



Draft literature review:  
Primary birthing options and  
planned Caesarean configurations

22<sup>nd</sup> September 2014

TOMORROW'S HEALTH TODAY

## Contents

Contents.....	1
Introduction.....	2
1. Primary birthing .....	2
1.1 Background.....	2
1.2 Alongside and standalone units.....	3
1.3 Service utilisation .....	4
1.4 Clinical outcomes .....	6
1.5 Cost effectiveness.....	10
1.6 Policy in England and Wales .....	13
1.7 Conclusion .....	14
2. Planned Caesarean sections.....	16
2.1 Background.....	16
2.2 Caesarean sections in elective surgical centres .....	16
2.3 Planned Caesarean section service model.....	17
2.4 Obstetrician operating model.....	20
2.5 Other options.....	20
Reference list .....	21
Appendix 1 .....	23
Appendix 2 .....	24

## Introduction

This literature review has been undertaken as part of the Auckland and Waitemata DHBs' collaborative maternity service planning. The purpose of the literature review is to provide New Zealand and international insights to:

1. Inform the development of primary birthing service configuration options, to promote primary birthing; and
2. Understand the feasibility and implications of an alternative configuration for planned Caesarean section services, to relieve acute hospital capacity pressure.

This review also draws on information gathered by Health Partners from stakeholder interviews as part of this project. Indeed, the absence of literature on the second topic (planned Caesareans) has required this review to focus solely on expert stakeholder views.

## 1. Primary birthing

### 1.1 Background

One of the potential service improvement initiatives suggested by stakeholders has been promotion of primary birthing for lower risk women.

In this review, primary birthing is defined as birth by spontaneous vaginal delivery in a primary facility. The Ministry of Health<sup>1</sup> defines a primary facility as one that does not have inpatient secondary maternity services or 24-hour on-site availability of specialist obstetricians, paediatricians and anaesthetists. A breakdown of maternity services available in 2010 in the Auckland region by DHB catchment area can be found in Appendix 1.

Promotion of primary birthing is considered important because:

- Spontaneous vaginal births for lower risk women are considered to be safe and cost-effective with potentially improved outcomes for mothers and babies relative to more interventionist birthing options<sup>1,3</sup>
- An analysis of current birth data for the two DHBs showed that an estimated 600-900 births could have occurred in primary rather than secondary facilities if rates similar to those of another DHB were achieved
- Analysis demonstrates that the two DHBs' Caesarean rates have been increasing faster than the expected clinically indicated intervention rate. Births starting in primary facilities currently have a low (5%) Caesarean rate.

Despite strong support for primary birthing, a New Zealand Ministry of Health Report on Maternity in 2010 identified that 86% of births occurred in secondary or tertiary hospitals, 11% in primary facilities, and the remaining 3% in the women's home<sup>1</sup>. Stakeholder interviews conducted by Health Partners identified a number of reasons for the comparatively low numbers of primary births in Auckland and Waitemata DHBs, including:

- The limited availability and geographic location of primary birthing units impedes access for some LMC midwives and hence women
- The relatively high LMC market share held by private obstetricians, who don't use primary birthing facilities
- The absence of epidural pain relief on site, which is seen a limiting factor for many women
- A generational shift in the midwifery workforce bringing less experienced and less confident midwives, with a lesser commitment to primary birthing.

Several potential service configuration options have been developed to support primary birthing. A primary birthing facility can take a number of forms:

- 'Lock-up' primary birthing units
- 'Standalone' units
- 'Alongside' units
- 'Inside' units.

The first of these is used for low volume rural facilities such as Wellsford (WDHB). This type of unit does not have any dedicated staffing; instead staffing is provided by the LMC midwife and a supporter for each labour and birth. Given the busy urban settings of the proposed locations for any additional primary birthing facilities in the two DHBs, this type of unit is not considered suitable.

The other three facility types are staffed, and are differentiated by their proximity to a secondary maternity service. An 'inside' unit has very close proximity, with the initial attempt to have two primary birthing rooms in NSH being illustrative of this type of model. These rooms are seldom used as they are considered too close to secondary services, with the proximity to epidurals making it more difficult for women to adhere to their intended birth plan, and location in a busy secondary facility meaning the midwifery-led, 'low-tech' characteristics of a primary facility as lost.

The focus of discussion then lies in whether the alongside or standalone model is most suitable for the objective of promoting primary birthing for lower risk women in the two DHB context.

To assist in answering this, this literature review has focused on the following:

- Description of each facility option
- The 'type' of women that utilise the units and influencers of their choice
- Clinical outcomes associated with each type of unit, including transfer and intervention rates
- The cost effectiveness of each type of unit.

Particular emphasis is placed on the results of the Birthplace in England Research Programme – the largest study on birth location, and one that was rigorous and comprehensive, and carried out in a system with many similarities to our own.

### **1.2 Alongside and standalone units**

Midwives take the primary professional responsibility for antenatal care in both the alongside and standalone units. The fundamental difference between the units, is that the alongside unit (ASU) is situated in either the same building, or a separate building on the same site as a hospital with obstetric, neonatal and anaesthetic care available. A standalone unit (SAU) is not situated on a hospital site, meaning the secondary maternity services mentioned above are not immediately available. In both cases, women need to be physically transferred to the obstetric unit if obstetric care is needed, however the distance of transfer is significantly greater for SAUs, and is normally by car or ambulance compared with bed or wheelchair for ASUs<sup>2,3</sup>.

#### *Service configuration, scope and size*

Internationally, variation exists in primary birthing scope and capacity between and within the different types of units<sup>4</sup>. For example, in the Birthplace in England Research Programme<sup>5</sup>:

- Of the 56 freestanding midwifery units (FMUs – equivalent to SAUs), the average number of delivery beds was two per FMU
- Of the 26 alongside midwifery units (AMUs – equivalent to ASUs), the average number of delivery beds was five per AMU

- Midwifery staffing levels were higher in FMUs at 35 midwives per 1,000 births compared with 31 midwives per 1,000 in AMUs
- The scope of intrapartum related services within FMUs and AMUs were more extensive than those that would be available in a 'primary birthing facility' in New Zealand (Table 1)<sup>i</sup>.

**Table 1 :** Availability of intrapartum related services in different types of maternity units, 2007, England<sup>5</sup>

Facility	Unit Type (%)			Total units n=262
	FMU n=56	AMU n=26	OU n=180	
Pregnancy day assessment unit	28.6	76.9	95.0	79.0
Early labour assessment by midwife at home	64.3	57.7	46.7	51.5
Birthing pool (fixed)	76.8	88.5	78.9	79.4
24 hour epidural service	0.0	23.1	93.9	66.8
1 or more Obstetric HDU beds	0.0	0.0	48.9	34.0
Adult Intensive Care Unit on site	10.7	76.9	92.8	73.7
1 or more dedicated obstetric theatres	0.0	0.0	98.9	67.9
Transfusion service on site	10.7	92.3	95.6	77.1
Neonatal unit on site	0.0	100.0	98.9	77.9

\* OU – Obstetric unit, equivalent to secondary maternity services in New Zealand

Variation in many aspects of maternity care in the individual primary birthing units of the Birthplace in England Research Programme was raised as a concern that may reflect inequalities in provision. However, due to the low number of adverse neonatal and maternal outcomes, there was inadequate statistical power to make comparisons between individual units. Therefore no evidence is currently available from the study on the impact of variation of service configuration between the units on outcomes of birth, and this is seen as requiring further examination<sup>6</sup>.

