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A comparison of midwife-led and obstetrician-led antenatal care for women with one previous Caesarean section

by

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RM, BSc (Hons), PG Cert, Grad Dip Law

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ABSTRACT

FACULTY OF HEALTH SCIENCES

Midwifery

Doctor of Clinical Practice

A COMPARISON OF MIDWIFE-LED AND OBSTETRICIAN-LED ANTENATAL CARE FOR WOMEN WITH ONE PREVIOUS CAESAREAN SECTION

By Helen Kate White (nee Barnes)

This research compared midwife-led with obstetrician-led antenatal care for women who had previously given birth by Caesarean section (CS) and had no other risk factors. The primary outcomes under investigation were intended and actual mode of birth. Safety outcomes were also evaluated and compared.

Internationally, CS rates have risen dramatically over the last three decades. There is large variation between rates in different maternity units. Vaginal birth after Caesarean (VBAC) is considered a safe option for the majority of women who have a previous CS. Evidence suggests that factors in antenatal care can influence women's mode of birth decision, most notably the interaction with health professionals. Midwife-led care is known to have benefits for 'low-risk' women; it is argued that these benefits can be extrapolated to women whose only risk factor is a prior CS.

This research was a retrospective, comparative cohort study. A quantitative methodology was applied to objectively compare intended and actual VBAC rates between women who received either midwife-led or obstetrician-led antenatal care. Women's case-notes were reviewed and data collected (n=405). The sample size was calculated to test a non-inferiority hypothesis: that midwife-led antenatal care elicits a VBAC rate that is equal to or higher than obstetrician-led.

Analysis indicates that receiving midwife-led antenatal care resulted in higher intended and actual VBAC rates compared with obstetrician-led antenatal care: 90% vs. 77%, OR 2.78 (95% confidence interval 1.57-4.92), $p<0.001$ and 61% vs. 47%, OR 1.79 (1.2-2.66), $p=0.004$, respectively. These findings remained significant after adjustment for clinically important confounding factors. Analysis also provides some evidence that midwife-led antenatal care is safe and results in fewer episodes of unscheduled antenatal care and antenatal inpatient admissions. Significant improvements were demonstrated with midwife-led compared to obstetrician-led antenatal care with regard to continuity of carer, the environment of care and the time women had to make their mode of birth choice. It is theorised that these differences, the organisation's support of the innovation and, perhaps most importantly, the midwifery expertise and focus on normal birth increased the VBAC rate by enhancing women's confidence in their ability to birth naturally.

This research has demonstrated an association between midwife-led antenatal care and increased VBAC rates and has provided some evidence that this type of care is safe.

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DECLARATION OF AUTHORSHIP

I, Helen Kate White (nee Barnes), declare that the thesis entitled 'A comparison of midwife-led and obstetrician-led antenatal care for women with one previous Caesarean section' and the work presented in the thesis are both my own, and have been generated by me as the result of my own original research. I confirm that:

- this work was done wholly or mainly while in candidature for a research degree at this University;
- where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;
- where I have consulted the published work of others, this is always clearly attributed;
- where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;
- I have acknowledged all main sources of help;
- where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;
- none of this work has been published before submission.

Signed: ……..

Date:……

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Definitions and Abbreviations

aOR	Adjusted odds ratio
95% CI	95% confidence interval
CS	Caesarean section
DH	Department of Health
DRA	Data retrieval assistant
EBL	Estimated blood loss
EDD	Estimated due date
ERCS	Elective repeat Caesarean section
GP	General Practitioner
GTT	Glucose tolerance test
HCP	Health care professional / practitioner
IOL	Induction of labour
LREC	Local Research Ethics Committee
MLAC	Midwife-led antenatal care
MROP	Manual removal of placenta
NICE	National Institute of Health and Clinical excellence
NMC	Nursing and Midwifery Council
OLAC	Obstetrician-led antenatal care
OR	Odds ratio
PPH	Postpartum haemorrhage
RCM	Royal College of Midwives
RCOG	Royal College of Obstetricians and Gynaecologists
RCT	Randomised controlled trial
RR	Relative risk
SD	Standard deviation
TTN	Transient tachypnoea of the newborn
UK	United Kingdom
VBAC	Vaginal birth after Caesarean section
VTE	Venous thromboembolism
WHO	World Health Organisation
WTE	Whole-time equivalent

1. Introduction

1.1 Background to research

In 1985 the World Health Organisation (WHO) stated that Caesarean section (CS) rates should not exceed 10-15%, as above this no additional health benefits are conferred to the mother or neonate (WHO, 1985). The expert opinion on which this recommendation was based has been supported by good quality observational research. Villar et al (2006) found that higher CS rates are associated with greater severe maternal and perinatal morbidity and mortality, even after accounting for risk factors. Citing a lack of evidence to the contrary, the upper limit recommendation was reiterated by the WHO in 2010 (Gibbons et al, 2010). Despite this, the CS rate has risen dramatically in the United Kingdom (UK) from 10.4% in 1985 (Health and Social Care Information Centre, 2009) to 25.5% in 2012-13 (Health and Social Care Information Centre, 2013). A similar picture is seen globally. CS rates have risen in Australia from 18% in 1991 to 32% in 2011 (Li et al, 2013); the United States (US) national rate was 32.7% in 2013 (Hamilton et al, 2014) with some states reaching rates of nearly 40% (Martin et al, 2013). Hence, safely reducing the CS rate is a national and international focus for Governments, health organisations, health service commissioners, professional colleges and individual Trusts (American Congress of Obstetricians and Gynecologists (ACOG), 2010a; House of Commons Health Committee, 2003; NHS Institute for Innovation and Improvement, 2007; Gibbons et al for the World Health Organisation (WHO), 2010). Concentrating efforts to reduce the CS rate for women who have previously birthed by CS is considered worthwhile as a large epidemiological study carried out by Bragg et al (2010) of 146 NHS Trusts in England demonstrated that repeat CS contributes a substantial percentage to the overall CS rate. Of the 147,726 CSs carried out during 2008 in England, 46,748 (32%) were undertaken on women who have previously birthed by CS; of these 70% were elective (Bragg et al, 2010).

Vaginal birth after Caesarean (VBAC) is accepted as a safe and viable option for the majority of women who have previously given birth by lower segment CS (LSCS), with

low rates of maternal and perinatal morbidity and mortality (ACOG, 2010; Dodd et al, 2013; National Collaborating Centre for Women's and Children's Health (NCCWCH), 2011; Royal College of Obstetricians and Gynaecologists (RCOG), 2007; RCOG, 2008). Hence, encouraging the appropriate women to attempt VBAC is an acceptable way to reduce CS rates (NHS Institute for Innovation and Improvement, 2007) and to confer health benefits to individual mothers and babies (section 2.3). A recent meta-analysis of interventions aimed at increasing VBAC rates, including decision-aids and antenatal education, indicates that none of these interventions have succeeded in their primary objective in a clinically relevant or statistically significant way (Nilsson et al, 2015). This research meets the authors' urgent recommendation of the evaluation of a woman-centred intervention that can achieve higher VBAC rates.

1.2 Rationale for research

This research considered the provision of antenatal care in a subsequent pregnancy for women who have previously birthed by CS. The question to be answered is whether the profession of the individual providing that care impacts on the intended and actual rates of VBAC. Specifically, this research compared the innovative midwife-led model of antenatal care with traditional antenatal care, led by an obstetrician, for women with one previous CS and no other risk factors.

As a midwife undertaking a training programme to become a consultant midwife, the clinical need to safely reduce the CS rate was apparent to me when this research was conceived. At the Trust where this research took place, focussing this goal on the large proportion of women who have previously birthed by CS (about 11%) was a clinical priority (reference withheld for confidentiality). Clinical leadership is strong within the Trust, therefore clinically driven service improvements, such as this one, are expected when a need is highlighted. Consultant midwives (and consultant midwife trainees) work closely within the midwifery team and with their obstetric colleagues in service development. With multidisciplinary agreement, the Trust embarked on the implementation of midwife-led antenatal care (MLAC) for women who had one

previous CS and no other medical, obstetric or psychological complications. As a consultant midwife trainee at the time, I took a significant responsibility in implementing this innovation within the Trust and led the research to evaluate it.

Various drivers precipitated the multidisciplinary decision to implement MLAC within the Trust. Research evidence supports the concept of MLAC (see chapter 2). The plethora of research into maternal and perinatal outcomes for mothers who undertake either VBAC or ERCS demonstrate that the risks of severe morbidity or mortality are rare with either option, leading to the recommendation of maternal choice in national guidelines (ACOG, 2010; Dodd et al, 2013; NCCWCH, 2011; RCOG, 2007; 2008). Given that the best maternal and neonatal outcomes follow successful VBAC (section 2.3), it follows that women who have a good chance of achieving a successful VBAC should be encouraged and supported to do so by their healthcare professional (HCP). The literature indicates that women expect high quality information in order to make an informed choice about mode of birth during their next pregnancy (Lundgren et al, 2012) and that they consider having control over decision making to be important (Fenwick et al, 2003). Evidence indicates that the individual HCP and the organisation of care can have an influence on women's mode of birth choice (Goodall et al, 2009; Moffat et al, 2007). National documents and guidance papers provide encouragement for MLAC. '*Maternity Matters'* outlined the clinical priority of choice in maternity care (DH, 2007), with more recent papers building on this, adding aspirational high quality care in the community, with continuity of care, carer and information (DH, 2007a; 2008; Royal College of Midwives [RCM], 2009) to the care that women should expect. Given the stretched resources within maternity services in this country (RCM, 2013) the King's Fund address the need to consider alternative models of care and the most appropriate use of resources by recommending midwife-led models of care for the majority of women, including those at 'low' and 'medium' risk of complications (Sandall et al, 2011). Through their focus on reducing CS rates, the NHS Institute for Innovation and Improvement (2007) theorised that a midwife-led model of antenatal care may optimise VBAC rates among women with a previous CS.

Despite MLAC being supported by the literature and a national think-tank, the basis of this research was my own clinical practice. Part of my role as a consultant midwife

trainee and later as a consultant midwife was counselling women who had previously birthed by CS about their options for mode of birth. As a reflective and reflexive practitioner, I seek to understand my own beliefs and biases in order that they can positively influence my daily practice (Bolton, 2010). My philosophical and professional standpoint is that, for the majority of women, pregnancy and childbirth are normal life events. I believe that this remains true for women who have previously given birth by CS and who have no other medical, obstetric or psychological complications. This view has shaped consultations with women who are making their decision about mode of birth following a previous CS. For some women making the decision is easy, but for others it is a difficult process taking into consideration the clinical risks and benefits and complex social and emotional aspects that shape their views of birth. Experience of individualising the decision-making discussion with different women based on their informational needs, level of understanding and prior experiences has demonstrated the value of my philosophical and professional standpoint. Far from trivialising or normalising the risks inherent with each mode of birth, this has enabled me to acknowledge and address them truthfully, providing women with the full picture of risks and benefits and allowing them to ascribe their own value to what this means for them. Perhaps most importantly, these values lead me to naturally focus on the social and emotional aspects of making a decision about mode of birth following a previous CS. Where women have a fear of childbirth, which may be based on their previous experience, I have used my midwife's expertise in normal birth to engage women in discussion about this and strive to provide emotional and practical reassurance for their forthcoming birth. These are skills that I share with my colleagues. My experience leads me to believe that midwives are perfectly placed to counsel women about their mode of birth choice.

Women are generally active participants in their maternity care. They do not passively accept the care that is being provided to them, without considering what it means for them and their baby. In an era of openness (NHS England, 2013) and informed choice (DH, 2007), women may be aware of the rationale behind the care they receive and the recommendations that are made. This creates a paradox that must be evident to women who have previously birthed by CS. The following description of a passage of

care demonstrates this. Traditionally, women with a previous CS are informed of their high-risk status at their booking-in appointment with their midwife. Their midwife informs them that they need to be referred to an obstetrician '*because of what happened last time'.* The woman will then attend antenatal clinic appointments with an obstetrician, usually situated in the main hospital. The woman's community midwife may or may not feel confident enough or have the time to initiate discussion about the mode of birth options available to her. Therefore, the woman's only opportunity to discuss her options may be during visits to see the obstetrician. If appropriate, the woman is then expected and encouraged to choose VBAC. This mode of birth option will sound contradictory to the high-risk status that the woman may have presumed for herself, based on her referral to an obstetrician and care provided in a hospital. To reassure her, she is told that technology can keep her safe. She may perceive VBAC to be associated with so much monitoring and 'labour time-limits' that she feels she might as well remove the uncertainty and plan an elective repeat CS (ERCS). This description of the potential effect of traditional care for women with a previous CS is intended to be extreme to illustrate the point. However, it is clear why some women who are appropriate to plan VBAC feel that it is too much of a risk and that they are not capable. It is my belief and was my expectation when designing this research that MLAC would safely increase the rates of women who intend to birth by VBAC, due to the midwifery expertise of maintaining normality where appropriate.

Despite being instrumental in the implementation of MLAC, my belief in the principle of evidence-based practice led me to conceive of this research. My experience of leading the MLAC service development raised research and operational questions from colleagues. I was conscious of the fact that the innovation was yet to be formally evaluated for efficacy, safety, women's and healthcare professionals' opinions and health economic evaluation. I was also aware that previous extensions to the role of the midwife, including the newborn examination, have been formally evaluated through research (see section 6.4.2), which has led to their wider implementation into midwifery practice. Within the resource constraints of this research, I judged that the clinical priority was to evaluate the efficacy and safety of MLAC.

This research was undertaken with the intention of informing clinical practice for the benefit of women and the maternity service as a whole. Hence, it was designed to answer a clinically relevant question and to provide statistically robust results, on which to base future clinical practice and research priorities. This thesis was written for the award of Doctorate in Clinical Practice.

1.3 Thesis structure

The rationale for this research was embedded in my own clinical experience and was bolstered by research into the phenomenon of previous CS, which supports the philosophy of MLAC for this group of women. Chapter 2 discusses the risks and benefits of VBAC and repeat CS, the issues of decision making and informed choice for women, and midwife-led models of care. National policies supporting women-centred care and informed choice are highlighted, demonstrating driving forces for the provision of MLAC (DH, 2007; 2008; RCM, 2009).

A thorough discussion of the practice context in which this research took place and justification of the research design are outlined in chapter 3. In brief, this research used a quantitative methodology and a retrospective cohort study design. In order to provide the most clinically relevant results this research was interested in efficacy and safety, in its context as the first evaluation of MLAC in comparison with traditional obstetrician-led antenatal care (OLAC). The primary outcomes were intended and actual mode of birth.

