are true and correct. I understand that I can change my Maternity Carer at any time.

Birth Mother or Caregiver Signature: \_\_\_\_\_ Date: \_\_\_\_\_

## Appendix 5. CMDHB Antenatal Clinic Locations

Figure 44: Location of CMDHB Provided Antenatal Clinics



Note: Circle size denotes clinic frequency per week

## Appendix 6. CMDHB Antenatal Clinic Non-Attendance Sample Letters

Figure 45: Letter Following First Non-Attendance of a CMDHB Antenatal Clinic

7th October 2010

Miss Maternity Patient  
123 Road Street  
Manukau City

Patient Number:

Dear Miss Patient

From our records, it appears you were unable to attend your appointment on Wednesday 6<sup>th</sup> October with the CMDHB Midwife.

As early antenatal care reduces the risk to mother and baby we would strongly advise you come and see the midwife and have made another appointment

**On: Wednesday 13<sup>th</sup> October 2010**  
**Time: 11:00am**  
**Location: Otara Union Health Centre**  
**3/100 Alexander Crescent**  
**Otara**  
**Manukau**

- If this appointment still does not suit you and wish to change it phone Maternity Administration between 8.30am – 4.30pm Monday to Friday on (09) **276 0044**  
**Ext. 2976 for Manurewa patients**  
**Ext. 2383 for Mangere patients**  
**Ext. 2520 for Otara and Otahuhu patients**  
**Ext. 2072 for Papatoetoe patients**

If the telephone is busy or unattended, leave a message on the answer phone stating your name, patient number and reliable contact phone number.

- If you can attend this appointment please confirm by phoning our call centre on (09) 277 1660 between 8.30am - 4.30pm Monday to Friday

Thank you

Maternity Administration Services  
Women's Health  
Middlemore Hospital

**Figure 46: Letter Following Second Non-Attendance of a CMDHB Antenatal Clinic - Letter of Responsibility to Patient**

7<sup>th</sup> November 2010

Miss Maternity Patient  
123 Road Street  
Manukau City

**Your Patient Number:**

Dear Mrs Patient

From our records it appears you did not attend your second appointment with a CMDHB Midwife

**On: Wednesday 13<sup>th</sup> October 2010**  
**Time: 11:00am**  
**Location: Otara Union Health Centre**  
**3/100 Alexander Crescent**  
**Otara**  
**Manukau**

Due to the high demand for antenatal appointments we have not scheduled you another appointment with the Midwife. However, you are welcome to contact us and we can discuss further follow up with you. It has been proven that regular antenatal care improves the health of both mother and baby.

**Please contact Maternity Administration between 8.30am – 4.30pm on (09) 276 0044:**

**Ext. 2976 for Manurewa patients**  
**Ext. 2383 for Mangere patients**  
**Ext. 2520 for Otara and Otahuhu patients**  
**Ext. 2072 for Papatoetoe patients**

If you have already received an appointment letter to attend a Consultant clinic, we encourage you to attend this appointment as a Consultant has reviewed your referral and requested that appointment was made for you to discuss a particular aspect of your pregnancy.

Thank you

**Maternity Administration Services**  
**Women's Health**  
**Middlemore Hospital**

## Appendix 7. CMDHB Antenatal Visit Schedules

When a women is booked for Shared Care or Closed Unit Care she is provided with a schedule of usual antenatal visits as shown below.