### 1.3 Service utilisation

The type of birthing unit a woman chooses is dependent on two core aspects:

1. Eligibility to birth in the different units
2. Perception of the most suitable type of unit.

#### *Eligibility*

Midwifery units offer care to 'low risk' women. A woman is considered at 'low risk' of complications if she<sup>2</sup>:

- Does not have any medical conditions such as high blood pressure, diabetes, epilepsy, hyperthyroidism or infections which present a potential risk to the baby
- Is not obese (obese being a Body Mass Index > 35 kg/m<sup>2</sup>)
- Is not giving birth preterm (before 37 weeks)
- Has not had a previous Caesarean section or experienced serious complications in a previous birth
- Is not expecting twins or the baby is in a breech presentation
- Does not require a Caesarean section or induction of labour for any reason that she is aware of.

<sup>i</sup> For example on-call paediatric or neonatal services were available in all alongside and standalone units in the Birthplace study

However in addition to this, many midwives tend to have their own admission guidelines or exclusion criteria. In the Birthplace in England Research Programme, all FMUs and AMUs had either a written protocol or guideline. These incorporated the above exclusion criteria and also included likelihood of epidural anaesthesia, distribution of parity, and maternal age. However for AMUs, the factors listed were less likely to be considered critical in decision-making about place of birth, which is likely to be due to proximity to secondary services<sup>7</sup>.

#### *Women's perception*

International literature suggests women's views of safe care are influenced by<sup>8</sup>:

- What is locally on offer (both facility, and LMC access agreement and preferences in the New Zealand context)
- Their previous experience
- Experiences of women they know.

One component of safe care that is believed to heavily influence women's decision on where to give birth is the possibility of transfer during labour. In fact, the Birthplace in England Research Programme established the median distance for FMUs to secondary/tertiary services to be 17 miles (~27kms)<sup>3</sup>. Median overall transfer time from FMUs to an obstetric unit was calculated to be 60 minutes. Transfer times from AMUs was not investigated but presumed to be significantly less. Regardless, the possible impact of these transfer times on outcomes does not appear to have an effect, as the Birthplace primary analysis found similar rates of adverse perinatal outcomes in planned FMU and AMU births<sup>9</sup>.

Similar results were gathered in another study evaluating the possible impacts of increased travel distances on perinatal health outcomes. Overall mortality was not associated with living far from a maternity unit<sup>10</sup>.

The quest for safety appears to be integral in influencing women's decision on place of birth. A local study evaluating the difference in women's perception based on the facility accessed for birth identified the strongest influence on women accessing secondary services was a belief in the safety of the type of facility<sup>11</sup>. This was compared with the cohort using primary units who had differing perceptions of the relative importance of safety, and identified important factors to them such as:

- Closeness to home
- Ease of access
- Atmosphere of the unit
- Avoidance of unnecessary intervention.

The demographic characteristics of the women accessing primary and secondary maternity facilities were evaluated. Women accessing primary facilities were more likely to be young, have lower educational attainment, have lower incomes, and be Māori when compared with women accessing secondary maternity facilities. These characteristics are opposite to those reported in international literature with women birthing in primary facilities more likely to be Caucasian, have a fluent understanding of English, and live in more socioeconomically advantaged areas. This suggests that there are multiple complex factors influencing women's decisions and perceptions of safety that vary across nations<sup>7,11</sup>.

#### 1.4 Clinical outcomes

The Birthplace in England Research Programme undertook an extensive research project to establish perinatal and maternal outcomes by planned place of birth. A range of adverse outcomes were identified as indicators of safety for mothers and babies based on the supposition that the frequency of these events occurring may reflect differences in the quality of perinatal care (known as primary outcomes)<sup>2</sup>. A range of 'secondary outcomes' were also derived, including:

- Number and type of obstetric interventions
- Rate of birth without any medical interventions
- Transfer rate from primary to secondary maternity facilities with reasons.

Tables outlining the primary outcomes, secondary outcomes and exclusions can be found in Appendix 2.

Overall the study found no significant difference in adverse perinatal and maternal outcomes for low risk women with planned births in FMUs and AMUs when compared with planned births in an obstetric unit. However, there were also certain statistically significant benefits for birthing in FMUs and AMUs, and variances between them that should be considered<sup>2</sup>:

- There was a reduced chance of a neonatal admission for babies being born to low risk women in FMUs
- Low risk women birthing in FMUs had a greater likelihood of initiating breastfeeding before discharge home. Although the direction of effect was similar for planned AMU births this was not statistically significant
- There were significantly fewer medical interventions for low risk women who planned birth in an FMU or AMU. This means women were less likely to have their baby delivered by Caesarean section or ventouse in primary facilities. Approximately 75% of all women who birthed in primary facilities didn't receive medical intervention compared with 58% of women birthing in obstetric units
- Low risk women who planned to birth in FMUs were less likely to receive forceps delivery than in AMUs
- The odds of receiving epidural or spinal analgesia or of receiving general anaesthesia was significantly reduced in births planned in FMUs and AMUs
- The likelihood of receiving syntocinon augmentation was significantly lower for births planned in FMUs and AMUs
- The odds of a blood transfusion were lower in births planned in FMUs
- The odds of low risk women being admitted to a high dependency area, intensive care unit or other higher level of care were significantly reduced for planned FMU births
- The use of immersion in water for pain relief was significantly higher for births planned in FMUs and AMUs
- The odds of not receiving active management of the 3rd stage were significantly increased for births planned in FMUs and AMUs
- The likelihood of receiving an episiotomy was significantly reduced for births planned in FMUs and AMUs.

Similar conclusions have been drawn from other reviews evaluating the impact of birth settings on perinatal and maternal outcomes in low risk women<sup>12-14</sup>. The definition of low risk and the outcomes evaluated were reasonably consistent across both studies. One of these was a review conducted by the Cochrane Collaboration to assess alternative versus conventional institutional settings for birth. Alternative settings included 'home-like' bedrooms within or adjacent to hospital labour wards and free-standing birthing centres.

The study identified the following benefits of alternative institutional settings<sup>13</sup>:

- An increased likelihood of:
  - spontaneous vaginal birth
  - labour and birth without analgesia/anaesthesia
  - breastfeeding at six to eight weeks postpartum
  - satisfaction with care
- A decreased likelihood of:
  - oxytocin augmentation
  - assisted vaginal birth
  - Caesarean birth
  - episiotomy.