The maternal baseline demographics and results are presented in chapter 4. The main findings of this research are that MLAC is statistically significantly associated with a higher rate of intended (OR 2.78 (95% CI 1.57-4.92), $p<0.001$) and actual (OR 1.79 (95% CI 1.2-2.66), $p=0.004$) birth by VBAC, compared with OLAC. Additional data analysis investigated maternal and neonatal outcomes.

Chapter 5 discusses the findings of this research in relation to previous research evidence and generates theories about why differences in outcomes may exist

between the MLAC and OLAC groups. The higher rates of intended and actual VBAC with MLAC compared with OLAC are discussed in light of other research demonstrating a similar association. Theories relating to the influence of health professionals, the philosophy of midwife-led care, continuity of care, the environment in which care is provided, and women's previous childbirth experience are presented in reference to these results. Previous evidence related to the safety of midwife-led care is outlined, demonstrating correlation with the safety profile highlighted in this research.

Given the positive findings for MLAC in this research, it is important to consider the implications, application and implementation of MLAC in clinical practice. Chapter 6 appraises the further research implications and the local and regional application of these research findings. The factors to be considered prior to implementation are then discussed, including the role of the midwife, extending this role to encompass MLAC, the modern milieu of maternity services and change management theory.

Finally, concluding remarks are made about the innovation of MLAC in comparison to OLAC in chapter 7. The clinically and evidence-based background to this research is explained. The research design is justified and critiqued, including discussion of its strengths and weaknesses. Additionally, self-analysis and reflection demonstrate the learning experience that this research and completion of this thesis have ensured. Importantly, the dissemination plans and research priorities are also set out.

1.4 Summary

A significant proportion of women giving birth in this country have previously birthed by CS (7.7-11%) (Bragg et al, 2010; The Information Centre, 2011; Thomas et al, 2001 (England and Wales)). Hence, the findings of this research have the potential to impact upon the antenatal care and birth outcomes for up to one in every ten women cared for by the maternity services. My clinical experience, research evidence and national policy bolster the justification for implementing a midwife-led model of antenatal care for women with one previous CS and no other risk factors. The imperatives of safety and high quality maternity care validated the rationale for conducting this research,

which aimed to investigate the efficacy and safety of MLAC for this large group of women.

2. Literature review

2.1 Introduction

This literature review outlines the research evidence related to VBAC, decision making and what influences this process for women following a previous CS, and midwife-led care. The theory on which this research is based is outlined; that midwife-led care confers important benefits and shows no adverse outcomes (Sandall et al, 2013) and that these benefits may be extrapolated to women who have previously birthed by CS and could positively impact on VBAC rates. A robust literature search methodology was employed to ensure all relevant evidence was reviewed (see appendix 1).

2.2 The rising rate of Caesarean sections

As already stated (section 1.1) international CS rates have risen significantly since the WHO made a recommendation about an upper limit of 10-15% (WHO, 1985). Epidemiological data and societal changes provide some explanation for this escalation. The changing demographics and health status of women giving birth in the UK over the past few decades are likely influencing factors. Two such examples are maternal obesity and advancing age. Research evidence indicates that both raised maternal BMI and age are associated with high CS rates (Barau et al, 2006; Naftalin and Paterson-Brown, 2008; O'Leary et al, 2007; Roman et al, 2008). In 2012, 25% of women over 16 years of age were obese (BMI > 30kg/ m^2) (The NHS Information Centre, 2014) compared to just 8% in 1980 (Great Britain Parliament House of Commons Health Committee, 2004). The proportion of women giving birth over the age of 40 in England and Wales has also increased from 1.36% (9,336 of 687,725 live births) in 1989 to 3.82% (26,976 of 706,248 live births) in 2009 (Office for National Statistics, 2000; 2010).

NICE (NCCWCH, 2011) outline clinical indications for CS, including presumed fetal compromise, 'failure to progress' in labour and breech presentation. In these cases the risks of a vaginal birth are deemed to outweigh those of a CS. Despite such guidance, wide variations exist in national and international CS rates even after adjustment for clinical risks (Bragg et al, 2010; Fantini et al , 2006; Hanley et al, 2010), indicating that the threshold for recommending a CS differs between organisations. Commentators suggest that individual perceptions of the risks of CS, approach to decision making and organisational culture may have a greater impact on CS rates than maternal characteristics (Hanley et al, 2010).

Where CS is considered the most appropriate mode of birth due to individual maternal or fetal factors an obstetrician must thoroughly discuss the procedure with the woman in order that she can provide her informed consent. The RCOG provide clear guidance aimed at standardising the content of this discussion, ensuring that the woman has adequate, consistent information (RCOG, 2009). The guidance outlines the risks to the mother and the baby, quantifying the risks that are most serious and most frequent (Table 2.1). These risks apply to all women undergoing CS regardless of their individual circumstances. However, CS under specific circumstances or where there are pre-existing maternal co-morbidities, including obesity and previous abdominal surgery, carries increased risks of serious complications (RCOG, 2009). Given the risks of CS, methods for standardising practice and safely reducing the CS rate are national and international foci.

Table 2-1: Maternal and fetal risks for CS (whole population) (adapted from RCOG, 2009)

Serious risks	**Frequency (approximate)**
Need for emergency hysterectomy	7-8 women per 1,000 (uncommon)
Need for further surgery at a later date	5 women per 1,000 (uncommon)
Admission to intensive care unit	9 women per 1,000 (uncommon)
Haemorrhage	5 women in every 1000 (uncommon)
Thromboembolism	4-16 women in every 10,000 (rare)
Bladder injury	1 women in every 1000 (rare)
Ureteric injury	3 women in every 10,000 (rare)
Death	1 women in every 12,000 (very rare)
Frequent risks	
Persistent wound and abdominal discomfort in the first few months following surgery	9 women in every 100 (common)
Increased risk of CS when vaginal delivery attempted in a subsequent pregnancy	1 woman in every 4 (very common)
Readmission to hospital	5 women in every 100 (common)
Infection	6 women in every 100 (common)
Fetal lacerations	1 to 2 babies in every 100 (common)

Approximately one in ten women receiving maternity care in the UK have previously given birth by CS (Bragg et al, 2010; The Information Centre, 2011; Thomas et al, 2001) and have the option of choosing to birth by ERCS or VBAC. The risks and benefits of each option and the challenges of the decision making process for women and health professionals are now discussed.

2.3 The evidence for vaginal birth after CS (VBAC) versus elective repeat CS (ERCS)

VBAC rates and their trend over the past few decades vary between countries, and the UK and US are examples of this. VBAC rates are not routinely recorded in the UK by national bodies such as the Office for National Statistics, Hospital Episode Statistics, or the RCOG or RCM. Women with a prior CS account for nearly one third of the overall CS rate (Bragg et al, 2010), making the lack of a national database that records and evaluates the CS rate for this group lamentable. As a result, evaluation of the trends in VBAC rates is limited to data from research articles that are specifically interested in this outcome and that will apply different inclusion and exclusion criteria. However, it appears to be the case that VBAC rates in the UK have relatively stable over the past 15 years: 33% in 2000 (RCOG, 2001), 29% in 2008 (Bragg et al, 2010) and 33% in 2011-12 (Knight et al, 2014). Conversely, VBAC rates in the US have varied significantly over time, rising steadily from around 5% in 1985 to 28% in 1996, as VBAC successes increased the confidence of women and their care providers to choose this mode of birth option (ACOG, 2010a). However, by 2006 the rate had declined to 8.5%, amid restrictions placed on women's choice by hospitals and insurers (ACOG, 2010a). This variation between countries perhaps reflects the support for VBAC from the Royal College of Obstetricians and Gynaecologists (RCOG), who advise that there are very few occasions where VBAC is not recommended and ERCS is a safer choice (RCOG, 2008). Women who opt for VBAC have a good chance of being successful (see section 2.3.1), but may require an emergency CS. Evidence regarding VBAC and ERCS, presented in this section, indicates that both modes of birth have risks and benefits. However, the best maternal and neonatal health outcomes, particularly regarding mortality and blood loss, are reported following successful VBAC compared to ERCS or emergency CS (Tan et al, 2007; Tan et al, 2008; Wen et al, 2004).

The quality of evidence about outcomes for women who plan either VBAC or ERCS following a single prior CS is limited due to the lack of randomised controlled trials (RCTs) (Dodd et al, 2013). RCTs are unlikely to be possible in view of the recommendation for maternal choice (NCCWCH, 2011) and strong maternal

preference about mode of birth following a prior CS (Crowther et al, 2012). Evidence is therefore mainly derived from non-randomised cohort studies that are usually retrospective and hence have an inherent potential for bias.

2.3.1 Uptake of and success rates for planned VBAC

The vaginal birth rate for women who have previously birthed by CS is determined by the proportion of women who choose to attempt VBAC over ERCS and the percentage of those who are successful. Knight et al (2014) aimed to investigate the demographic and obstetric factors associated with the uptake and success of vaginal birth following a previous CS. The overall rate of attempted VBAC was 52.2%, of these the percentage who achieved a successful VBAC was 63.4%. This study was limited by its retrospective, cohort design and reliance on a pre-existing database for data collection. However, the large sample size (n=143,970) and robust data analysis ensured useful and reliable epidemiological evidence about the women who attempt and achieve VBAC in the English National Health Service (NHS). After adjustment for known confounders, analysis showed that women who were younger, who were of non-white ethnicity and who lived in the most deprived areas of England had the highest rates of attempted VBAC and younger women of white ethnicity had the highest success rates (p<0.001 for all) (Knight et al, 2014).

Larger, international studies report the overall success rate for women who attempt VBAC as approximately 75% (Bias et al, 2001; Kwee et al, 2007; Landon et al, 2005; Tan et al, 2007; Turner et al, 2006), with rates ranging from 56% (Stone et al, 2000) to 80% (Jongen et al, 1998). This large range is a likely consequence of the lack of good quality evidence, as discussed previously. Reliance on a cohort design may render the studies inherently biased by factors such as the practice environment, the sampling strategy or data collection errors.

Evidence exists regarding individual factors that may make VBAC success more or less likely. A woman's chance of success is as high as 90% if she has had a previous vaginal birth, especially a previous VBAC (Gyamfi et al, 2004). Successful VBAC is inversely

related to increasing BMI and less likely in women over 35 years of age (Bujold et al, 2005; Srinivas et al, 2007). Success is less likely for women whose labour has been induced or augmented or whose previous CS was for 'failure to progress' in labour (Landon et al, 2005; Rageth et al, 1999; Stronge et al, 1996). Knight et al (2014) also found that women who previously had an emergency CS, especially those with a failed induction of labour (IOL), had lower VBAC success rates than those who did not (OR 0.59; 95% CI 0.53-0.67). This information has not led to the validation of a tool for predicting VBAC success (Smith et al, 2005). Such tools are considered to have limited clinical value (Catling-Paull et al, 2011a) as even women with all of these risk factors have a reasonable chance (about 40%: Landon et al, 2005) of benefiting from the advantages of successful VBAC. However, obstetricians and midwives can use this information when counselling women about planning VBAC to evaluate their individual chances and help them make an informed choice about mode of birth.

2.3.2 Maternal mortality

Maternal mortality is rare in the UK, with an overall mortality rate of 10.12 per 100,000 maternities, with deaths directly attributable to pregnancy being even more infrequent (3.25 per 100,000) (Knight et al 2014a). An association between CS and maternal mortality was highlighted in the Saving Mothers' Lives report that preceded this research (CMACE, 2011). Sixty-one percent (n = 189) of women who died gave birth by CS. Importantly, a significant number of CSs (40; 21%) were peri-mortem; conducted in an attempt to save the mother's life or to save the fetus when the mother was known to have already died. It is difficult to distinguish between deaths where there was an underlying complication and those that were as a direct consequence of the CS. Therefore, the CS itself cannot be said to be the causal influence of all such maternal deaths.

For women who have previously given birth by CS, the risk of maternal mortality is influenced by planned mode of birth. In their large systematic review, Guise et al (2010) found that the overall risk of maternal death remained low for women with a

previous CS (26 in 402,883 or 6.45 per 100,000). They found that planning a VBAC reduced the risk of maternal death (3.8 per 100,000) compared to ERCS (13.4 per 100,000); relative risk (RR) with planned VBAC 0.33 (95% CI 0.13-0.88; *p* = 0.027). Two-hundred and three randomised controlled trials, cohort and case-control studies were included in the analysis of this systematic review. Trials involving women who were suitable for either VBAC or ERCS were included. However, given that non-randomised trials made up the vast majority of the review (199 of 203), it is likely that the women who made up the VBAC group were somehow different to those in the ERCS group, including the possibility that the VBAC group were inherently lower-risk than those who opted for ERCS. Whilst the risk status of the populations who opted for either VBAC or ERCS may explain the finding that planned VBAC brings a lower risk of maternal death, the clinical implication is that women who are willing and suitable with a good chance of achieving a successful VBAC should be encouraged to plan VBAC.

2.3.3 Uterine rupture

The consequences of uterine rupture for the mother and neonate can range from catastrophe to relatively minor morbidities (Turner et al, 2006). The risk of uterine rupture is rare following a previous CS, although it is higher with a planned VBAC compared to planned ERCS (NCCWCH, 2011). The risk of uterine rupture with planned VBAC is approximately 0.5% (Lydon-Rochelle et al, 2001; Umeadi et al, 2007; Zwart et al, 2009); although other recent studies report lower rates (Dekker et al, 2010; Fitzpatrick et al, 2012). In their large population-based retrospective cohort study (n = 29,008 women) conducted in Australia, Dekker et al (2010) reported low overall uterine rupture rates for those attempting VBAC, in a population with a VBAC rate of 54.3%. The lowest rupture rate for women planning VBAC was in the group who laboured spontaneously without augmentation (0.15% complete ruptures). Fitzpatrick et al (2012) reviewed all uterine ruptures in the UK in 2009-2010 in their large national case-control study (n=852,206 maternities). They also reported low rates of uterine rupture; with an overall rate of 0.11% for women with a previous CS. The rate for

women attempting VBAC was 0.21%. Suggested reasons for the difference between these findings and the higher overall rates for uterine rupture in the Zwart et al (2009) study include the higher VBAC rate in the Netherlands and also the Dutch practice of single layer closure of the uterus. UK National guidance advocates two layer closure of the uterus, except in a research context (NCCWCH, 2011), as single layer closure has been linked to an increased risk of rupture.

Induction or augmentation of labour are known to increase the risk of uterine rupture, with reported rates between 0.54% and 2.4% (Dekker et al, 2010; Lydon-Rochelle et al, 2001; Umeadi et al, 2007). Dekker et al (2010) found that the highest overall rate of uterine rupture was in the group of women who had a spontaneous onset of labour, but required augmentation with synthetic oxytocin (1.91%; 14 fold increase). Three retrospective cohort studies and two case control studies (Bujold et al, 2010; Bujold et al, 2002; Esposito et al, 2000; Fitzpatrick et al, 2012; Shipp et al, 2001) agree that a shorter interval between births also increases the chances of uterine rupture.