**Figure 47: Usual Antenatal Visits for Women with CMDHB Shared or Closed Unit Care**

Shared Care		Closed Unit	
Gest	Care Provided	Gest	Care Provided
<b>0-15</b>	First visit &/or Booking <ul style="list-style-type: none"> <li>Options of care discussed</li> <li>First antenatal bloods ordered</li> <li>Physical exam +/- swabs/smear</li> <li>Birth care plan started</li> <li>Ultrasound scan arranged</li> </ul>	<b>&lt;15</b>	See GP
<b>18</b>	Midwife or Hospital Doctor <ul style="list-style-type: none"> <li>Check that ultrasound has been arranged</li> <li>Care plan continued</li> <li>Choice of maternity unit &amp; postnatal stay explained</li> <li>Antenatal class information</li> </ul>	<b>15-18</b>	First Visit <ul style="list-style-type: none"> <li>Options of care discussed</li> <li>First antenatal bloods ordered</li> <li>Physical exam +/- swabs/smear</li> <li>Birth care plan started</li> <li>Ultrasound scan arranged</li> <li>Choice of maternity unit &amp; postnatal stay explained</li> <li>Antenatal class information</li> </ul>
<b>24</b>	<ul style="list-style-type: none"> <li>Polycose test ordered</li> <li>Second antenatal bloods ordered</li> </ul>	<b>24-28</b>	<ul style="list-style-type: none"> <li>Polycose test ordered</li> <li>Second antenatal bloods ordered</li> <li>Car seat information</li> <li>Discuss monitoring of baby's movement chart</li> </ul>
<b>28</b>	<ul style="list-style-type: none"> <li>Continue birth planning</li> <li>Car seat information</li> <li>Discuss monitoring of baby's movement chart</li> </ul>		
<b>32</b>	<ul style="list-style-type: none"> <li>Ongoing pregnancy monitoring</li> </ul>	<b>31</b>	<ul style="list-style-type: none"> <li>Continue birth planning</li> <li>Breastfeeding advice given</li> </ul>
<b>34</b>	<ul style="list-style-type: none"> <li>Ongoing pregnancy monitoring</li> </ul>		
<b>36</b>	<ul style="list-style-type: none"> <li>Ongoing pregnancy monitoring</li> <li>Third antenatal blood tests ordered</li> <li>Discuss well child provider options</li> </ul>	<b>36</b>	<ul style="list-style-type: none"> <li>Finalise birth plan</li> <li>Third antenatal blood tests ordered</li> <li>Discuss well child provider options</li> </ul>
<b>37</b>	<ul style="list-style-type: none"> <li>Ongoing pregnancy monitoring</li> </ul>		
<b>38</b>	<ul style="list-style-type: none"> <li>Ongoing pregnancy monitoring</li> </ul>	<b>38</b>	<ul style="list-style-type: none"> <li>Ongoing pregnancy monitoring</li> </ul>
<b>39</b>	<ul style="list-style-type: none"> <li>Ongoing pregnancy monitoring</li> </ul>		
<b>40</b>	<ul style="list-style-type: none"> <li>Review and finalise care plan</li> <li>Discuss options if pregnancy goes over due dates</li> </ul>	<b>40</b>	<ul style="list-style-type: none"> <li>Discuss options if pregnancy goes over due dates</li> </ul>
<b>41</b>	<ul style="list-style-type: none"> <li>GP to arrange appointment with Hospital Doctor to discuss induction of labour</li> </ul>	<b>41</b>	<ul style="list-style-type: none"> <li>Discuss monitoring of pregnancy if overdue</li> <li>Appointment with Hospital Doctor to discuss induction of labour</li> </ul>
<b>41+3</b>	<ul style="list-style-type: none"> <li>Post-dates appointment</li> </ul>	<b>41+3</b>	<ul style="list-style-type: none"> <li>Post-dates appointment</li> </ul>

KEY	Hospital Midwife	GP	Obstetric Consultant
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## Appendix 8. Section 88 Payment Rules for Ultrasound Scans

- (1) This fee may be claimed only if an appropriate referral has been received in accordance with clause DC4(a).
- (2) A code corresponding to the relevant indication in subclause (3) must be stated on both the referral form and on the claim.
- (3) The following list identifies the approved clinical indications for ultrasound in pregnancy. The listed conditions are mandatory indications and must be included on the referral form:

**Table 53: Approved Clinical Indications for Ultrasound in Pregnancy**

Code	Clinical indication	Comment
TA	Threatened abortion	Scan at time of bleeding. Serial scans may be necessary if bleeding persists.
EP	Suspected ectopic pregnancy	e.g. Previous tubal surgery, PID or ectopic. Suggestive symptoms (e.g. abdominal pain).
PM	Pelvic mass in pregnancy	Any palpable abnormality in early pregnancy.
UD	Uterus not equal to dates	If discrepancy > 4 weeks, or discrepancy in amniotic fluid.
BA	Prior to booking CVS or amniocentesis or Nuchal Translucency	When unsure dates.
CT	Consideration of termination	
NT	Dating and early evaluation for chromosomal abnormality	Nuchal translucency assessment at 11-13+6 weeks, assessment for gestational age, diagnosis of multiple pregnancy.
NF	Early evaluation for chromosomal abnormality follow up	In cases where the first scan was technically unsuccessful.
AN	Anatomy	Scan to confirm dates, assess foetal anatomy and placental position. Performed at 18-20 weeks ideally.
AF	Anatomy follow up	In cases where the first scan was technically unsuccessful
GR	Suspected growth abnormality (IUGR or macrosomia)	Clinical suspicion of abnormal growth of foetus (IUGR or macrosomia) or abnormal volume of amniotic fluid.
GF	Suspected growth abnormality (IUGR or macrosomia) follow up	To assess growth trend (2 weeks after GR scan).
PL	Check placenta	To check placental site at around 36 weeks
AH	Antepartum haemorrhage	Bleeding in pregnancy. If serial scans are required refer to secondary maternity services.
AP	Abdominal pain	Abdominal pain in pregnancy
MP	Malpresentation	To assess fetal position and size, after 36 weeks
FC	Suspected foetal compromise	Significant reduction in foetal movements.
FD	Suspected intrauterine foetal death	
PP	Maternal postpartum	For suspected retained products or postpartum bleeding

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