The Cochrane Collaboration review concluded that:

*The results are consistent with a growing body of research which has demonstrated the independent effects of physical attributes of the hospital room on caregivers' behaviour and patients' health outcomes, including postsurgical complications and length of stay.*

*Pregnant women should be informed that hospital birth centres are associated with lower rates of medical interventions during labour and birth and higher levels of satisfaction, without increasing risk to themselves or their babies. Decision-makers who wish to decrease rates of medical interventions for women experiencing normal pregnancies should consider developing birthing units with policies and practices to support normal labour and birth<sup>13</sup>.*

A second study was a New Zealand based retrospective analysis of data from the Midwifery Maternity Provider Organisation database. Data on approximately 40,000 births in 2006 and 2007 were obtained, accounting for 32% of births nationally at the time. Women were stratified by risk using a similar definition of 'low risk' to the Birthplace study. However any woman with a condition noted in the past history was excluded, potentially skewing the evaluation – supported by an exclusion rate of 58.5%. Mode of birth, intrapartum interventions, and neonatal outcomes were compared with results adjusted for age, parity, ethnicity and smoking. Women planning to give birth in secondary or tertiary hospitals were compared with those intending on giving birth in a primary unit(14).

The study concluded that planned place of birth had a significant influence on mode of birth and rates of intrapartum intervention in childbirth. Women intending to birth in secondary or tertiary hospitals were found to have a higher risk of:

- Caesarean section (emergency Caesarean section rates 4.6 times higher)
- Assisted modes of birth
- Intrapartum interventions.

An Australian database study of 240,000 low risk births compared the place of birth in respect of public versus private hospitals, with private hospitals having a higher intervention rate and the same or worse outcomes<sup>18</sup>. The authors noted:

*The continual rise in obstetric intervention for low-risk women in Australia, especially in private hospitals, may be contributing to increased morbidity for healthy women and babies and higher cost of healthcare. The fact that these procedures which were initially life-saving are now so commonplace and do not appear to be associated with improved rates of perinatal mortality or morbidity demands close review. Early term delivery and instrumental births may be associated with increased morbidity in neonates and this requires urgent attention. Previous claims that high-intervention rates in private hospitals lead to better perinatal outcomes than those seen in public hospitals need to be questioned.*

### Transfers

Parity appears to be an important contributor to the rate of transfer, with an almost 30% higher rate of transfer for first time mothers birthing in either an FMU or AMU in the Birthplace in England study<sup>2</sup>:

- For women having a first baby, the transfer rate during labour or immediately after the birth was 36% for planned FMU births and 40% for planned AMU births
- For women having a second or subsequent baby, the transfer rate during labour or immediately after the birth was 9% for planned FMU births and 13% for planned AMU births.

Other studies attempting to compare birth outcomes based on place of delivery have shown high transfer rates, up to 67% in a Cochrane review<sup>13</sup> and 34% in an Australian study of 22,000 birthing centre births<sup>17</sup>.

By way of comparison, transfer rates in the Auckland setting are 11-20% across primary facilities, where transfer is defined as after admission but before delivery. For Birthcare Parnell, 34% of first time mothers transferred, while only 8% of multiparous women who started birth there transferred in 2013. Similar figures pertain to the Waitemata DHB-based primary units.

Reasons for transfer can vary from a woman wanting stronger forms of analgesia to the LMC midwife's clinical concerns for the mother and/or baby. The Birthplace study on outcomes determined that:

- Women who transfer, on average, have more labour complications than women who do not
- Women who planned to birth in FMUs were less likely to transfer for an epidural compared with those who planned to birth in AMUs
- Transfer due to neonatal concerns occurred less frequently in the AMU group, probably reflecting the fact that the mother did not need to be transferred if the baby needed admission for a higher level of care.

The most common clinical concerns resulting in transfer, expressed as percentages of all by planned place of birth are outlined in Table 2.

**Table 2 :** Complicating conditions identified at the start of care in labour in low risk women by planned place of birth<sup>2</sup>

	OU n=19706		Home n=16840		FMU n=11282		AMU n=16710	
	n	%	n	%	n	%	n	%
Prolonged rupture of membranes (>18 hours)	1462	7.4	395	2.4	231	2.1	383	2.3
Meconium stained liquor	1254	6.4	242	1.5	140	1.2	233	1.4
Proteinuria (1+ or more)	347	1.8	80	0.5	110	1.0	370	2.2
Hypertension	502	2.6	92	0.6	78	0.7	113	0.7
Abnormal vaginal bleeding	274	1.4	41	0.2	22	0.2	37	0.2
Non-cephalic presentation	108	0.6	37	0.2	25	0.2	29	0.2
Abnormal fetal heart rate	393	2.0	68	0.4	52	0.5	65	0.4
Other	54	0.3	14	0.1	17	0.2	17	0.1
Conditions per woman:								
0	15794	80.5	15757	94.6	10643	94.5	15512	93.1
1	3345	17.0	847	5.1	572	5.1	1078	6.5
2+	490	2.5	51	0.3	50	0.4	78	0.5
Missing	77		185		17		42	

OU – Obstetric unit, (equivalent to secondary maternity services in New Zealand), low risk births only  
Home – home births

As displayed, significant differences between planned places of birth and rate of complications existed. Almost 20% of women whose planned place of birth was an obstetric unit had at least one complicating condition compared with less than 7% in the primary birthing facilities. This was unexpected given that all women were identified as low risk.

The main conclusion one is led to from the literature is that close proximity to available methods of intervention increases the chance of such an intervention occurring. While this is consistent with many other areas of medicine, the size of the effect may be being overstated a little:

1. More common complications may be diagnosed at a home visit or over the telephone by the midwife, enabling the woman to be directed to the obstetric unit prior to admission (pre-selection)
2. Residual risks not specifically targeted or identifiable in studies may have been present in women directed to the obstetrics unit more than in those going to primary units. The sometimes high rates of transfer from primary to secondary units suggests some difficulty in risk stratification to select 'low risk' women
3. Conditions/complications may be more likely to be recognised and recorded in the larger facilities, or otherwise have a lower threshold for attention. A local example would be the research interest in post-partum haemorrhage (PPH) at National Women's Hospital in the past, leading to very careful recording of instances of even relatively low volume bleeds, and an apparent very high PPH rate compared to other centres
4. Women who are anxious about their imminent delivery may be more likely to select the larger centre for 'safety' reasons. Equally their anxiety may make them more likely to opt for interventions if that is perceived as the safer or less uncertain course.

Prolonged rupture of membranes and meconium stained liquor were the most common complications across primary and secondary birthing facilities, occurring at a rate approximately three times higher in obstetric units. Prevalence of proteinuria (protein in the urine) was also common in planned births in AMUs.

## 1.5 Cost effectiveness

Cost effectiveness analyses have compared planned primary places of birth with planned birth in an obstetric unit. Cost-effectiveness was determined by comparing the difference in costs and difference in outcomes between the FMUs and AMUs relative to obstetric units<sup>15,16</sup>. Cost-effectiveness has been expressed as an incremental cost-effectiveness ratio (ICER), which is the difference in costs divided by the difference in effects. The ICER represents the additional cost of an additional unit of outcome through FMUs and AMUs, when compared to obstetric units. ICERs used to determine the cost effectiveness include:

- The incremental cost per 'adverse perinatal outcome' avoided
- The incremental cost per 'adverse maternal outcome' avoided
- The incremental cost per additional 'normal birth' (see Appendix 2).