Planned ERCS lowers the risk of uterine rupture significantly but does not avoid it completely, with rates between 0.03% and 0.16% (Fitzpatrick et al, 2012; Lydon-Rochelle et al, 2001).

2.3.4 Placenta praevia and placenta accreta in future pregnancies

Decision making about mode of birth following a primary CS should also take into account the woman's future family plans, as undergoing a further CS increases risks in future pregnancies. Silver et al (2006) found that following a second CS there was an association between CS and placenta praevia. This confirmed the findings of Miller et al (1997) who, from their retrospective case analysis, found that the risk of placenta praevia was directly related to the number of previous CSs ($p < 0.01$). Research evidence is also in agreement that increasing numbers of CSs significantly increases the

risk of placenta accreta (Miller et al, 1997; Silver et al, 2006; Usta et al, 2005) (see table 2.2). Placenta praevia and placenta accreta increase the risk of significant morbidity and mortality for the mother and baby. In addition to the risk of haemorrhage, placenta praevia is also associated with increased risk of placental abruption and preterm birth (Usta et al, 2005). Placenta accreta carries a 7% mortality rate, as well as the complications of severe haemorrhage, infection and adjacent organ damage (Usta et al, 2005).

Table 2-2: Risk of placenta accreta and CS (Silver et al, 2006)

Number of previous CSs	Placenta accreta (%)	OR (95% CI)
0 (n = 6,201)	15 (0.2)	-
1 (n = 15,808)	49 (0.3)	1.3 (0.7-2.3)
2 (n = 6,324)	36 (0.6)	2.4 (1.3-4.3)
3 (n = 1,452)	31 (2.1)	9.0 (4.8-16.7)
4 (n = 258)	6 (2.3)	9.8 (3.8-25.5)
≥5 (n = 89)	6 (6.7)	29.8 (11.3-78.7)

CI, confidence interval; OR, odds ratio

2.3.5 Blood transfusion and peripartum hysterectomy

Peripartum haemorrhage can cause significant maternal morbidity and is a leading cause of maternal mortality (Paterson-Brown et al, 2014). Rouse et al (2006) demonstrated that the risk of requiring a blood transfusion increases significantly with each repeat CS (see table 2.3). Significantly, for women with previous CSs, placenta praevia is an additional risk of requiring a blood transfusion (OR 15.9; 95% CI 12.0-21.0).

Table 2-3: Risk of requiring blood transfusion following CS (Rouse et al, 2006)

Number of previous CSs	1	2	3	4	5
Risk of requiring a blood transfusion	1.8%	2.6%	4.7%	4.6%	14.6%

($p<0.001$ for trend)

Guise et al (2010) reported similar rates of transfusion in their comparison of women planning VBAC and ERCS. Transfusion rates were numerically lower among women who attempted VBAC compared with ERCS (0.9% vs. 1.2%; *p* non-significant). When limited to studies only including 'term' deliveries (≥37 weeks gestation), attempting VBAC was associated with a significantly higher risk of transfusion compared with ERCS (0.7% vs. 0.5%; RR 1.30, 95% CI 1.15-1.47, $p<0.001$), resulting in a risk difference that equates to 1.4 more transfusions per 1,000 attempted VBACs. (Guise et al, 2010). Although not clear from the discussion, it is likely that failed VBAC resulting in delivery by emergency CS accounts for a large proportion of women requiring transfusion in the attempted VBAC group. Both the Rouse et al (2006) study and Guise et al (2010) review are limited by the retrospective nature of the included studies. Neither included studies with a prospectively standardised blood transfusion policy, therefore differences may reflect variances in clinical practice. However, they do provide interesting information about blood transfusion rates in actual clinical practice.

Peripartum hysterectomy is a 'last resort' procedure to either prevent or treat life-threatening peripartum haemorrhage. Bodelon et al (2009) carried out a population based case-control study, which indicates that repeat CS carries the highest risk of peripartum hysterectomy (OR 7.9; 95% CI 5.8-10.7) compared with VBAC (OR 1.9; 95% CI 1.2-3.0), with vaginal birth with no previous CS as the reference (OR 1). The reliability of this research is limited by its reliance on data from birth certificates and discharge summaries. The clinical utility of these findings is also restricted as the actual mode of birth is reported, rather than the planned mode of birth. Hence application of this evidence is reliant on the clinicians' ability to predict which women will have a successful VBAC. Silver et al (2006) also found that the overall risk of

requiring a hysterectomy increases with increasing numbers of previous CSs (see table 2.4). This strengthens the recommendation for VBAC for women who may plan to have further pregnancies.

Table 2-4: Risk of hysterectomy following CS (Silver et al, 2006)

Number of previous CSs	Hysterectomies (%)	OR (95% CI)
0 (n = 6,201)	40 (0.7)	-
1 (n = 15,808)	67 (0.4)	0.7 (0.4-0.97)
2 (n = 6,324)	57 (0.9)	1.4 (0.9-2.1)
3 (n = 1,452)	35 (2.4)	3.8 (2.4-6.0)
4 (n = 258)	9 (3.5)	5.6 (2.7-11.6)
≥5 (n = 89)	8 (9.0)	15.2 (6.9-33.5)

$p < 0.001$

2.3.6 Venous Thromboembolism

There is a five-fold increased risk of venous thromboembolism (VTE) for women who give birth by CS compared with vaginal birth (about 1% and 0.2% respectively) (Lindqvist et al, 1999). As CS is considered a significant risk factor of VTE (Jacobsen et al, 2008; Liu et al, 2007) the RCOG (2009) and the National Clinical Guideline Centre (NCGC, 2010) outline robust clinical practice guidelines regarding VTE prophylaxis for women following this procedure. Despite a decrease in maternal deaths due to VTE in the last triennium (Knight et al, 2014b), it remains a major cause of maternal death and mitigating the risks of this complication as far as possible remains a clinical priority.

2.3.7 Perinatal death and serious adverse outcome

Rates of delivery-related perinatal death are reported to be higher in women who attempt VBAC (12.9 per 10,000; 95% CI 7.9-19.9) compared to those who plan ERCS (1.1 per 10,000; 95% CI 0.0-6.1); relative risk (RR) 11.6 (95% CI 1.6-86.7) (Smith et al, 2002). The wide confidence intervals should be noted, possibly due to the rarity of perinatal death, which nevertheless indicate that this association should be viewed with caution. The risk of delivery-related perinatal death in women who attempt VBAC is similar to the risk for nulliparous women planning vaginal birth (9.8 per 10,000; 95% CI 8.3-11.6); (RR) 1.3 (95% CI 0.8-2.1) (Smith et al, 2002). Guise et al (2010) also report a statistically significant increase in perinatal death when VBAC is the planned mode of birth compared to ERCS (RR 1.82; 95% CI 1.24-2.67 p = 0.041), without differentiating delivery-related perinatal death. However, when the raw data presented by Guise et al (2010) are analysed independently using SPSS, no statistically significant difference is found in rates of perinatal death with ERCS compared with planned VBAC (RR 0.738; 95% CI 0.509-1.068) (see table 2.5). These findings more closely reflect those published by NICE (NCCWCH, 2011). The Guise et al (2010) meta-analysis utilised a logistic random effects model in order to include studies where zero events were noted, in view of the rarity of events such as perinatal death. The different methods of statistical analysis may account for the different result. It is noteworthy that NICE decided to publish their own statistical analysis (which more closely reflects that shown below), rather than reporting that carried out by Guise et al (2010).

Table 2-5: Count and risk estimate of perinatal death (planned ERCS and planned VBAC) using raw data from Guise et al (2010)

PlannedERCS * Perinataldeath Crosstabulation

Count

		Perinataldeath		
		Yes	No	Total
PlannedERCS	Yes	46	35640	35686
	No	72	41141	41213
Total		118	76781	76899

Risk Estimate

	Value	95% Confidence Interval	
		Lower	Upper
Odds Ratio for PlannedERCS (Yes / No)	.738	.509	1.068
For cohort Perinataldeath = Yes	.738	.510	1.068
For cohort Perinataldeath = No	1.000	1.000	1.001
N of Valid Cases	76899		

A composite outcome measure of perinatal death and serious infant morbidity until discharge from hospital (see table 2.6) was the primary outcome in Crowther et al's (2012) cohort study, with a nested RCT, comparing planned VBAC and ERCS. The authors attempted to recruit women to a RCT, as they acknowledged that this would be the gold standard for assessing outcomes for planned VBAC or ERCS. However, as they had predicted from their preliminary survey, very few women agreed to be randomised (22 out of 2,345 women) due to their strong preference for mode of birth. Fifty-three percent of women preferred to plan a VBAC and 47% planned elective CS. The composite measure of perinatal death (0 vs 2 in ERCS and VBAC groups respectively) and serious infant morbidity (10 vs 28) was found to be reduced in women in the planned ERCS group (RR 0.39; 95% CI 0.19-0.8; $p = 0.011$). Perinatal death alone did not reach statistical significance, due to the rarity of this event. The authors comment that the 2 perinatal deaths in the VBAC group were unexplained stillbirths at 39 weeks gestation, based on post-mortem examination. This suggests that they were not delivery related, although this is not explicitly stated. There was a high rate of elective CS (27%) in the planned VBAC group. Therefore it could be speculated that these women had some underlying co-morbidity that precipitated their decision to change to ERCS, causing the overall planned VBAC group to be more likely to have poorer perinatal outcomes.

Table 2-6: Composite outcome measure in Crowther et al (2012)

• Perinatal death • Death of liveborn infant prior to hospital discharge • Birth trauma: subdural or intracerebral haemorrhage, spinal cord injury, basal skull fracture, other fracture, peripheral nerve injury present at discharge from hospital	• Seizures at 24 hours old or requiring ≥drugs to control • Apgar score 4 at 5 minutes • Cord pH <7.0 (arterial or venous) and / or base deficit >12 • Neonatal encephalopathy stage 3	• Admission to NNU > 4 days • Severe neonatal lung disease • Proven necrotising enterocolitis • Proven systemic infection in first 48 hours of life treated with antibiotics

2.3.8 Neonatal respiratory and other morbidity

Kamath et al (2009) conducted a retrospective cohort study to compare outcomes for neonates born by ERCS compared with VBAC, following one prior CS. Their results demonstrate that babies born from mothers who intended to give birth by ERCS had a higher rate of neonatal intensive care (NICU) admission than those born from mothers who planned VBAC. Babies born by emergency CS following a failed VBAC had similar NICU admission rates compared to those born by planned ERCS. Babies born by successful VBAC had the lowest rates of admission. Fewer babies in the planned VBAC group were admitted to NICU due to hypoglycaemia. However, the need for immediate resuscitation was greater in babies born in the intended VBAC group compared with the intended ERCS group (see table 2.7). More babies born by ERCS had on-going respiratory morbidity demonstrated by their greater oxygen requirement in NICU. The authors hypothesise that babies born by intended ERCS lacked the catecholamine surge triggered by labour, which has an important role in lung clearance and glycaemic control. One limitation of this study is the lack of explicit NICU

admission criteria, meaning that the clinical applicability of these findings may be limited in a practice environment that employs different NICU admission criteria.

Table 2-7: Neonatal outcomes by intended and actual mode of birth (adapted from Kamath et al, 2009)

	Intended ERCS (no labour)	Intended ERCS (labour)	Intended VBAC (successful)	Intended VBAC (failed)	*P* =
NICU Admission	9.6%	8.7%	3.7%	8.2%	<0.001*
	9.3%		4.9%		= 0.025*
NICU admission: hypoglycaemia	3.8%	2.9%	0.8%	1.2%	=0.14
	3.5%		0.9%		= 0.03*
O^2 requirement in delivery room	40.2%	44.2%	18.9%	35.3%	<0.001*
	41.5%		23.2%		<0.001*
Bag and mask ventilation	2.5%	1.9%	1.2%	9.4%	<0.001*
	2.3%		3.3%		<0.001*
Intubation	0.8%	0	1.2%	5.9%	<0.001*
	0.6%		2.4%		<0.001*
O^2 requirement in NICU	5.9%	5.8%	1.2%	5.9%	= 0.04*
	5.8%		2.4%		= 0.028*

*p<0.05

These findings appear to agree with the meta-analysis conducted by Guise et al (2010), which also found that babies born following planned VBAC were more likely to receive bag and mask ventilation compared to those born by ERCS; 5.4% (95% CI 3.5-7.6%) vs. 2.5% (95% CI 0.72-5.0%) respectively; risk difference (RD) 2.5% (95% CI 0.72-5.0%).

There was a trend towards higher rates of transient tachypnoea of the newborn (TTN) with planned ERCS, however this did not reach statistical significance; 3.6 % (95% CI: 0.9 to 8.0%) vs. 4.2% (95% CI: 1.9 to 7.3%); RD -0.83% (95% CI: -3.35 to 1.7%). No meta-analysis was conducted on NICU admission rates due to the heterogeneity of the included studies; however, there was evidence that rates were higher with planned ERCS (Guise et al, 2010).

There appears to be agreement in the literature that the strongest predictor for neonatal morbidity is unplanned CS i.e. failed VBAC (Hook et al, 1997; Tan et al, 2008). This may be expected, as women who plan VBAC but who birth by CS are likely to have experienced a complication that precipitated emergency delivery, such as suspected fetal compromise, or delay in progress. Such complications, along with the increased technical difficulty in performing a CS in advanced labour (RCOG, 2009), increases the risk of neonatal morbidity. However, it is also evident that achieving a successful VBAC is associated with the lowest risk of neonatal respiratory and other morbidity. Hence, women who have a good chance of having a successful VBAC should be supported in this option.