Adverse perinatal outcome and normal birth are defined as they were in the Birthplace cohort study (Appendix 2). 'Adverse maternal outcome' was defined as the woman experiencing any of the following: general anaesthetic, instrumental birth (forceps or ventouse), Caesarean section, severe perineal trauma, blood transfusion, or admission to an intensive care/high dependency unit.

### *Costs*

The Birthplace economic evaluation was conducted from a health system perspective and consequently only direct costs to the NHS were included, ie:

- Midwifery care during labour and immediately after the birth
- The cost of any medical care and procedures needed in hospital
- The cost of any stay in hospital
- Midwifery unit
- Neonatal unit immediately after the birth.

Based on this, the average cost per birth in each of the respective birthing units were:

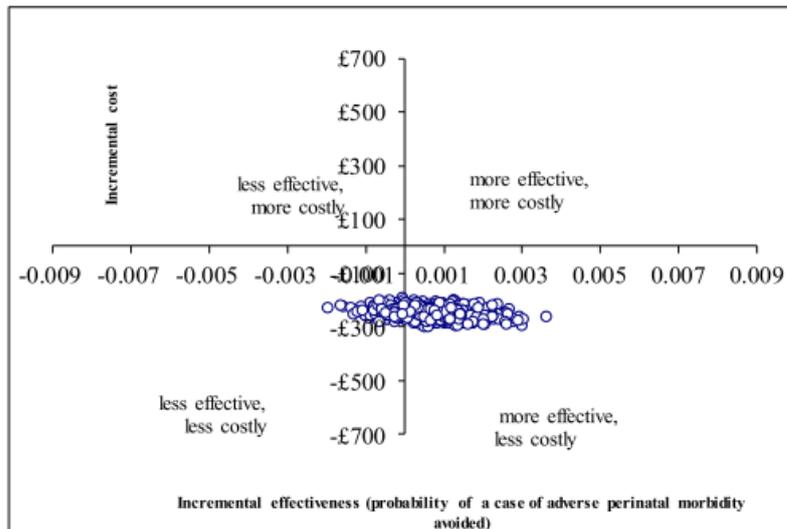
- £1631 for a planned birth in an obstetric unit
- £1461 for a planned birth in an AMU
- £1435 for a planned birth in an FMU

The increased cost associated with birthing in an obstetric unit can be attributed to hospital overheads being higher and a greater number of interventions (as discussed above), which are relatively more expensive.

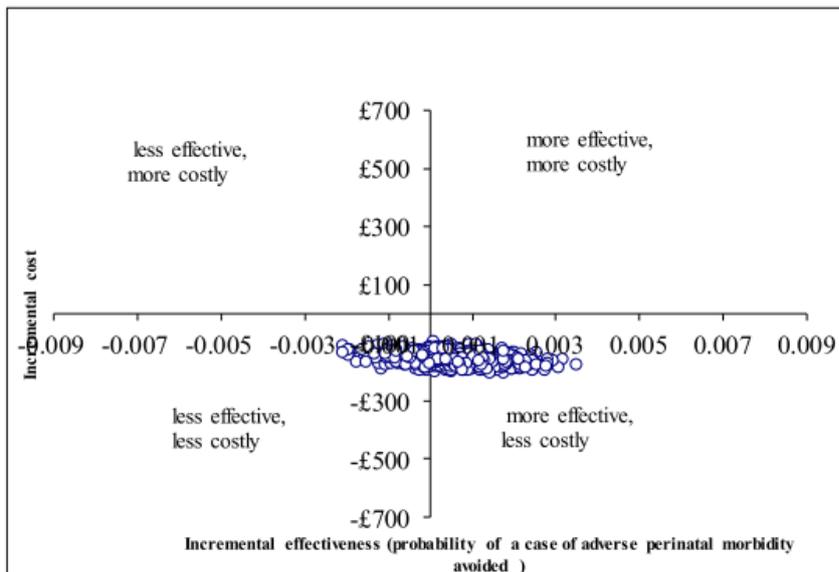
### *Cost effectiveness*

The ICER for adverse perinatal outcomes avoided showed that, on average, births planned in FMU and AMU settings would be cost saving when compared with births planned in an obstetric unit, and would lead to improved perinatal outcomes on average for births planned in the midwifery units, although the latter was not statistically significant (Figure 1 & Figure 2)<sup>15</sup>.

**Figure 1 :** Cost effectiveness plane: planned birth in a FMU compared with obstetric unit for all 'low risk' women, perinatal morbidity avoided

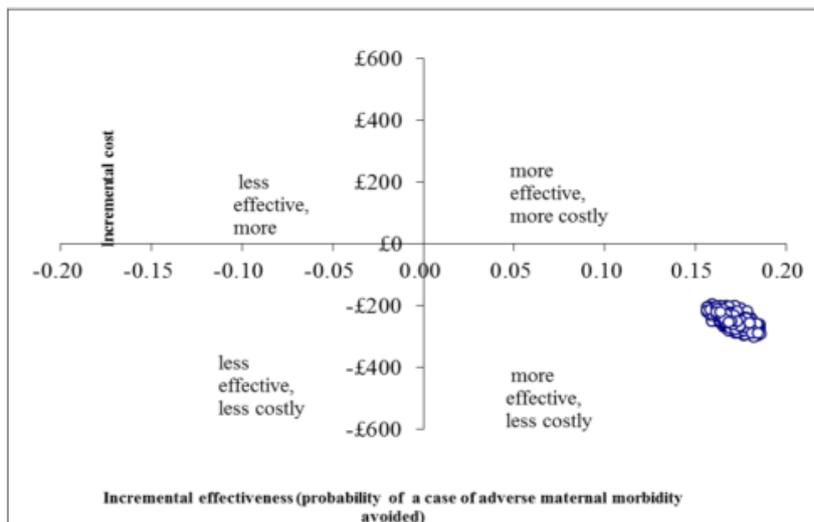


**Figure 2 :** Cost effectiveness plane: planned birth in a AMU compared with obstetric unit for all 'low risk' women, perinatal morbidity avoided

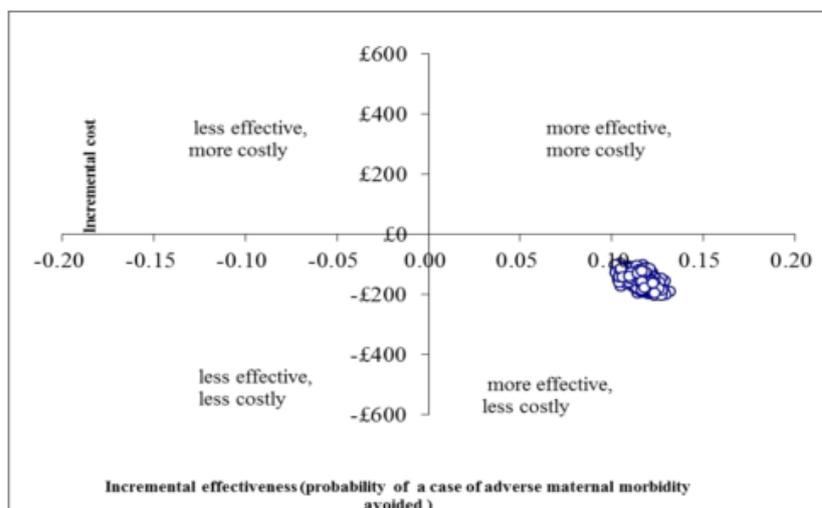


The ICER for adverse maternal outcomes avoided showed that, on average, planned births in FMUs and AMUs led to increases in positive maternal outcomes and reductions in costs to the NHS when compared to planned birth in an obstetric unit (Figure 3 and Figure 4).