2.3.9 Other neonatal outcomes

The literature indicates that CS may adversely affect the long-term health of babies through reduced uptake of breastfeeding. Leung et al (2002) carried out a prospective cohort study, using a self-administered questionnaire, which assessed the impact of mode of birth on breastfeeding. They found that CS was a risk factor for not initiating breastfeeding, for breastfeeding for less than one month and reduced duration overall. This confirms the findings from a previous population study by Bruce et al (1991), who found that breastfeeding rates were 76% among those who birthed vaginally, compared with just 39% who gave birth by CS. Rowe-Murray and Fisher (2002) comment that hospital practices following CS could be a factor. Their prospective longitudinal study of self-reported breastfeeding practices amongst women who gave

birth at four Australian hospitals found that women who birthed by CS experienced a significantly longer delay in initiating the first breastfeed compared to women who birthed vaginally (p <0.001). Early initiation is considered an important step in successful breastfeeding (WHO and United Nations Children's Fund (UNICEF), 1989). A recent small study (n = 34) into infant sucking and breastfeeding behaviour following vaginal or CS showed a similar problem (Sakadilis, 2013). Compared to babies who were birthed vaginally, babies born by CS had a later time to first breastfeed (p = 0.01), faster suck rate on day 3 (p <0.001) and lower neuro-behavioural scores (p = 0.047). It is important to note that the women who gave birth by CS in this study received post-operative analgesia via pethidine patient-controlled epidural analgesia, which over a long period of time may pass through to the baby in breast milk. More recently, a systematic review including 53 studies (n=554,568) reported that early initiation of breastfeeding was significantly reduced following CS birth compared with vaginal birth (odds ratio (OR) 0.57, 95% CI 0.50 to 0.64, p<0.00001), in particular prelabour (or elective) CS (OR 0.83, 95% CI 0.80 to 0.86, p<0.0001) (Prior et al, 2012). The benefits of breastfeeding for mother and infant are well-known (Leon-Cava et al, 2002; Stuebe, 2009). Breastfeeding reduces the risks associated with artificial formula feeding, including acute otitis media, non-specific gastroenteritis, severe lower respiratory tract infections, atopic dermatitis, asthma, obesity, type 1 and 2 diabetes, childhood leukaemia, sudden infant death syndrome and necrotizing enterocolitis (Ip et al, 2007). Additionally breastfeeding confers benefit to the mother in reducing the risk of type 2 diabetes, ovarian and breast cancer, postnatal depression (Ip et al, 2007) and cardiovascular disease (Schwarz et al, 2009). Given the links with poorer health outcomes for the mother and infant, the risk of reduced uptake of breastfeeding with CS birth should not be taken lightly.

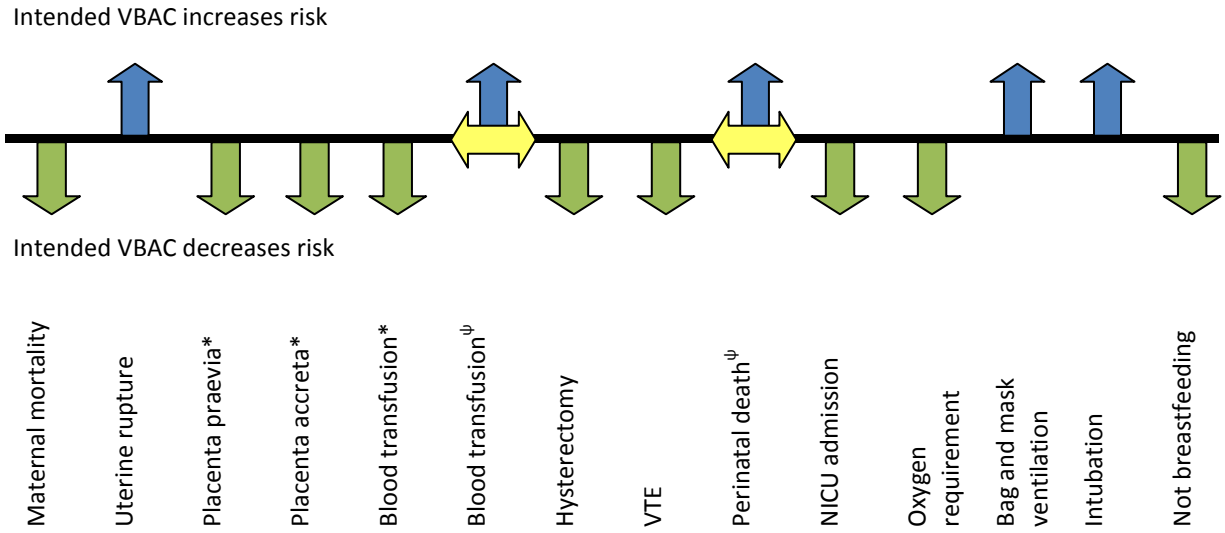
Research evidence is emerging suggesting that the process of labour itself is essential for newborns to appropriately adapt to extra-uterine life (Hyde et al, 2012); not doing so may lead to increased risk of short-term and long-term health complications. Short term complications such as impaired lung-function defined by reduced mean thoracic gas volume (Lee et al, 1999), reduced thermogenic response resulting in low

temperature (Christensson et al, 1993) and altered metabolism causing hypoglycaemia (Zanardo et al, 2006) have been known to be associated with CS birth for many years. Such sequelae provide some explanation for the increased risk of NICU admission following CS (section 2.3.8). The association between CS birth and poorer long-term health outcomes for the newborn is also demonstrated in the literature, including links with type 1 diabetes (Cardwell et al, 2008), obesity (Goldani et al, 2011) and asthma (Thavagnanam et al, 2008). Such research evidence has led to the hypothesis that normal labour and birth exert a positive stress on the neonate. This prepares the newborn for extra-uterine life and may also permanently influence changes in gene expression, explaining the link with certain health outcomes in later life; this theory is generating future research (Dahlen et al, 2013a).

2.3.10 VBAC versus ERCS summary

Figure 2.1 demonstrates the direction of risk for each complication discussed. The research evidence about VBAC is limited by the lack of RCTs. However, the available literature indicates that maternal and perinatal mortality and morbidity are low regardless of planned mode of birth and that successful VBAC is associated with the best maternal and neonatal outcomes. The practice implication is that women who are considered to have a high chance of achieving a successful VBAC, such as those whose only medical or obstetric risk factor is a previous CS, should be encouraged and supported to do so.

Figure 2-1: Depiction of direction of risk with intended VBAC compared with intended ERCS (arrows denote direction, not the relative size of the risk).



*In future pregnancies; ψConflicting results

(Based on Crowther et al, 2012; Fitzpatrick et al, 2012; Guise et al, 2010; Kamath et al, 2009; Leung et al, 2002; Lindqvist et al, 1999; Lydon-Rochelle et al, 2001; Miller et al, 1997; Rouse et al, 2006; Silver et al, 2006; Usta et al, 2005).

2.4 Decision making about mode of birth after a previous CS

2.4.1 Information provision

Section 2.3 has demonstrated that the increased risks faced by women who have one previous CS and no other risk factors manifest during the intrapartum period. The antenatal period of a subsequent pregnancy does not pose additional risks, hence national and international guidelines focus on women's need to be supported by a HCP to make an informed choice about mode of birth (ACOG, 2010; NCCWCH, 2011; NIH, 2010). Qualitative research into women's experiences of pregnancy following a previous CS highlights how difficult making a decision about mode of birth can be.

Women reported feeling like a first time mother, but with the additional burden of fears associated with their previous experience (Dahlen et al, 2013). Lundgren et al's (2012) metasynthesis of qualitative research identified the theme of women's difficulty in seeking and processing information about mode of birth choice and describe this as 'groping through the fog'. Emmett et al (2006) discovered that women often reported their need to actively seek information about mode of birth as it was not routinely offered to them. Indeed Gamble and Creedy (2001) reported that the women in their research did not appear well informed about the risks and benefits of VBAC and ERCS. Information provision is an essential element of the antenatal care of women following a previous CS. HCPs must work hard to resolve the paradox that women find being involved in decisions difficult but that they also find it an important aspect of their care (Lundgren et al, 2012).

2.4.2 Choice and control

In the UK the aspiration of women's choice was set out in the landmark Changing Childbirth report (DH, 1993) and has been a common theme in national documents since (DH, 2004; 2007; 2008; RCM, 2009; RCA, RCM, RCOG, RCPCH 2007). Hundley et al (2001) carried out an investigation into the importance that women ascribe to certain aspects of maternity care. Although this survey was in relation to intrapartum care, it is significant that involvement in decisions was one of the most important attributes women look for in maternity services. In one of the first qualitative investigations into women's experiences of VBAC, Ridley et al (2002) investigated what influences women to choose VBAC. Having a sense of control over the decision making process was a central theme.

Fenwick et al (2003) conducted a small pilot survey to elicit women's views about CS and VBAC. The survey was distributed by the Australian 'Birthrites' organisation, who are lobbyists for better services and provide information and support to women who have birthed by CS. Women reported a loss of control over decision making for mode of birth. These findings were echoed by Dahlen et al (2013), who carried out thematic

analysis on data retrieved from internet blogging sites specific to VBAC. This methodology may be criticised as internet blogging sites may be considered to be only representative of the views of individuals with particularly strong opinions. The authors acknowledge this criticism, countering that blogs are personal expressions of maternal narrative that are reflective of reality and are therefore legitimate sources of information. Choice and control were central themes to the discourses about VBAC. Women described how these elements were missing in their previous birth experience and were therefore even more important this time (Dahlen et al, 2013). Both studies mainly presented the opinions of women from Australia and the United States, where there has been a decline in VBAC rates and many women are not given the choice of VBAC (Fenwick et al, 2003; Dahlen et al, 2013). The sampling technique of both studies renders the subsequent findings biased by their population. However, the opinions expressed may represent those of a significant population of women who are dissatisfied with their experiences of care following a previous CS.

Providing women with enough information to enable help them to take control in making an informed choice is important but complex. How well the HCP does this is likely to impact on both the decision that the woman makes and also how positive she feels about her care.

2.4.3 Women's perceptions of birth

Healthcare professionals must consider maternal preferences and priorities when advising women about mode of birth following a prior CS (NCCWCH, 2011). In their qualitative analysis of the decision making processes of 35 Western Australian women who planned a VBAC following a previous CS, Fenwick et al (2007) found that women viewed their birth as a social, rather than a medical, event. This echoes the findings of Eden et al (2004), in their systematic review of women's childbirth preferences after a previous CS. Women reportedly considered family factors to be more important than the health risks and benefits of each mode of birth (Eden et al, 2004; Meddings et al, 2007). Emmett et al (2006) reported that when women were certain about their

preferred mode of birth, the decision was based on practical and experiential factors rather than maternal or neonatal safety. It is unclear whether these women were fully informed about the risks and benefits of VBAC and ERCS, or whether they believed the risks to be equal. Regardless, it is evident that for these women, the psychosocial aspects of each mode of birth hold more influence than the physical. This clearly demonstrates that HCPs must strike a balance between focusing on the psychosocial aspects that are important to women and the clinical risks and benefits that are imperative to informed choice.

2.4.4 The effect of the Healthcare Professional on decision making

The major difference between the two types of care being compared in this research, MLAC and OLAC, is the professional group caring for and providing information to women. Traditionally the role of the midwife is to be the lead professional in the care of women who are having a 'normal' pregnancy and birth (NCCWCH, 2008; NMC, 2009) and to provide care for women with more complex needs under the guidance of an obstetrician. The NICE Antenatal Care guideline (NCCWCH, 2008) outlines baseline clinical care for all pregnant women, stating that women who have previously given birth by CS (and women with other risk factors) may require additional care. However, that care is not defined and is therefore open to interpretation. Traditionally it has been interpreted that women with a previous CS receive OLAC, where the obstetrician leads the care, which is shared with the midwife and sometimes also the general practitioner (GP) (see section 3.4.2). Only the Royal College of Obstetricians and Gynaecologists are explicit in suggesting obstetrician involvement in antenatal care, stating that the mode of birth decision should be agreed between the woman and her obstetrician ideally before 36 weeks (RCOG, 2007).

The literature indicates that HCPs themselves can have an effect on women's decision making about mode of birth following a previous CS. Women report that they are aware of their health professional's opinion about mode of birth even if it is not explicitly stated (Emmett et al, 2006; Meddings et al, 2007). Goodall et al (2009)

suggest that the woman's perception of her lead carer's views on mode of birth can influence her decision, for and against VBAC. Given that informed choice is important to many women and the majority will make their final decision about mode of birth following consultations with a HCP (Dodd et al, 2004; Meddings et al, 2007; Moffat et al, 2007), it is essential that HCP's views are evidence based and that reflective practice is undertaken to understand the influence they have on women's decision making (Kamal et al, 2005).

2.4.5 Shared decision making and informed choice

Having established the importance of information provision and 'choice and control' to women who have previously birthed by CS, the issue of how this is facilitated by HCPs is now discussed.

Noseworthy et al (2013) comment that it is now generally accepted that 'consumers' of healthcare are autonomous individuals who are not only capable of but demand to be part of the decision making process. Paternalistic and consumerist models of decision making are now rejected in the literature in favour of shared decision making. Kaimal and Kuppermann (2010) describe this as a process by which the decision is shared by clinicians and patients, "*informed by the best evidence available, and weighted according to the specific characteristics and values of the patient*" (page 332). The literature documents attempts to ease women's decision making by the invention of decision-aids. One such aid is described by Sharma et al (2011) and was based on a principle of shared decision making by asking women to attribute values to each potential outcome, to help guide them towards their most favourable mode of birth.

McKenzie (2009) describes the ideal of informed decision making by way of the division of cognitive labour and control; information provision is HCP-led and the decision patient-led. How 'informed' women really are when they make their mode of birth decision is discussed in the literature. Lundgren et al (2012) reported that women frequently describe inadequate information from HCPs, affecting their ability to make an informed decision; findings that were echoed by Chen and Hancock (2012).

Bernstein et al (2012) carried out a prospective, observational study in the US to determine how informed women are about VBAC and ERCS. They revealed that women lacked knowledge about both modes of birth; only 13% of women undergoing VBAC and 4% of women who opted for ERCS were aware of VBAC success rates, 64% of women having ERCS did not know the risk rate of uterine rupture and 52% did not know the difference in recovery time. This suggests that the HCP may subconsciously use strategies such as withholding or emphasising information to guide women to their preferred option, which is consistent with the work of Kamal et al (2005).

Kamal et al (2005) interviewed 25 obstetricians and midwives from two hospitals in an English city to determine their attitudes towards VBAC, ERCS and supporting women with decision making. The findings suggest that individual HCPs favour different approaches to enabling decision making. The majority of midwives subscribed to a consumerist approach, asserting that women have the right to choose their mode of birth as long as they are adequately informed. Some expressed their preference for this approach in terms of the fact that it divested them of responsibility for the decisions once they have provided women with the information they needed. Despite being identified as the preferred approach over paternalism, Emmett et al's (2006) findings suggest that consumerism is a step too far. Indeed, they identified that some women would have preferred more guidance from their HCP. McCourt (2006) carried out a small-scale, in-depth observational analysis of midwives' and women's interactions during the 'booking' appointment. Findings included the difference in approaches to information provision and decision making between 'case-load' and traditional community midwives. Case-load midwives used a more partnership approach than community midwives, which women reported gave them more information, choice and control. The research appears to suggest that different HCPs favour distinct approaches, which may not be determinable by their profession (i.e. midwife or obstetrician), but more by their philosophy and beliefs. Emmett et al (2006) concluded that HCPs need to make an individualised assessment of the type of support each woman may require.

2.4.6 The effect of the organisation of antenatal care on women's decision making

The schedule and organisation of antenatal care may have an influence on women's decision making about mode of birth, in addition to the effect of the HCP. Moffat et al (2007) assert that eliciting women's preference about mode of birth early in their next pregnancy enables more time for detailed discussions that are individualised to each woman's circumstances and level of understanding. This concurs with Eden et al's (2004) literature review, suggesting that interventions involving VBAC information provision and discussion should start before or as early as possible in the next pregnancy.

Kamal et al's (2005) interviews of midwives and obstetricians indicated that both groups of health professionals felt that the organisation of antenatal care in the next pregnancy can have a significant impact on decision making about mode of birth. Midwives and obstetricians recognised that appropriately and successfully advising women about mode of birth depends on gaining their trust. Both groups of professionals felt that midwives were well-placed to develop trusting relationships with women. Catling-Paull et al (2011b) agree with this contention based on their systematic review of quantitative trials of non-clinical interventions to increase the uptake and success rates of VBAC. They concluded that evidence-based information provision and the development of specific VBAC clinics can increase VBAC uptake and reduce decisional conflict for women. The authors assert that providing consistent information is important and that midwives are pivotal in information provision.

2.4.7 Conclusion about decision making following previous CS

Information provision is an important aspect of antenatal care for women who have previously birthed by CS and is essential to informed decision making. The literature has demonstrated that women want and need individualised information and that interactions with HCPs following a primary CS can have an influence on their decision making about mode of birth. Different clinicians have different approaches to providing this information and facilitating an informed decision. This implies that

organisational and individual modifications to that interaction and acknowledgement of the psychosocial aspects of birth may affect the rate of VBAC uptake.

2.5 Midwife-led Antenatal Care

Midwife-led models of care work on the premise that pregnancy is a normal life event; it is women-centred and believes in women's natural ability to give birth without routine intervention if normal, or with minimal intervention (Sandall et al, 2013). Given that the majority (75% and more) of low-risk women with one previous CS could have a successful VBAC, this philosophy should remain true even for these women. In addition to monitoring and responding to the physical wellbeing of women and their babies, midwife-led models focus on the psychological, spiritual and social wellbeing of the woman and her family.

MLAC recognises the role of midwives as autonomous practitioners, providing care that enhances opportunities for normal birth. Enabling midwives to be the main care provider unless risk factors arise can ensure high quality care within the community, better continuity of midwifery care, carer and information and facilitate informed choice. These benefits echo the main themes of recent national documents such as the National Service Framework 'Maternity Services Report' (DH, 2004); 'Maternity Matters' (DH, 2007); 'Safer Childbirth' (DH, 2007a); the 'NHS Next stage review' (DH, 2008); and also 'Midwifery 2020' (Royal College of Midwives (RCM), 2009).

As yet no research has compared midwife and obstetrician-led models of care specifically for women with a previous CS. Sandall et al's (2013) systematic review of the literature compared midwife-led and other models of care and analysed outcomes for women classified as at 'low' and 'high' risk of complications, which encompassed some studies where women with a previous CS were included. In midwife-led models the midwife was the lead professional in planning and delivering care from the first antenatal to the end of the intrapartum period or the final postnatal appointment, there was continuity of carer to differing degrees and input from obstetricians in the ante- and intra-partum periods as necessary. 'Other' models of care included care led

by the obstetrician or GP, or shared-care. Women in the midwife-led models of care were more likely to experience a spontaneous vaginal birth (n=14, 995; risk ratio [RR] 1.05, 95% CI 1.03 to 1.08), no intrapartum analgesia (n=3,328; mean difference 0.5 hours, 95% CI 0.27 to 0.74) and to be attended by a known carer in labour (n=5,225; RR 7.83, 95% CI 4.15 to 14.80); and less likely to experience regional analgesia in labour (n=15, 982; RR 0.85, 95% CI 0.76 to 0.90), instrumental vaginal birth (n=15, 809, RR 0.88, 95% CI 0.81 to 0.96), preterm birth (n=11,546; RR 0.77, 95% CI 0.62 to 0.94), amniotomy (n=3,253; RR 0.80, 95% CI 0.66 to 0.98), episiotomy (n=15,982; RR 0.84, 95% CI 0.76 to 0.92), or fetal loss before 24 weeks (n=13,953; RR 0.81, 95% CI 0.66 to 0.99). The authors advise exercising caution in extrapolating these findings to women who have 'substantial' medical or obstetric risk factors. It could be argued that women who have a prior CS are not at 'substantial' risk during the antenatal period, as the main risks manifest during the intrapartum period. Sandall et al (2013) conclude that midwife-led care confers significant benefits and most women should be offered this option.

2.5.1 Midwife-led Antenatal Care for women with a previous CS

Section 2.4 highlights the potential impact of the care provider, the organisation of antenatal care and women's perceptions of birth after a previous CS on decision making. Given the impact of promoting and encouraging normality during antenatal care and the proven benefits of midwife-led care, the practice implication is that women who have previously birthed by CS may benefit from this model. The midwife-led model of antenatal care for women with one previous CS was proposed within the NHS Institute for Innovation and Improvement (2007) document 'Pathways to success – a self-improvement toolkit; Focus on Caesarean section' in order to optimise opportunities for normal birth and reduce the CS rate, which was based on expert opinion and practices in Trusts with a low CS rate.

In her modestly sized, mixed methods study of women receiving antenatal care following a previous CS, Cox (2007) discovered that women would prefer to receive

information about mode of birth from their community midwife rather than from a hospital doctor. In their evaluation of the 'Next Birth after CS' service (including a dedicated midwife-led telephone line for women who have previously given birth by CS), David et al (2010) found that women frequently sought out information from midwives to help them overcome decisional conflict and plan their mode of birth. Cox (2007) found that conflicting advice from different HCPs caused women great anxiety. This issue can be decreased by reducing the number of caregivers involved in women's antenatal care, as discovered by Morgan et al (1998) through a large preference and satisfaction survey, and case-notes review. For most women midwives are the HCP that they will encounter most frequently. By empowering midwives to provide this informational support, women have many more opportunities for support in decision making compared to the few occasions they meet an obstetrician.

The pathway of MLAC ensures that obstetric appointments are reserved for women who require the expertise that only an obstetrician can provide. Whilst no specific costing has been carried out for MLAC versus OLAC, it is likely that MLAC will be more cost effective, including off-setting the cost of extending the midwives' role to provide this care. Sandall et al (2013) reported in their systematic review that antenatal care was between 20% and 25% cheaper when midwife-led compared to obstetrician-led.

Despite acknowledging the potential benefits of MLAC for women with one previous CS, it is also important to acknowledge that the safety of this type of care has not yet been evaluated. To my knowledge at the time of writing only the Trust where this research took place has implemented MLAC. The patient safety agenda is a top priority within the NHS (NPSA, 2010). Hence, before this type of care can be adopted as accepted practice nationally or internationally it requires evaluation.

2.6 Summary

Reducing the CS rate is an international focus (ACOG, 2010a; House of Commons Health Committee, 2003; NHS Institute for Innovation and Improvement, 2007). VBAC is a safe and recommended option for women with one previous CS, for a non-

recurrent reason, and who have no other risk factors. Successful VBAC elicits better health outcomes for mothers and neonates than birth by CS, either elective or emergency.

Antenatal care following a previous CS includes assessment of women's suitability for a planned VBAC and information provision to help them make an informed choice about their mode of birth, in addition to monitoring their physical, emotional and social wellbeing. Research has demonstrated that information provision is important to women and the manner in which it is provided may influence their mode of birth choice and satisfaction with care.

Evidence indicates that midwife-led care can confer benefits to women and the maternity service. Instilling a perception of normality into the antenatal care of women with one previous CS through midwife-led care may also influence women's decision making about their intended mode of birth.

The literature bolsters the rationale for implementing a midwife-led model of antenatal care for women with one previous CS, in order to increase the uptake of VBAC where appropriate. However, there has been no formal evaluation of the safety or efficacy of this type of care. This is required before wider implementation can be endorsed. Therefore, this research aims to evaluate the efficacy and safety of MLAC as a means of safely increasing the VBAC rate compared with the current standard of care, OLAC. Chapter 3 outlines the methodology and design employed to do this.

3. Study design

3.1 Introduction and aim of research

In order to influence practice, this research intended to investigate the theory that the profession of the individual leading a woman's antenatal care, either midwife or obstetrician, may impact on her mode of birth. Hence the aim of this research was to examine the relationship between the type of antenatal care received, either MLAC or OLAC, and intended and actual mode of birth.

This chapter describes and justifies the study design. The methodology is outlined alongside discussion of another potential methodology that was rejected based on local context and resource constraints. The research design is then described, justified and critiqued, with reference to other midwifery research. The practice context in which this research took place is illustrated, as this was the intervention being studied. Finally, the sampling strategy, data collection method, data analysis and ethical considerations are described.

3.2 Methodology

This was a retrospective, comparative cohort study of midwife-led versus obstetrician-led antenatal care for women with one previous CS and no other risk factors. The study employed a quantitative methodology to objectively compare the intended and actual mode of birth for women who received midwife-led or obstetrician-led antenatal care (described in section 3.4 and tables 3.3 and 3.4).

This research was designed to begin the collation of evidence about the efficacy of MLAC to increase VBAC rates and its safety. Arguably, a randomised controlled trial (RCT) would have been the most rigorous way to conduct this research, as it would be less likely to be biased by confounding factors that may be known or unknown (Bowling, 2002). However, running a RCT was not feasible locally as MLAC was already fully implemented within the Trust at the point the research was proposed. A RCT

within this Trust would have been biased by the fact that all midwives had experience of being the lead antenatal clinician for women with a previous CS. Therefore, even the women who were randomised to receive OLAC would have been cared for by a midwife who was experienced in providing MLAC, including risk assessment and provision of evidence based information. Hence, it would not have been possible to compare MLAC with *traditional* OLAC, where the midwife may not discuss mode of birth options with the woman. It is widely accepted that RCTs are expensive and require a lot of resource (Bowling 2002; WHO, 1998), particularly time and personnel, which were beyond the constraints of this research. Furthermore, conducting a RCT at another Trust was not possible as none were considering implementing this innovation, or would have been willing to undertake such a change prior to analysis of its efficacy and safety through this proof of principle research. Designing a RCT comparing OLAC with MLAC would also have raised the ethical consideration of removing women's choice about their type of care. Denying women the opportunity to receive either the traditional and accepted OLAC or the innovation of MLAC through the randomisation process may have been considered unethical by the Research Ethics Committee and by clinicians (Bowling, 2002). Indeed, less than 1% of women agreed to be randomised in an RCT to compare VBAC and ERCS (22 out of 2,345) (Crowther et al, 2012) indicating that removing women's choice is neither acceptable nor practical in the UK. Given that MLAC was already fully accepted and implemented within this Trust, it was considered to be the most ethical and proportional use of resources to design a well-conducted, retrospective study at this Trust to begin the collation of evidence about the safety and efficacy of MLAC.

3.3 Research design

Women's medical notes were used to collect the data. The notes of consecutive women who gave birth in 2008 and fit the inclusion criteria (see table 3.5) made up the OLAC group. In order to be most representative of current practice, the MLAC group was made up of all consecutive women who fit the inclusion criteria and gave birth in 2011. It is acknowledged that the potential for bias was increased due to the time gap

between the two groups. However, including data from early on in the implementation of MLAC would have introduced the possibility of additional bias. The homogeneity of the groups would have been called into question if women from the early implementation period were included for two reasons. Firstly, there may have been professional selection of the women who received MLAC while the number of midwives trained to provide this care was limited. Secondly, the group of midwives providing MLAC may not have been representative of an average cohort of midwives, as those who chose to undertake early MLAC training may have been most enthusiastic about midwifery care and normal birth, which could have influenced women's mode of birth decisions, as discussed (section 2.3.2).

National clinical guidelines for the care of women who had previously birthed by CS did not change between 2008 and 2011. Local Trust guidance only changed with regard to the implementation of MLAC. Clinicians are expected to work within evidence-based guidelines, unless they have a clear justification for not doing so. Therefore, whilst it is not possible to state with certainty that clinical practice was not different, with the exception of MLAC, it was likely to have been similar between the two cohorts, particularly in relation to intrapartum care. As a proxy measure for differences in clinical practice, maternal and neonatal outcomes for all women from 2008 and 2011 at the Trust have been compared (table 3.1).

Table 3-1: Maternal and neonatal outcomes 2008 and 2011

Outcome	**2008 (%) n = 5887 women**	**2011 (%) n = 6225 women**
Normal birth	63.2	60.8
Total CS	20.5	23.0
Elective CS	7.0	7.3
Emergency CS	13.6	15.7
Induction of labour	20.6	22.4
NNU admissions	625 (number of cases)	568 (number of cases)

Outcomes in 2008 and 2011 were similar, suggesting that clinical practice was also similar. There was a tendency towards increased intervention (including CS and IOL) in 2011, which follows the national trend as previously discussed (section 2.2). Therefore, a finding of reduced intervention with MLAC (the 2011 group) in this study may be more significant than it first appears. In consultation with senior midwives who were instrumental in implementing MLAC at the Trust, it was considered that using pre-implementation data for the OLAC group and the most recent data for the MLAC group would bring the least potential for bias.

An alternative way of reducing the potential bias introduced by the time gap was considered: researching concurrent cohorts of women who received antenatal care and gave birth at different Trusts. There were two problems with this type of design. Firstly, some Trusts had introduced different pathways of care for women with a previous CS, including the introduction of midwife-run VBAC clinics alongside OLAC (Warriner and Haines, 2007). Secondly, conducting this research across two different Trusts potentially introduced additional bias that could not be controlled for. Recent, well-conducted research found that variations in CS rates between hospitals cannot be

explained by different maternal and clinical factors (Bragg et al, 2010; Coonrod et al, 2008; Paranjothy et al, 2005). Brennan et al (2009) compared the CS rates of 9 large maternity units across 9 developed countries (including the UK), totalling 47,402 births. Their study showed large differences in CS rates, ranging from 15-34%. Of most relevance to this study, their research demonstrated widely varying CS rates, of 51-81%, for women with a prior CS. The authors conclude that such disparities are more to do with obstetric practices than clinical risk factors. These studies indicate that endemic differences in obstetric practice influence CS rates, including rates for the group of women who have had a previous CS. The potential differences in obstetric practices between Trusts would have added significant bias to a multi-centre, comparative cohort study, which could not be controlled for within the time and budget constraints of this research. Hence this research design was rejected.