**Figure 3 :** Cost effectiveness plane: planned birth in a FMU compared with obstetric unit for all 'low risk' women, maternal morbidity avoided

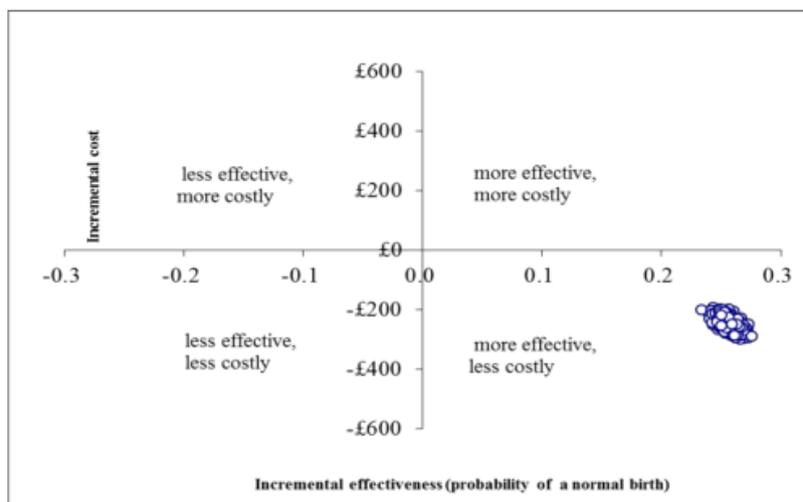


**Figure 4 :** Cost effectiveness plane: planned birth in a AMU compared with obstetric unit for all 'low risk' women, maternal morbidity avoided

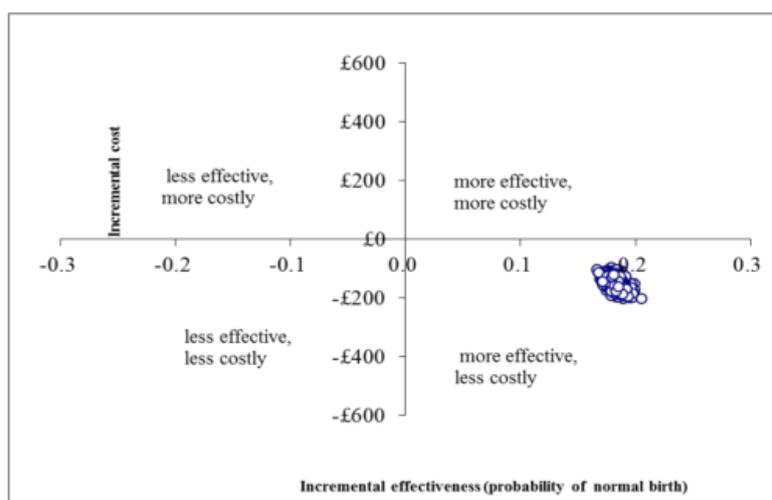


The ICER for additional normal birth showed that, on average, planned births in FMUs and AMUs led to cost savings and improved outcomes in normal birth when compared to planned birth in an obstetric unit (Figure 5 and Figure 6).

**Figure 5 :** Cost effectiveness plane: planned birth in FMU compare with an obstetric unit, normal birth



**Figure 6 :** Cost effectiveness plane: planned birth in AMU compare with an obstetric unit, normal birth



The cost effectiveness study did not compare births planned in FMUs head-to-head with those in AMUs. However, based on the comparison of births planned in FMUs and AMUs with births planned in obstetric units, no statistically significant difference in cost or outcomes were identified.

### 1.6 Policy in England and Wales

Over the two year period of the Birthplace study the number of maternity units increased from 261 to 289<sup>5</sup>. Changes identified included:

- Closure of five obstetric units
- Closure of four and opening of seven FMUs
- Opening of 27 AMUs.

Several potential reasons were identified including:

- The political and financial climate meant that more emphasis was being placed on reconfiguring existing environments rather than building new facilities
- Concerns around the rate and time taken for transfers from FMUs, particularly in first time mothers
- Although FMUs emerged as a cost-effective option in the short-term, occupancy rates and the small size of the units made covering overheads difficult – as displayed with the number of closures.

### **1.7 Conclusion**

Table 3 overleaf summarises the key findings of the Birthplace analysis comparing standalone and alongside units. Maternal and perinatal outcomes did not differ significantly between the two; the direction of the small differences are shown in the table. It appears that either style of unit could be considered in the Auckland setting.

**Table 3 :** Comparison summary of standalone and alongside primary birthing units in the Birthplace Study

Standalone unit	Alongside unit
<ul style="list-style-type: none"> <li>• Smaller number of delivery beds (2 per FMU)</li> <li>• More staff required (35 midwives per 1,000)</li> <li>• Risk stratification by written protocol or guideline</li> <li>• No significant adverse perinatal and maternal outcomes for low risk women when compared with planned births</li> <li>• Slightly lower chance of a neonatal admission</li> <li>• Slightly less likely to receive forceps delivery</li> <li>• Slightly lower odds of receiving epidural or spinal analgesia or of receiving general anaesthesia</li> <li>• Slightly lower odds of a blood transfusion</li> <li>• Slightly lower odds of being admitted to high dependency area</li> <li>• Longer transfer time to secondary maternity services</li> <li>• 36% of primiparous and 9% nulliparous women were transferred</li> <li>• Less likely to transfer for an epidural</li> <li>• More likely to transfer due to neonatal concerns</li> <li>• Average cost per birth £1,435</li> <li>• Incremental cost per adverse perinatal outcome avoided – no statistically significant difference to birthing in obstetric unit</li> <li>• Incremental cost per adverse maternal outcome avoided – significantly more cost effective when compared to birthing in obstetric unit</li> <li>• Incremental cost per additional normal birth – significantly more cost effective when compared to birthing in obstetric unit</li> </ul>	<ul style="list-style-type: none"> <li>• Greater number of delivery beds (5 per AMU)</li> <li>• Fewer staff required (31 midwives per 1,000)</li> <li>• Risk stratification by written protocol or guideline</li> <li>• No significant adverse perinatal and maternal outcomes for low risk women when compared with planned births</li> <li>• Slightly higher chance of neonatal admission</li> <li>• Slightly more likely to receive forceps delivery</li> <li>• Slightly higher odds of receiving epidural or spinal analgesia or of receiving general anaesthesia</li> <li>• Slightly higher odds of a blood transfusion</li> <li>• Slightly higher odds of being admitted to high dependency area</li> <li>• Shorter transfer time to secondary maternity services</li> <li>• 40% of primiparous and 13% nulliparous women were transferred</li> <li>• More likely to transfer for an epidural</li> <li>• Less likely to transfer due to neonatal concerns</li> <li>• Average cost per birth £1,461</li> <li>• Incremental cost per adverse perinatal outcome avoided – no statistically significant difference to birthing in obstetric unit</li> <li>• Incremental cost per adverse maternal outcome avoided – significantly more cost effective when compared to birthing in obstetric unit</li> <li>• Incremental cost per additional normal birth – significantly more cost effective when compared to birthing in obstetric unit</li> </ul>