The usual criticisms of retrospective studies are acknowledged below. They are often criticised for not being able to collect all of the relevant data, due to their reliance on pre-existing databases (Hess, 2004). As such databases are usually for billing or record keeping they may not provide accurate means of data collection (Cox et al, 2009). The collection of data directly from medical notes avoided this pitfall. A recent study that used a database for data collection was critiqued as part of the ongoing literature review for this research. Knight et al (2014) investigated the demographic and obstetric factors associated with the uptake and success of VBAC (the results are discussed in section 2.3.1). The Hospital Episodes Statistics (HES) database was used for all data collection. This biased the sampling strategy, as systematic or random errors can be inherent in databases that were not designed for the research purpose (Cox et al, 2009). Important individual characteristics that could not be identified using the database were not accounted for, thereby limiting the validity of the results. In this research, reliance on the Trust hospital database was rejected as the sole data collection tool, despite the potential to be quicker than use of medical notes. The potential for systemic errors was considered to be a significant risk. Data errors may have also existed within the medical notes; however, these were considered less likely as the surrounding narrative within clinical records would have identified them.

Furthermore, the database was not used for data collection because not all of the relevant information required to ensure thorough data analysis, interpretation or theory generation for this research question were routinely stored within it.

Bowling (2002) warns of the potential for recall bias and the difficulty understanding diagnoses in records with retrospective cohorts. These problems were not encountered, as all outcomes of interest were also important clinical outcomes that are traditionally routinely recorded and were therefore very likely to be accurate and present in the medical records.

The decision to undertake a retrospective review of medical records was justified by the wealth of rich data that was routinely collected (Gearing et al, 2006), which, when analysed robustly, fulfilled the aim of this research.

Another study reviewed as part of the literature review was de Jonge et al's (2013) retrospective cohort study, which aimed to test the hypothesis that low-risk women at the onset of labour with a planned homebirth have higher rates of severe morbidity than women who plan hospital birth, and to compare rates of manual removal of placenta (MROP) and postpartum haemorrhage (PPH) in the Netherlands. This research demonstrated that women who plan homebirth have significantly less severe maternal morbidity, PPH and MROP than those who plan to birth in hospital. Despite the limitation of the reliance on a pre-existing database, these results have clinical significance as they relate directly to actual clinical practice. The retrospective design of both the de Jonge et al (2013) and this study was a strength as the main outcomes were not influenced by the research process itself meaning the findings depict true clinical practice. Collecting data retrospectively removed the potential for reporting bias; in a prospective study midwives may have subconsciously changed their practice as they were aware they were being studied (the Hawthorne effect: Landsberger, 1958). The retrospective nature of this research ensured that what was studied was as close to usual clinical practice as possible. The retrospective design was also beneficial as it enabled a large amount of data to be collected in a relatively short amount of time (Cox et al, 2009).

Having considered different methodologies to objectively compare OLAC and MLAC and having designed the research to limit bias, a retrospective, comparative cohort study using two groups of women's case-notes from the same Trust was used.

3.3.1 Comparison with other midwifery research

Cohort studies are relatively common in midwifery research. One large, well-known study used this methodology and is critiqued in comparison with this research below (see appendix 7 for full critique of three cohort studies using the Critical Appraisal Skills Programme (2010) tool, that were reviewed to inform the critical appraisal of this research).

The Birthplace cohort study was a large, national, multicentre, prospective cohort study, designed to compare perinatal and maternal outcomes and interventions based on planned place of birth in England (Birthplace in England Collaborative Group, 2011). The Birthplace study is similar to this research in that it used a cohort design to compare mode of birth. As in this research, a randomised controlled trial may have been considered the gold standard. However, the policy of maternal choice for place of birth (DH, 2007; NCT, RCM, RCOG, 2007; NCCWCH, 2007; 2008) is well-established in England and to remove this choice for research purposes would be considered unethical. Therefore, a prospective cohort study was the most appropriate. This design was possible as women in England continue to have a choice of place of birth and the resources were available to recruit Trusts across England to complete the data collection tool for all women who fit the inclusion criteria, enabling a large sample size (n=64,538). As previously discussed (section 3.2), a prospective study was not possible within the constraints of this research, as the choice to receive OLAC for women who fit the inclusion criteria was no longer part of routine care. Therefore, inclusion into the OLAC group would have relied on women specifically requesting this type of care over MLAC. Thus it would have taken a prohibitively long time to achieve the pre-

specified sample size (section 3.5) and the research would have been significantly biased by self-selection.

As in 'Birthplace', the data collection strategy meant that no patient identifying data needed to be collected, hence the Local Research Ethics Committee (LREC) deemed that consent did not need to be gained from each woman (section 3.8). In both the Birthplace study and this research, a large sample was achieved and the research was not biased by only including those who provided consent.

A limitation of the Birthplace study is that inherent differences, such as psychological and emotional reasons for selecting a particular birth environment, could not be controlled for. This criticism cannot be levelled at this research as there was no or minimal self-selection of the antenatal care that women received. Inclusion in the OLAC or MLAC group was dependant on the year in which the woman received her antenatal care, rather than her preferences. MLAC was not an available option for women in 2008 and no women in 2011 who were included in this research requested OLAC.

The design of this research took account of the potential weaknesses and assets of cohort studies. Characteristics that strengthened the design were included, whilst being pragmatic to the confined resources available. Important characteristics were not using a pre-existing database for data collection, avoiding inherent practice bias through studying care in a single centre, calculation of sample size, the pre-definition of data collection variables and a data analysis plan to account for confounders. These elements are described in detail below.

3.4 Research setting

3.4.1 The Trust

This research was conducted within the maternity department of a large teaching hospital on the south coast of England, where approximately 6,000 women give birth each year. The Trust employs 9 consultant obstetricians, 1.5 whole time equivalent (WTE) consultant midwives and approximately 200 WTE midwives. The majority of midwives work in integrated teams, meaning that they provide care in the community and within the hospital or birth centre on a shift-by-shift basis. At the time of the research there were 5 midwifery teams providing ante-, intra- and post-partum care to women on a case-loading basis, based on individual need (e.g. teenage mothers) or geographical location. The area this Trust serves covers both urban and rural locations and was ranked 81st out of 326 English local authorities in the Index of Multiple Deprivation (1st being the highest deprivation) (reference withheld for confidentiality), but also includes areas of affluence. The Trust gives women a choice of place of birth: the obstetric delivery suite, an integrated midwife-led unit, two free-standing midwife-led units or home.

3.4.2 Obstetrician-led Antenatal Care (OLAC)

Until January 2009, all women with the risk factor of one previous CS were routinely referred for OLAC. The lead clinician was the obstetric consultant. Women received care from midwives and their GP in the community, and saw the obstetric consultant or a doctor within their team at up to three antenatal clinic appointments (see table 3.3). The obstetrician conducted the first mode of birth choice discussion with women at their 20 week antenatal clinic appointment. Midwives provided routine antenatal care (as per NICE: NCCWCH, 2008 and table 3.3), which did not specifically include discussion of mode of birth options, although discussion of the woman's 'birth plan' was recommended at 36 weeks. Women who requested elective CS against the advice of their obstetrician or care that was outside of the recommended guidelines (e.g. homebirth) may have been referred to the consultant midwife clinic, where they were

counselled by a consultant midwife or consultant midwife trainee. The clinics provided women with the opportunity to discuss the reasons for their request, evidence-based risks and benefits for different plans of care and to jointly design a practical plan of care for birth. The majority of referrals to this clinic came via the obstetric team and some via the midwife. Tables 3.3 and 3.4 compare operational aspects of OLAC with MLAC.

3.4.3 Midwife-led Antenatal Care (MLAC)

It is agreed that the antenatal period does not pose any additional risk for women with a previous CS, as the recognised risks manifest intrapartum (section 2.3). MLAC was suggested in the 'Focus on normal birth and reducing caesarean section toolkit' (NHS Institute of Innovation and Improvement, 2007) as a service development that could positively influence VBAC rates without increasing the risk of harm to women and babies. The aim of the toolkit was to assist maternity units in promoting normal birth and was developed by a consultant midwife and consultant obstetrician at the Institute who had worked with Trusts with low CS rates. The Trust initiated MLAC in 2009 following multidisciplinary consultation, guideline development, training and resource needs analysis and Trust-wide agreement. The training and resource needs analysis indicated that midwives already had the requisite skills to provide MLAC, as it involves providing evidence-based information, helping women to understand that information and empowering them to make a decision for themselves about mode of birth. Midwives are already educated and experienced in giving this type of care in relation to many diverse issues in pregnancy, birth and parenting: including fetal anomaly screening, HIV and other infectious disease screening during pregnancy, place of birth choices, birth analgesia choices, vaccinations and many more. Hence, VBAC and MLAC specific professional development was formulated for all midwives under the auspices of the consultant midwives and consultant obstetricians. Workshops were developed for all midwives who provided care to women in the community, in order to update their skills and knowledge, outline the operational aspects of MLAC (including that recommendations for intrapartum care were not changed) and increase their

confidence to be the lead antenatal carer for women with a previous CS and no other risk factors. The two-hour long theoretical and practical workshop addressed the initial risk assessment; provision of up-to-date, evidence-based information to women; and birth planning discussions. Midwives were encouraged to discuss scenarios and prior experiences with their peers. They were provided with resources to assist them in their extended role; including a risk assessment proforma (table 3.2); statistics aide-memoire; antenatal care schedule (including MLAC only and 'Both' elements of table 3.3); and birth planning stickers. The training workshops provided all midwives with the same high quality evidence and tools to ensure that consistent information was given to women every time, although it was left to the midwives' individual professional judgement to decide how to impart this information. The implementation strategy for MLAC included securing 'buy-in' from all professional groups via a launch event to provide an update of the evidence about VBAC and ERCS and the changes to the guideline. By the end of 2010, all midwives had attended the workshop and all women who had one previous CS and no other risk factors received MLAC.

Clear, strict criteria were agreed to ensure that all women with risk factors that preclude VBAC or enable VBAC with caution were referred for obstetrician-led care, following the proforma (table 3.2); these women were not included in this research.

Table 3-2: Risk assessment proforma for MLAC and inclusion in research

<table>
<tr><td colspan="3">1 - Number of Previous Caesarean Sections</td></tr>
<tr><td colspan="2">1
Continue to part 2</td><td>>1
Refer to Consultant Care
Exclude from Research</td></tr>
<tr><td colspan="3">2- Type of Caesarean Section</td></tr>
<tr><td>Lower Segment Caesarean Section

Continue to part 3</td><td>Classical Incision</td><td>Unsure / Unknown and previous notes unavailable to review

Refer to Consultant Care
Exclude from Research</td></tr>
<tr><td colspan="3">3 - Reason for Previous Caesarean Section</td></tr>
<tr><td colspan="2">• Elective CS for placenta praevia
• Elective CS for breech
• Delay in 1st / 2nd stage
• Suspected fetal compromise
• Unsuccessful Induction

Continue to part 4</td><td>• Maternal medical condition
• Fetal medical condition
• Uterine anomaly e.g. fibroids
• Unknown and notes unavailable for review.

Refer to Consultant Care
Exclude from Research</td></tr>
<tr><td colspan="3">4 – Complications following Previous Caesarean Section</td></tr>
<tr><td>No

Continue to part 5</td><td colspan="2">Yes - i.e.
• Major Haemorrhage (over 1500ml or requiring a blood transfusion)
• Thromboembolism
• Severe infection requiring IV antibiotics or readmission
• Other major complication

Refer to Consultant Care
Exclude from Research</td></tr>
<tr><td colspan="3">5- Other reasons for referral</td></tr>
<tr><td>No

Suitable for Midwifery-led VBAC Care and Inclusion in Research</td><td colspan="2">Yes
Medical Obstetric Other

Refer to Consultant Care
Exclude from Research</td></tr>
</table>

Midwives providing MLAC had theoretical and practical support from their obstetric colleagues and consultant midwives, who provided additional consultancy, advice or referral if the midwife was concerned or felt the woman required it. Robust methods of communication between midwives and consultant obstetricians and consultant midwives were already well established in the Trust prior to the implementation of MLAC. This ensured that midwives could easily discuss an individual case with these colleagues if they felt unsure about whether the woman was appropriate to remain on the MLAC pathway, required a consultant opinion or referral to care of an obstetrician due to risk factors.

Women with a preference for ERCS following an initial discussion with their midwife were referred to either the consultant midwife clinic (described above), thereby remaining on the midwife-led pathway of care, or the obstetric clinic. Women could choose which professional they were referred to, based on their individual needs and personal preference. In 2014 it is estimated that about 150 women are referred to the consultant midwife clinic annually. Prior to MLAC it is likely that referrals to the consultant midwife clinic were fewer, although exact numbers are not known. Following this consultation if their preference remained for ERCS this was booked following further consultation with an obstetrician. Table 3.3 outlines the routine schedule of MLAC and OLAC, including shared elements; table 3.4 compares OLAC and MLAC.