## 2. Planned Caesarean sections

### 2.1 Background

Intervention rates in maternity services across Auckland continue to trend upwards, with Caesarean section rates climbing from 25% in 2001 to 30% in 2013, with an accelerating growth rate. Caesarean deliveries require more staff resources, use scarce theatre capacity, and have hospital postnatal stays. If trends in the rate of intervention continue, capacity pressures can be expected in all secondary maternity facilities across Auckland and Waitemata DHBs (National Women's Hospital, North Shore Hospital and Waitakere Hospital). This pressure will be most immediately on theatre capacity, but will also impact on postnatal capacity given the longer inpatient stays post-Caesarean

Capacity modelling suggests that if the rate of growth in interventions continues at National Women's Hospital there will be a need for an extra five postnatal beds, five medical staff, and 10 nursing staff over the next 10 years due to the Caesarean rate change alone.

Urgency of access to NWH theatres for emergency Caesareans is the main driver of the potential need for additional theatre capacity. With Caesarean rates projected to reach 40% by 2025, assuming the split in proportions of elective to emergency Caesareans remains consistent, there would be an additional 340 emergency Caesareans per year by 2025 at NWH. This is made up of 40 added due to birth growth, 20 due to ethnicity mix changes, and the remaining 280 due to the projected increasing Caesarean rate.

Assuming the procedures follow the same pattern as currently, without additional theatre capacity at NWH one could expect an additional 50 cases whereby two emergency Caesareans occur within the same hour – known as a 'double up', and one extra case of a 'triple up'. This would bring the total double-ups from 26 to 76, or from one a fortnight to one every five days, which is likely to trigger the need for a second dedicated Caesarean theatre.

Although it is anticipated that the promotion of primary birthing will impact on the increasing Caesarean rates, it is important to recognise that the drivers for the increase are multifaceted and thus intervention rates may continue to rise even within a higher proportion of primary birthing. Therefore one option that could assist with managing these pressures is to shift planned Caesarean sections away from an acute hospital setting and into an elective surgery centre. This may have the additional benefit of the increased throughput efficiency that could accrue from separation of acute and planned activity.

### 2.2 Caesarean sections in elective surgical centres

A thorough search of the literature has found no published evidence of planned Caesarean sections being performed away from an acute hospital setting. Hence the focus shifted to interviews with two clinicians with relevant experience:

- Dr David Sage, an experienced obstetric anaesthetist and former CMO, Auckland DHB
- Dr Mary Oliver, Clinical Director Maternity Services, Canterbury DHB.

Canterbury DHB was selected because of reports of planned Caesareans being conducted at St Georges Hospital (a private elective facility) in the recent past. However, through the interview with Dr Oliver it was established that this in fact did not occur. Although some thought was given to the concept, a number of clinical and logistics concerns were identified which are discussed throughout this document.

The information gathered during the interviews have been summarised and grouped into the following themes:

- Planned Caesarean section service model
- Obstetrician operating model
- Other options.

We have also added maternity utilisation data relating to ADHB and WDHB to illustrate implications.

### **2.3 Planned Caesarean section service model**

#### *Neonatal services*

Neonatal services are needed following a planned Caesarean section due to the increased risk of neonatal respiratory distress when compared with vaginal delivery, regardless of gestational age<sup>19</sup>. The cost implications of providing neonatal services at an elective surgical centre has been perceived as high due to the requirement for neonatal surveillance by a paediatrician with appropriate onsite access to comprehensive neonatal resuscitation equipment. However, improvements in obstetric anaesthesia and antenatal monitoring technology have triggered significant debate around the need for specialist paediatricians to attend planned Caesarean sections.

The need for paediatrician presence arose in an era when Caesarean section deliveries were usually the consequence of unexpected preterm births and were usually carried out under general anaesthesia<sup>20</sup>.

More recent literature suggests with regional anaesthesia in the absence of fetal distress or other significant perinatal factors, the need for vigorous resuscitation is no different from that which occurs in an uncomplicated vaginal birth<sup>21-23</sup>. This means the attendance of a midwife, as for an uncomplicated vaginal birth, would be appropriate. However personnel trained in advanced neonatal resuscitation should be nearby and available should ongoing resuscitation be required<sup>21</sup>.

The Royal Australasian College of Physicians – Paediatric and Child Health Division released a policy document<sup>24</sup> in 2007 informed by:

- A survey of Australian and New Zealand paediatricians on their opinions regarding the attendance of specialist paediatricians at elective non-emergency Caesarean section; and
- A review of relevant literature.

The policy document concluded that:

*An elective Caesarean section with no maternal or fetal risk factors is a low risk birth and requires the same care as any other low risk birth. There is no evidence that a paediatrician/trainee or paediatrician/other junior medical staff member is required to attend an elective Caesarean section where there are no identified maternal or fetal complicating factors that would predict the need for vigorous resuscitation.*

*The choice of personnel should be based on appropriate communication between obstetrician and paediatric team on matters of risk analysis and procedure planning to achieve optimal neonatal outcome.*

The emergence of this evidence that the use of lower cost specialist personnel, such as midwives, with less intensive resuscitation equipment is adequate for low risk elective Caesarean sections should significantly reduce the cost drivers of delivering neonatal care away from an acute hospital setting.

It is important to note neonatal care is only one component of Caesarean section procedures. To provide Caesarean section procedures a team of specialist clinicians, midwives and nursing staff with the appropriate training in maternity care is required. Therefore shifting planned Caesarean sections away from an acute hospital setting will incur additional costs through either upskilling current staff or recruiting appropriately trained staff to accommodate for this. In doing so this will essentially duplicate significant areas of costs associated with perinatal care delivery, given that planned Caesarean sections only produce a relatively small proportion of total births. For example, there were just over 1900 planned Caesarean sections at ADHB and WDHB facilities in 2013 - 14% of total births and 44% of total Caesarean sections.

*Risk stratification*

The use of midwives to provide neonatal care limits the cohort eligible for 'low risk' planned Caesarean sections. A number of clinical factors have been identified through the literature that increases the risk of fetal compromise and the need for vigorous resuscitation. These include<sup>22-24</sup>:

- Multiple pregnancies
- Low birth weight <2 kg
- Prematurity <36 weeks
- General anaesthetic
- Non-cephalic presentation
- Known congenital abnormality
- Intrapartum fetal tachycardia
- Maternal conditions including:
  - Preeclampsia
  - Chronic hypertension
  - Diabetes
- Intrauterine growth restriction.

Similar criteria were applied to planned Caesarean section rates at National Women’s Hospital and Waiata DHB hospitals (tables 4 and 5). Data provided to Health Partners did not provide a clear measure of fetal risks pre-delivery, therefore Apgar at 5 minutes scores were used as a proxy.

**Table 4 :** National Women’s Hospital eligible patients

<b>NWH</b>	<b>No</b>	<b>remaining</b>	<b>%</b>
All electives	1205		
Higher risk:			
<37 weeks	99	1106	92%
<2000g	0	1106	92%
GA	30	1076	89%
multiple	6	1070	89%
Apgar <8*	19	1051	87%
Breech/other	165	886	74%

\* proxy for likely known fetal distress/abnormality

**Table 5 :** Waitemata DHB hospitals

Waitemata DHB hospitals	No	remaining	%
All electives	714		
Higher risk:			
<37 weeks	30	684	96%
<2000g	1	683	96%
GA*	0	683	96%
multiple	2	681	95%
Time in SCBU**	20	661	93%
Breech/other**	0	661	93%

\* not available

\*\* proxy for potential foetal factors

\*\*\* none recorded for elective Caesar patients

Based on this we see that approximately 886 and 661 women would be eligible to receive planned Caesarean sections in an elective surgical centre, from NWH and Waitemata DHB hospitals respectively. This would equate to an average of 5-6 per work day (assuming Monday to Friday operation) if all were so assigned. If, for example, 1000 cases ended up being assigned to a separate elective facility this would average 4 per working day. Assuming one hour per case would imply half a theatre being needed.

Given the establishment and ongoing costs associated with shifting planned Caesarean sections away from an acute hospital setting, a minimum volume of cases would be needed for this option to be viable. Consideration should be given to whether the approximate figures displayed above, along with the potential efficiencies gained through separating acute and planned Caesarean sections, would offset the establishment and ongoing costs.

The risk of perverse incentives for obstetricians to increase the rate of planned Caesarean sections is if the delivery of planned procedures becomes 'smoother' in a dedicated facility, and if there are incentives to keep volumes high to ensure service viability. This would run counter to a strategic goal of promoting primary birthing and reducing the rate of medical intervention.

To mitigate this risk and also clinical risks, criteria could be applied to determine the cohort of women suitable for receiving planned Caesarean sections away from an acute hospital setting. A guideline or protocol for determining risk would need to be established in consultation with senior obstetricians, anaesthetists and paediatricians, which could be trialled and refined over time. The obstetrician would take responsibility for categorisation of risk on each Caesarean delivery and plan accordingly. Policy guidance, clinical audit and peer review could all be applied to support adherence to the criteria.

#### *Transfers*

Despite the application of such selection criteria, there would still be cases that would require transfer to a secondary or tertiary obstetrics service at an acute hospital, necessitating a pathway for such transfers. The attending midwife can adequately perform bag-mask ventilation while the neonate is transferred as in the case of vaginal deliveries.

#### *Postnatal services*

Establishing an appropriate package of postnatal care to meet the needs of women and their babies is a crucial component of maternity services<sup>25</sup>. Mothers and babies are at highest risk of adverse outcomes in the first days after birth. Postnatal care encompasses post-partum care and lactation support. Although this does not require any specialist equipment, it does require rooms (preferably single) and staffing by midwives and nurses. There is the possibility of postnatal care being delivered at another facility, accessed via a postnatal transfer.

## **2.4 Obstetrician operating model**

Planned Caesareans are undertaken by both public and private obstetricians. Even though some of the latter work in teams, the majority of planned Caesareans undertaken by a private obstetrician are for women who have selected that obstetrician as their LMC.

Shifting planned Caesareans to a non-acute site would have the potential to create operational complexities for private obstetricians, as they balance their private LMC and planned Caesarean caseload across different facilities. This would be exacerbated if the elective surgical centre was on a different campus from the acute hospital.

Public obstetricians would not be affected in the same way, as they could be rostered to work in either the acute or planned setting.

(Given that the majority of private obstetricians also work in a public capacity, conflicts between their public and private commitments would continue to require active management, but would not be worsened under an 'off-site' model.)

## **2.5 Other options**

Given the cost implications of duplicated staff and equipment, operational complexity and clinical risks of shifting planned Caesarean sections into an elective surgical centre, an alternative strategy to manage capacity pressure would be to expand obstetric facility access within the acute hospital, and shift other non-obstetric services to the elective centre.

To accommodate the increase in non-obstetric services being relocated, the capacity and capability of the current elective surgery centres could be expanded – for example, through extended hours of operation or through establishment of an HDU to enable more invasive procedures to be undertaken.

## Reference list

### *Primary birthing:*

1. Ministry of Health. Report on Maternity, 2010. Wellington; 2012.
2. Hollowell J, Puddicombe D, Rowe R, Linsell L, Hardy P, Stewart M, et al. The Birthplace national prospective cohort study : perinatal and maternal outcomes by planned place of birth Birthplace in England research programme . Final report part 4. (November 2011).
3. Birthplace in England Collaborative Group. Birthplace programme overview : background , component studies and summary of findings Birthplace in England research programme . Final report part 1. 2011 p. 1–43.
4. Schott S, van der Avoort I, Descamps P, Richmond D, Adams T, Oei G, et al. Four countries, four ways of discussing low-risk pregnancy and normal delivery: in France, Germany, The Netherlands, and the United Kingdom. Arch Gynecol Obstet [Internet]. 2014 Feb [cited 2014 Sep 16];289(2):451–6. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/24253339>
5. Redshaw M, Rowe R, Schroeder L, Macfarlane A, Newburn M, Sandall J, et al. Mapping maternity care : the configuration of maternity care in England Birthplace in England research programme . Final report part 3. (November 2011).
6. Rowe RE, Townend J, Brocklehurst P, Knight M, Macfarlane A, McCourt C, et al. Service configuration, unit characteristics and variation in intervention rates in a national sample of obstetric units in England: an exploratory analysis. BMJ Open [Internet]. 2014 Jan [cited 2014 Sep 16];4(5):e005551. Available from: <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=4039829&tool=pmcentrez&rendertype=abstract>
7. Mccourt C, Rance S, Rayment J. Birthplace qualitative organisational case studies : how maternity care systems may affect the provision of care in different birth settings Birthplace in England research programme . Final report part 6. 2011;(November).
8. Mccourt C, Rayment J, Rance S, Sandall J. An ethnographic organisational study of alongside midwifery units: a follow-on study from the Birthplace in England programme. 2014;2(7).
9. Rowe RE, Townend J, Brocklehurst P, Knight M, Macfarlane A, McCourt C, et al. Duration and urgency of transfer in births planned at home and in freestanding midwifery units in England: secondary analysis of the birthplace national prospective cohort study. BMC Pregnancy Childbirth [Internet]. 2013 Jan;13:224. Available from: <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=4029797&tool=pmcentrez&rendertype=abstract>
10. Pilkington H, Blondel B, Drewniak N, Zeitlin J. Where does distance matter? Distance to the closest maternity unit and risk of foetal and neonatal mortality in France. Eur J Public Health [Internet]. 2014 Jan 2 [cited 2014 Sep 13];1–6. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/24390464>
11. Grigg C, Tracy SK, Daellenbach R, Kensington M, Schmied V. An exploration of influences on women's birthplace decision-making in New Zealand: a mixed methods prospective cohort within the Evaluating Maternity Units study. BMC Pregnancy Childbirth [Internet]. 2014 Jan [cited 2014 Aug 29];14(1):210. Available from: <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=4076764&tool=pmcentrez&rendertype=abstract>