Table 3-3: Antenatal care schedule: routine elements of OLAC, MLAC or common to both care pathways

Gestation in weeks	Aim of Consultation	OLAC or MLAC
Initial pregnancy contact	Midwife or GP: Give "Early antenatal information pack". General lifestyle advice: diet, supplements, exercise, smoking cessation; screening choices information. Arrange for GP to send referral form "assessment for pregnancy care" to Trust.	Both
	Midwife: Reaffirm the strong recommendation for VBAC.	MLAC
8-10 weeks "booking"	Midwife: Full booking. Screening information and discussion. Affirm lifestyle advice, complete any appropriate referral forms; give woman framework for antenatal care; discuss and arrange parent education. Send MSU; check blood pressure (BP) and urinalysis (every visit). Take all booking bloods.	Both
	Midwife: Assess suitability for midwifery-led antenatal care; inform woman of the benefit of attending VBAC Education Classes. Discuss VBAC care options and initial thoughts for pregnancy and birth care options, affirming strong recommendation for VBAC using statistics to ensure informed choice, early referral to Consultant Obstetrician or Consultant Midwife if woman's preference differs from the recommendations in the guideline.	MLAC
11-13+6	Ultrasound / Fetal Medicine department: Dating/nuchal translucency scan. Early serum screening blood test	Both
16	Midwife: Confirm, discuss and record screening results and estimated due date (EDD). (EDD now calculated using ultrasound rather than LMP). Arrange for glucose tolerance test (GTT) and Anti-D if indicated. Discuss fetal movements.	Both
	Midwife: Assess suitability for midwife-led antenatal care and VBAC and provide informed choice as appropriate (conduct at every visit)	MLAC
16	Ultrasound / Fetal Medicine department: Serum screening and dating if no nuchal translucency requested.	Both
19	Ultrasound department: Anomaly scan	Both
20	Obstetrician: Antenatal clinic appointment to assess suitability for VBAC. Discuss mode of birth care options.	OLAC

	Consider referral to Consultant Midwife if woman's mode of birth preference or VBAC birth plan differs from the recommendations in the guideline.	
25	Midwife: Measure symphysis-fundal height (SFH) (cms) & record this and fetal movements (every visit). Discuss importance of recognising pattern of fetal movements & where and when to self refer if concerned. Discuss anomaly scan result. Discuss plan for infant feeding. Issue Mat B1.	Both
	Midwife: Advise woman gives thought to birth plan, which will be discussed at next appointment.	MLAC
28	Midwife: Hb for all and antibody testing if Rh-ve. Anti-D administration for Rh-ve women. GTT if indicated.	Both
	Discuss birth plan, as per "sticker"; referral to Consultant Obstetrician or Consultant Midwife as appropriate if woman's preference differs from the recommendations in the guideline.	MLAC
31	Midwife: Discuss and record blood tests.	Both
	Midwife: Discuss birth plan if appropriate.	MLAC
34	Midwife: Routine antenatal examination.	Both
	Midwife: Discuss birth plan if appropriate.	MLAC
34-36	Obstetrician: Confirm and discuss birth plan, make arrangements for induction of labour (IOL) or CS if indicated	OLAC
36	Midwife: Confirm presentation. Haemoglobin (Hb) for all and antibody testing for Rh+ve women only. Record weight.	Both
	Discuss, finalise and record plans for birth; referral to Consultant Obstetrician or Consultant Midwife as appropriate if woman's preference differs from the recommendations in the guideline.	MLAC
38	Midwife: Record blood results in notes and re-confirm birth plans.	Both
40	Midwife: Discuss options re. IOL.	Both
40+7	Midwife: Membrane sweep	Both
	Midwife: Book IOL at 40+12, including discussion with Consultant Obstetrician	MLAC
40+7	Obstetrician: Discuss options re. IOL and book for 40+12	OLAC

Table 3-4: Comparison of routine care provided to women with one previous CS and no other risk factors

Average based on routine care schedule	OLAC	MLAC
Number of obstetric antenatal clinic appointments (hospital / satellite clinic)	Up to 3 (dependent on gestation of birth – 3rd appt at 41 weeks)	0
Number of community antenatal appointments (Midwife / GP)	7	10
First discussion of mode of birth options	20 weeks	Booking (before 12 weeks)
First birth planning discussion	34 / 36 weeks	28 weeks
Minimum number of health care professionals providing antenatal care (excluding GP)	2	1

The intervention (MLAC) is compound, consisting of three main differences from OLAC. These are:

- The lead professional is the community midwife, rather than the obstetrician;
- The setting of care is the community, as opposed to the hospital;
- Women received information about and encouragement for VBAC at their first antenatal appointment (before 12 weeks) and opportunities for discussion at every appointment, as opposed to the first discussion at 20 weeks and up to two further chances for discussion with OLAC.

As a result of theses organisational differences it was anticipated that women receiving MLAC would see fewer different carers during their antenatal care. These differences led to the hypothesis that shaped this research: that the professional leading antenatal care and the associated environmental factors would influence women's decisions about mode of birth.

3.5 Sample

The population under investigation were pregnant women who had one previous CS, for a non-recurrent reason and no other obstetric, medical or social risk factors that would preclude them from receiving MLAC (see table 3.5). The sample was the case-notes of all women who fit these criteria, who received their antenatal care and gave birth at this Trust in either 2008 (OLAC group) or 2011 (MLAC group). Women who fulfilled the inclusion and exclusion criteria were identified using the obstetric database at the Trust, as the necessary information to determine this was stored for all women. A similar sampling technique was followed by Knight et al (2014), who used the HES database for sampling and all data collection (discussed in section 3.3). The accuracy of their sampling technique was reliant on the sensitivity of the HES database to correctly identify women's previous and index mode of birth. The researchers acknowledged this reliance and reported high levels of internal consistency for mode of birth (Kappa=0.93, $p<0.001$). Individual rates of sensitivity were not reported for each of the exclusion criteria; therefore, women may have been erroneously included in or excluded from the study. This research would have been strengthened by reporting the level of internal consistency of the Trust database for previous mode of birth and obstetric, medical and social risk factors known at booking. Errors in the Trust's database may have biased the sample by erroneously excluding women who fit the inclusion criteria. The risk of erroneously including women with risk factors in this research was minimised by use of the medical notes for data collection thereby enabling confirmation that the case fit the inclusion and exclusion criteria.

In 2008, the OLAC cohort year, approximately 225 women giving birth at the Trust (3.82%) fitted the inclusion and exclusion criteria for this research: one previous LSCS and no other obstetric, medical, or psychological complications. The sampling technique meant that there is almost near certainty that all women included in the research met the inclusion criteria. There is a small possibility that women who fitted the inclusion and exclusion criteria were erroneously excluded, due to errors in the obstetric database that was used for screening. In 2011, 244 women (3.91%) received MLAC and, therefore, fitted the criteria for this research. According to the sample size

calculation (below), the case-notes of 212 women were requested for each study year (2008 and 2011), equating to 94.2% in 2008 and 86.9% in 2011 of women who were eligible for inclusion. In order to avoid selection bias, identification of eligible women started with those who gave birth at the end of December 2008 and 2011, respectively, working backwards selecting consecutive women who fitted the inclusion criteria until 212 was reached for each year. As a result, the sample of this study is strongly representative of the population being investigated, thereby enhancing the external validity of this research.

Table 3-5: Inclusion and exclusion criteria

Women included in the research	**Women excluded from the research**
One previous CS	More than one previous CS
Previous lower segment CS (LSCS)	Previous Classical incision, unknown type of previous incision or concerns regarding type of repair (i.e. CS performed abroad, where single layer closure may be practised)
Non-recurrent reason for previous CS, including: • Placenta praevia • Breech • Delay in 1st / 2nd stage of labour • Suspected fetal compromise • Unsuccessful induction • Maternal request	Potentially recurrent reason for previous CS, including: • Maternal medical condition • Fetal medical condition • Uterine anomaly (e.g. fibroid, other previous scarring) • Unknown reason and notes unavailable for review
No significant complications following previous CS	Complications following previous CS, including: • Major Haemorrhage (over 1500ml or requiring a blood transfusion) • Thromboembolism • Severe infection requiring IV antibiotics
No other indications for referral to Obstetrician-led Care	Other indications for referral to Obstetrician-led care. The Trust maintain a list of detailed criteria for referral to a consultant obstetrician, which all midwives and obstetricians are aware of and adhere to.

3.5.1 Sample size

Statistical analysis was planned to compare intended and actual mode of birth, either vaginal or by CS, for women who received either MLAC or OLAC. The sample size was calculated so that the results can be generalised to the local population to inform local practice, which may influence practice nationally or internationally. Finding a vaginal birth rate with MLAC that is equal to or greater than OLAC was prospectively considered to be of significant interest, especially if this research discovered additional benefits to MLAC. Therefore, in order to evaluate whether MLAC elicited vaginal birth rates that were equal to or higher than OLAC, the sample size was calculated to test a non-inferiority hypothesis (Pocock, 2003). This sample size calculation was made with advice from a statistician.

Using data from the Trust, the VBAC rate was calculated for women who fit the inclusion criteria and received OLAC. Data from 2008 were used, as national and Trust-wide information and recommendations have not changed since then, aside from MLAC provision at this Trust (RCOG, 2007).

Sample size was calculated thus:

- The main outcome measure: VBAC rate in 2008 = 48%;
- 80% statistical power (meaning there is an 80% chance of finding a difference, if one exists);
- 5% significance (meaning that there is a less than 5% chance that the result is a false-positive (type 1 error));
- The non-inferiority sample size calculation required predictions based on clinical judgement of the expected VBAC rate with MLAC and the percentage difference between the two groups that would be considered clinically insignificant. Based on professional opinion from discussion with senior midwife / obstetrician, it was agreed that:
    - The expected increase in VBAC rate for the MLAC care group (A) would reasonably be between 5-15%;

  - The percentage difference in vaginal birth rate between the two groups that would be considered clinically insignificant (B) would be between 1-5%;

- If A = 5% and B = 1% the sample size for each group was 857 (total = 1714); this was too large for the resources available in this research;
- If A = 15% and B = 5% the sample size for each group was 75 (total = 150); whilst this would have been manageable for this research, the expected increase in vaginal birth rate for MLAC was considered too high;
- If A = 10% and B = 2% the sample size for each group was 212 (total = 424); it was anticipated that MLAC could elicit VBAC rates 10% higher than OLAC, which would provide useful information on which to base local practice and to inform subsequent studies.

Therefore, each group required a sample size of 212 women. Total sample size 424.

3.6 Data Collection

The Local Research Ethics Committee (LREC) stipulated that only members of women's 'care team' could have access to their medical records, as explicit consent for use by another individual had not been gained. Therefore, two Data Retrieval Assistants (DRAs) who were part of the women's care team were employed to access the medical notes and transfer the relevant data onto the anonymised data collection tool (appendix 6). The DRAs completed this work outside of their NHS employment and were paid using a bursary from the Royal College of Midwives (RCM). Gearing et al (2006) explain the importance of well-selected data collectors. The DRAs were chosen as they were both senior maternity support workers (MSWs) at the Trust, who had detailed knowledge of the notes, were experienced in record keeping, data extraction and appropriate management of health care records and were bound by their employment contract to maintain confidentiality. The DRAs both undertook their Good Clinical Practice in Research training prior to data collection.

Data were collected directly from the women's medical notes, using the prospectively designed data collection tool (appendix 6). The data collection tool was developed following a review of the literature (Crowther et al, 2012; Fitzpatrick et al, 2012; Guise et al, 2010; Kamath et al, 2009; Landon et al, 2005; Leung et al, 2002; Lindqvist et al, 1999; Lydon-Rochelle et al, 2001; Miller et al, 1997; Rouse et al, 2006; Silver et al, 2006; Usta et al, 2005) (described in detail in section 2.3) and consultation with senior clinicians (consultant obstetrician and consultant midwife) to ensure that no important parameters were omitted. Confounding factors represent a potential bias that distorts the intervention-outcome relationship (Cox et al, 2009), and hence need to be accounted for during data analysis. Confounding factors were prospectively identified (Figure 3.1) and included in the data collection and analysis strategy. Jansen et al (2005) recommend examining the flow of information within medical records to design a well-structured tool likely to achieve good quality data. This was conducted in consultation with the DRAs. The data collection tool was trialled prior to the commencement of data collection (Gearing et al, 2006; Jansen et al, 2005). A guide exemplar tool was created for the DRAs to refer to during data collection (Gearing et al, 2006). This exemplar tool was handwritten, generated by me and consisted of a completed data collection tool using a mock set of case-notes. The completed exemplar tool included clear signposting to demonstrate where each piece of datum could be found within the case-notes.

I was in regular contact (at least monthly) with the DRAs throughout the data collection process and was available via telephone on an ad hoc basis if any questions arose. Twenty data collection sheets were quality checked by a midwife from the Trust, who was independent of this research following full consultation about the aims of the research. A midwife was selected to conduct this independent quality check due to their extensive professional understanding of medical records in relation to the research aim. Arguably, employing a midwife to undertake data collection may have been more appropriate for this reason; however, the financial constraints of this research precluded this. Some minor errors were identified by the independent midwife, which would be expected with such a large sample size and lengthy data collection sheet. The most common errors were the calculation of time since the

previous CS, gravida and parity. The most significant mistake was inaccuracy of the number of previous VBACs. Where known the mistake was rectified by the midwife. Given the routine nature of the data collected and the experience of the DRAs, the inclusion of few errors may be anticipated.

The anonymised data collection sheets were used to transfer the data into SPSS version 20 for Windows (IBM Corp, 2011) for analysis. Missing data and entries outside of the expected normal range were checked for. Where obvious errors or meaningless data were noted the missing data code was inputted. Following retrieval of the medical notes and collection of the data, the list of hospital numbers was destroyed; hence no identifying data has been retained.

3.7 Data Analysis

Once all of the data were inputted, they were analysed using SPSS version 20 for Windows (IBM Corp, 2011). The statistical tests used were planned with a statistician in advance of data collection and advice from a statistician was available and accessed during the analysis process. Bivariate analysis was used to demonstrate the relationship between the type of care women received and the primary research outcomes, intended and actual mode of birth. A contingency table (table 3.6) was designed to display this data analysis. The chi-squared test was used to establish the degree to which a relationship existed between type of care received and the intended and actual mode of birth. The chance of a woman opting for and achieving a vaginal birth after MLAC compared to OLAC is displayed in this thesis using 'Relative Risk' (RR), with confidence intervals (CI).

Table 3-6: Contingency table

Type of Birth	**Type of Antenatal Care**			
	Obstetrician-Led		**Midwife-Led**	
Vaginal Birth	No.	%	No.	%
CS	No.	%	No.	%
Total	---		---	

'Type of care received' is an independent variable, therefore, it was possible to show an association between 'type of care' and 'intended' and 'actual mode of birth'. Confounding factors needed addressing through robust data analysis to ensure that the research provided valid results that could shape clinical practice. Therefore, *a priori* assumptions were made about the causal relationship between certain maternal characteristics and mode of birth. Using my own professional knowledge, that of senior clinicians and the extensive literature review, confounding factors were identified (figure 3.1) and included in the data collection strategy. Following advice from a statistician, confounding factors were addressed using logistic regression (Bowling, 2002).

Figure 3-1: Confounding factors

- Maternal age
- Parity
- Previous vaginal births
- Previous VBACs
- Ethnic category
- Requirement for interpreter
- Employment status
- Partner's employment status
- Smoking status
- BMI
- Reason for previous CS
- Number of antenatal appointments
- Number of antenatal carers
- Gestation of discussion about mode of birth
- Gestation of birth planning
- Method of onset of labour
- Length of labour
- Analgesia in labour
- Method of fetal heart rate monitoring
- Continuity of care in labour

Analysis of secondary outcomes was planned to add to the evidence base for VBAC. This included the relationship between 'actual mode of birth' and confounding factors, antenatal and intrapartum events and care, maternal and neonatal outcomes. The chi-squared test was used for calculations with binary outcomes. Adjusted residuals were used to highlight significant differences in proportions for categorical outcomes (Agresti, 2002). Fisher's exact test was used where more than 20% of the variables had expected outcomes <5 (Field, 2009). The independent *t* test and Mann-Whitney U test were used for linear data, with normal and non-normal distribution respectively.

The results of the secondary outcomes analysis are displayed using RR, with CI. This enabled comparison of the various maternal and neonatal outcomes for each group, including outcomes that demonstrate safety (see table 3.7).