12. McIntyre MJ. Safety of non-medically led primary maternity care models: a critical review of the international literature. *Aust Health Rev* [Internet]. 2012 May;36(2):140–7. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/22624633>
13. Hodnett, ED, Downe S, Walsh D. Alternative versus conventional institutional settings for birth ( Review ). *Cochrane Database Syst Rev*. 2012;(8).
14. Davis D, Baddock S, Pairman S, Hunter M, Benn C, Wilson D, et al. Planned place of birth in New Zealand: does it affect mode of birth and intervention rates among low-risk women? *Birth* [Internet]. 2011 Jun;38(2):111–9. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/21599733>
15. Schroeder L, Petrou S, Patel N, Puddicombe D, Redshaw M. Birthplace cost-effectiveness analysis of planned place of birth : individual level analysis Birthplace in England research programme : final report part 5. 2011;(November).
16. Schroeder E, Petrou S, Hollowell J, Redshaw M, Brocklehurst P. Birthplace cost-effectiveness analysis of planned place of birth : decision analytic model . Birthplace in England research programme . Final report part 7 . 2014;1–119.
17. Laws PJ, Tracy SK, Sullivan EA. Perinatal outcomes of women intending to give birth in birth centers in Australia. *Birth* 2010; 37(1):28-36.
18. Dahlen HG, Tracy S, Tracy M, et al. Rates of obstetric intervention and associated perinatal mortality and morbidity among low risk women giving birth in private and public hospitals in NSW (2000–2008): a linked data population-based cohort study. *BMJ Open* 2014;4:e004551.

*Caesarean configurations:*

19. Afolabi BB, Lesi F. Regional versus general anaesthesia for caesarean section ( Review ). 2012;(10).
20. Grant GJ. Anesthesia for cesarean delivery Author Anesthesia for cesarean delivery. 2011;1–14.
21. Atherton N, Parsons SJ, Mansfield P. Attendance of paediatricians at elective Caesarean sections performed under regional anaesthesia: is it warranted? *J Paediatr Child Health* [Internet]. 2006 Jun [cited 2014 Sep 21];42(6):332–6. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/16737472>
22. Tooke LJ, Joolay Y, Horn AR, Harrison MC. Is the attendance of paediatricians at all elective caesarean sections an effective use of resources? *S Afr Med J* [Internet]. 2011 Oct;101(10):749–50. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/22272855>
23. Ozlu F, Yapicioglu H, Ulu B, Buyukkurt S, Unlugenc H. Do all deliveries with elective caesarean section need paediatrician attendance? *J Matern Fetal Neonatal Med* [Internet]. 2012 Dec [cited 2014 Sep 21];25(12):2766–8. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/22708525>
24. Royal Australasian College of Physicians: Paediatrics and Child Health Division. Paediatric Policy: Paediatrician attendance at Caesarean Sections. Sydney; 2007.
25. Kerber KJ, de Graft-Johnson JE, Bhutta Z a, Okong P, Starrs A, Lawn JE. Continuum of care for maternal, newborn, and child health: from slogan to service delivery. *Lancet* [Internet]. 2007 Oct 13;370(9595):1358–69. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/17933651>

## Appendix 1

**Figure 7 :** Primary, secondary and tertiary maternity services by DHB catchment area, 2010

DHB region	Tertiary maternity and level III specialist neonatal services	Secondary maternity and level II specialist neonatal services	Primary maternity
Auckland	Auckland City		Birthcare Auckland
Northland		Whangarei	Bay of Islands (Kawakawa)
			Dargaville
			Kaitaia
			Hokianga
Waitemata		North Shore Waitakere	Wellsford
			Warkworth
	Helensville		
Counties Manukau	Middlemore		Pukekohe
			Papakura
			Botany Downs

Source: (1)

## Appendix 2

**Table 6 :** Primary outcomes

Stillbirth after the start of care in labour
Early neonatal death (within 7 days)
Neonatal encephalopathy
Meconium aspiration syndrome
Brachial plexus injury
Fractured humerus or clavicle

**Table 7 :** Secondary outcomes

<b>Perinatal outcomes</b>
Stillbirth after the start of care in labour
Early neonatal death (within 7 days)
Neonatal encephalopathy
Meconium aspiration syndrome
Brachial plexus injury
Fractured humerus
Fractured clavicle
Fractured skull
Cephalohaematoma
Cerebral haemorrhage
Early onset neonatal sepsis
Kernicterus (severe bilirubin encephalopathy)
Seizures
Neonatal unit admission
Apgar score less than seven at five minutes
Breastfeeding initiation

<b>Perinatal outcomes</b>
<p>Mode of birth:</p> <ul style="list-style-type: none"> <li>○ Spontaneous vertex birth</li> <li>○ Vaginal breech birth</li> <li>○ Ventouse delivery</li> <li>○ Forceps delivery</li> <li>○ Intrapartum caesarean section</li> </ul>
<p>Normal birth – defined as birth with none of the following interventions:</p> <ul style="list-style-type: none"> <li>○ Induction of labour</li> <li>○ Epidural or spinal analgesia</li> <li>○ General anaesthetic</li> <li>○ Forceps or ventouse</li> <li>○ Caesarean section</li> <li>○ Episiotomy</li> <li>○ Third or fourth degree perineal trauma</li> <li>○ Blood transfusion</li> <li>○ Admission to an intensive therapy unit, high dependency unit or specialist unit</li> <li>○ Maternal death (within 42 days of giving birth)</li> </ul>

**Table 8 :** Maternal interventions in labour

Syntocinon augmentation
Immersion in water for pain relief
Epidural or spinal analgesia
General anaesthetic
Active management of the third stage of labour
Episiotomy

**Table 9 :** Exclusion criteria

Women who had a caesarean section before the start of labour
Women who presented in labour before 37 weeks and 0 days gestation
Women with a multiple pregnancy
Women who had received no antenatal care
Stillbirths occurring prior to the start of care in labour were excluded.