Table 3-7: Maternal and neonatal outcomes that demonstrate safety

Maternal	Neonatal
• Estimated blood loss • Perineal trauma • Uterine rupture • Hysterectomy • Placental complication • Infection • Venous-thromboembolism • Eclampsia • Bowel complications • Bladder complications • ITU admission • Maternal death • Length of postnatal stay • Readmission to hospital	• 5 minute Apgar score • Birth trauma • Intrauterine death • NNU admission • Jaundice requiring treatment • Respiratory distress • Hypothermia requiring treatment • Breastfeeding initiation • Breastfeeding at discharge • Neonatal death

Data were collected for uterine rupture, maternal death, intrauterine and neonatal death; however, this study was not sufficiently powered to draw any statistically significant conclusions about these very rare outcomes.

3.8 Ethical considerations and permissions

This research was designed in order to fulfil the research aim in the most appropriate and ethical manner. Based on my professional experience and the philosophy of woman-centred care, the MLAC research priorities included investigation of women's experiences of OLAC compared with MLAC. However, I judged that assessing the efficacy and safety of the intervention was required first. A woman-centred paradigm naturally suggests involving women directly in the research, in order that their voices

are heard. This may have been possible by asking women about their experiences of OLAC and MLAC and comparing the findings. However, the use of medical notes for data collection removed the danger of causing harm to women through unnecessarily involving them in the research process, however benign their involvement may have appeared (for example through use of a questionnaire). All of the relevant quantitative data were available within the medical notes and were not subject to potential recall bias or 'gratitude bias', a phenomenon with maternity satisfaction surveys where mothers view the care they received as the best (Bélanger-Lévesque et al, 2014). Therefore, as this research focussed on the efficacy and safety of MLAC compared with OLAC, as opposed to women's experiences, it was determined most appropriate to avoid potential harm to women and use medical records instead.

Permission to conduct this research was sought and granted from the LREC (appendix 2). LREC approval required that I did not have access to the medical notes, as previously discussed (section 3.6). Therefore the research design ensured that I only had access to anonymised data. Following retrieval of the medical notes by the DRAs, the list of identifying data was destroyed.

The Head of Midwifery (appendix 3), Obstetric lead and Research and Development department (appendix 4) at the Trust where the research took place were also approached and granted their permission. Prior to commencement of data collection I undertook Good Clinical Practice training (appendix 5).

3.9 Summary

As this chapter has demonstrated, this research was robustly designed to compare outcomes for women with one previous CS who have received either MLAC or OLAC. A retrospective, comparative cohort design was used. Within the constraints of this research and the professional and clinical context at the time, this was the most appropriate design. The results of this research are presented in chapter 4.

4. Results

4.1 Introduction

The results of this research show that receiving midwife-led antenatal care (MLAC) is significantly associated with a higher rate of intending and achieving VBAC compared to obstetrician-led antenatal care (OLAC). Presented here are the findings of this research and detailed statistical analysis. Maternal baseline demographics are presented by group. Statistical analyses of the main outcomes of intended and actual mode of birth are then outlined, followed by analysis of confounding factors. Further analysis includes comparison between the groups of safety outcomes, care during the antenatal period and intrapartum characteristics. Finally the whole dataset is analysed regardless of group to add to the evidence-base related to VBAC. Confounding factors and safety outcomes related to intended and actual mode of birth are also displayed.

Statistical analysis includes calculation of relative risks (RR) with 95% confidence intervals (95% CI), Chi-squared (χ^2) test of association, Fisher's exact test where expected frequencies are <5 (Field, 2009), adjusted residuals (Agresti, 2002) with standard deviations (SD), independent *t* test analysis, Mann-Whitney U test and logistic regression (see section 3.6). Some explanations regarding the context of care and outcomes are given, but the main discussion forms chapter 5. Data are rounded to 2 decimal places, unless doing so affects the statistical meaning of that datum. In all tables statistical significance is denoted with an asterisk (*) and a grey shading to the entire row.

4.2 Data collection outcomes

Women who gave birth at the Trust within the pre-set time periods, with one previous CS and no medical, obstetric and psychological complications were identified using the Trust obstetric database (n=424) and their case-notes were requested. 15 sets of maternal records were not available. The reason for unavailability was that they were

currently in clinical use and therefore not filed. Completed data collection sheets were received for 409 cases. Four cases were excluded following detailed inspection as they did not fit the inclusion criteria. Exclusions at this stage were due to previous obstetric risk factors (neonatal death and pre-eclampsia) that were not recorded on the electronic database, sometimes due to the previous birth taking place at a different hospital. Such risk factors were evident from annotations made by the DRAs. Hence a total of 405 sets of data (OLAC n=209; MLAC n=196) were entered into SPSS version 20 (IBM Corp, 2011) for analysis. The data were checked and cleaned. Each individual variable was sorted using the 'frequencies' function in SPSS. Any unusual or erroneous entries were then cross-checked with the original data collection sheet for accuracy. Erroneous data entries were also highlighted through the annotations of the DRAs and cross-checking mutually exclusive variables based on professional expertise; such as 'onset of labour' and 'induction methods'. In total 113 data collection errors were identified (0.39%). The most common error was the misclassification of the reason for the CS in the index pregnancy as 'maternal request' rather than 'previous CS' (*n* = 39; 9.62%). Whilst this was accurate because the women did 'choose' CS, the reason 'maternal request' was intended to indicate a maternal emotional or psychological reason for CS with no clinical indication whereas 'previous CS' is considered a clinical indication (NCCWCH, 2011). Indicating that CS was undertaken in the index pregnancy for 'previous CS' means that there were no other factors (such as multiple birth or malpresenation) that warranted a CS on clinical grounds.

Missing data in observational research is common; however, ignoring it is not an acceptable option (European Medicines Agency (EMA), 2011). To ensure transparency and enable peers to judge the validity of this research, the missing data rate and how they have been handled is made explicit here (von Elm et al, 2007). The missing data rate was 3.48%, including known errors. In their review of how missing data is reported in cohort studies, Karahalios et al (2012) found missing data rates between 2% and 65%. There is no rule regarding the maximum number of missing values that is acceptable (EMA, 2011), this is dependent on the nature of the variable, the design of the research and the source of information. Given the large sample size and extensive data collection tool, 3.48% may be considered low. The missing data rate in the De

Jonge et al (2013) study (section 3.3.1 and appendix 7) for the main outcome alone was 4.2%. Importantly, there were no missing data for the main variables (type of antenatal care, intended mode of birth, actual mode of birth). When analysed individually, only 6 variables had missing data rates over 5% (see table 4.1). The variables with the highest missing rate contributed to the description of the health and social status of this cohort, but they do not impact on the main results.

Table 4-1: Missing data rates when over 5% (n=405)

Variable	Missing count	Missing percentage
Employment status	190	46.9%
Smoking status	36	8.9%
Gestation of birth planning appointment	29	7.2%
Gestation of birth	23	5.7%
Analgesia used in labour	27	6.7%
Breastfeeding status at discharge from community midwife	27	6.7%

Complete-case analysis, where only cases with complete data are included, was not used. This approach would have significantly reduced the power of these findings and potentially increased bias (EMA, 2011; Vandenbroucke et al, 2007). Predicting missing variables in this research was not possible, as the missing data were dependent on record keeping practices and the information available to the health professional at the time the record was made. In view of this, it is reasonable to assume that the missing data were 'missing completely at random' (Vandenbroucke et al, 2007), where the fact that data were missing does not depend on the value of that variable, and will not impact on the results of the study. Therefore cases with missing data were not excluded from the main outcomes analysis. Where a variable had missing data the case was excluded for that specific analysis and *n* numbers displayed for transparency. The reader may therefore judge when the validity of certain findings may be impaired due to the high missing rate, for example analysis that includes employment status.

4.3 Baseline demographic data

Women in the sample were aged between 19 and 53 years, with a BMI between 18 and 40 kg/m² (see table 4.2). By definition, all women in the sample had given birth to at least one baby previously. Only 79 women had previously given birth vaginally, with 54 women having had a previous successful VBAC. Time since the previous CS ranged from 10-198 months, the mean being 51 months. The most common indication for CS was slow progress in the first stage of labour (n = 147; 36.3%), with breech (n = 93; 23%) and suspected fetal compromise (n = 86; 21.2%) the next two most common reasons.

Table 4-2**:** Maternal demographics (*n* = 405)

	Min	Max	Mean	Standard deviation (SD)
Maternal Age (years)	19	53	30.76	4.91
BMI (kg/m²)	18	40	26.29	4.97
Parity	1	6	1.3	0.7
Previous vaginal births	0	5	0.29	0.7
Previous VBACs	0	5	0.18	0.55
Time since previous CS (months)	10	198	50.69	35.75

The OLAC group comprised 209 women and the MLAC group 196. The difference was due to the availability of case-notes. An equal number of cases (212) were identified for each group; however, more case-notes were available to review from the OLAC group. Case-notes from the MLAC group may be more likely to be in clinical use as they relate to a more recent episode of care.

The groups were similar in age, BMI and time since the previous CS (See table 4.3).

Table 4-3**:** Demographics of women in the sample by type of antenatal care (*n* = 405)

	Obstetrician-led antenatal care			Midwife-led antenatal care			Difference	
Variable	Min	Max	Median & Mean (+/-SD)	Min	Max	Median & Mean (+/- SD)	Test statistic	*p*
Age (years)	19	53	30.67 (4.89)	19	43	30.86 (4.95)	0.393†	0.69
BMI (kg/m²)	18	40	25	19	40	25.5	19049.0Ψ	0.29
Time since index CS (months)	10	198	38	10	195	39	20015.5Ψ	0.82

†t-test statistic ΨMann-Whitney *U*-test statistic

A higher percentage of women in the MLAC group had previously given birth vaginally and by VBAC, although neither variance reached statistical significance (see table 4.4). Given the clinical significance of previous vaginal births, especially VBACs (Gyamfi et al, 2004; Landon et al, 2005) these variables were accounted for as confounding factors and are discussed later.

Table 4-4**:** Maternal demographics; odds ratios (95% CI) by type of antenatal care

	Total (%)	Obstetrician -led antenatal care (%)	Midwife-led antenatal care (%)	Odds ratio (95% CI)	*p* =	χ^2 (df) (n =)
Previously given birth vaginally	79 (19.5%)	34 (16.3%)	45 (23%)	1.53 (0.93-2.52)	0.09	2.88(1) (405)
Previously given birth by VBAC	54 (13.4%)	23 (11%)	31 (15.9%)	1.53 (0.86-2.73)	0.15	2.09(1) (404)
Single parent	12 (3.04%)	6 (3.02%)	6 (3.26%)	1.082 (0.34-3.41)	0.89	0.02(1) (395)
Requires interpreter	23 (6%)	14 (7.0%)	9 (4.8%)	0.676 (0.29-1.6)	0.37	0.8(1) (386)
Smoker	40 (10.8%)	23 (12.1%)	17 (9.5%)	0.762 (0.39-1.48)	0.42	0.65(1) (369)

Obstetrician-led antenatal care = reference (OR 1.0)

Analysis revealed that the groups were not statistically different from each other in the variables that indicate health and social status, including single parent status, requirement for interpreter, smoking status, ethnic category, employment status and partners' employment status (continued in table 4.5).

Table 4-5**:** Maternal demographics; comparison by type of antenatal care

		Obstetrician-led antenatal care		Midwife-led antenatal care		
	Variable	Count (%)	Adjusted residual	Count (%)	Adjusted residual	Total Count (total %)
Ethnic Category (n = 401)	White British	139 (67.1%)	-0.2	132 (68%)	0.2	271 (67.6%)
	White other	22 (10.6%)	1.2	14 (7.2%)	-1.2	36 (9%)
	Asian	31 (15%)	0.3	27 (13.9%)	-0.3	58 (14.5%)
	Black	9 (4.3%)	-1.6	16 (8.2%)	1.6	25 (6.2%)
	Mixed	4 (1.9%)	0.3	3 (1.5%)	-0.3	7 (1.7%)
	Other Ethnic category	2 (1%)	0	2 (1%)	0	4 (1%)
Employment (n = 215)	Employed	75 (56.4%)	-1.6	55 (67.1%)	1.6	130 (60.5%)
	Unemployed	58 (43.6%)	1.7	26 (31.7%)	-1.7	84 (39.1)
	Student	0 (0%)	-1.3	1 (1.2%)	1.3	1 (0.5%)
Partners' employment	Not applicable	2 (1%)	-1.2	5 (2.6%)	1.2	7 (1.8%)
	Employed	182 (91.9%)	1.5	165 (87.3%)	-1.5	347 (89.7%)
	Unemployed	12 (6.1%)	-1.1	17 (9%)	1.1	29 (7.5%)
	Student	2 (1%)	0	2 (1%)	0	4 (1%)

All adjusted residuals <2, indicating no significant difference between the groups. χ^2 not included: cannot be relied upon as all analyses included >20% cells with an expected count <5.

The reason for the previous CS was also similar between the two groups (see table 4.6). The previous CS indication was more likely to be breech and less likely to be suspected fetal compromise in the MLAC group. However, there was no difference in the rates of previous dystocia, categorised here as where a CS was performed for 'slow progress' in the first or second stage. This is clinically significant as true 'dystocia' may carry forward to the next pregnancy and affect the chances of achieving successful VBAC. Variance in the previous indication is clinically significant as research has demonstrated its influence on mode of birth in subsequent pregnancies (see section

5.2.8). Therefore, the indication for previous CS was included when confounding factors were considered (see section 4.5).

Table 4-6: Reason for previous CS, comparison by type of antenatal care

	Obstetrician-led antenatal care		Midwife-led antenatal care		
Variable	Count (%)	Adjusted residual	Count (%)	Adjusted residual	Total Count (total %)
Slow progress in the first stage of labour	73 (35.1%)	-0.6	74 (37.8%)	0.6	147 (36.4%)
Breech*	37 (17.8%)	-2.6	56 (28.6%)	2.6	93 (23%)
Suspected fetal compromise*	53 (25.5%)	2.1	33 (16.8%)	-2.1	86 (21.3%)
Failed induction of labour	9 (4.3%)	-0.6	11 (5.6%)	0.6	20 (5%)
Failed instrumental birth	10 (4.8%)	0.9	6 (3.1%)	-0.9	16 (4%)
Other reason	10 (4.8%)	1.2	5 (2.6%)	-1.2	15 (3.7%)
Slow progress in the second stage of labour	8 (3.8%)	0.7	5 (2.6%)	-0.7	13 (3.2%)
Placenta praevia	5 (2.4)	1.1	2 (1%)	-1.1	7 (1.7%)
Maternal psychological or social issue / request	2 (1%)	-0.5	3 (1.5%)	0.5	5 (1.2%)
Multiple birth	1 (0.5%)	0	1 (0.5%)	0	2 (0.5%)

*Adjusted residual >2, denoting a significant difference between groups in this category. χ^2 not included: cannot be relied upon as all analyses included >20% cells with an expected count <5.

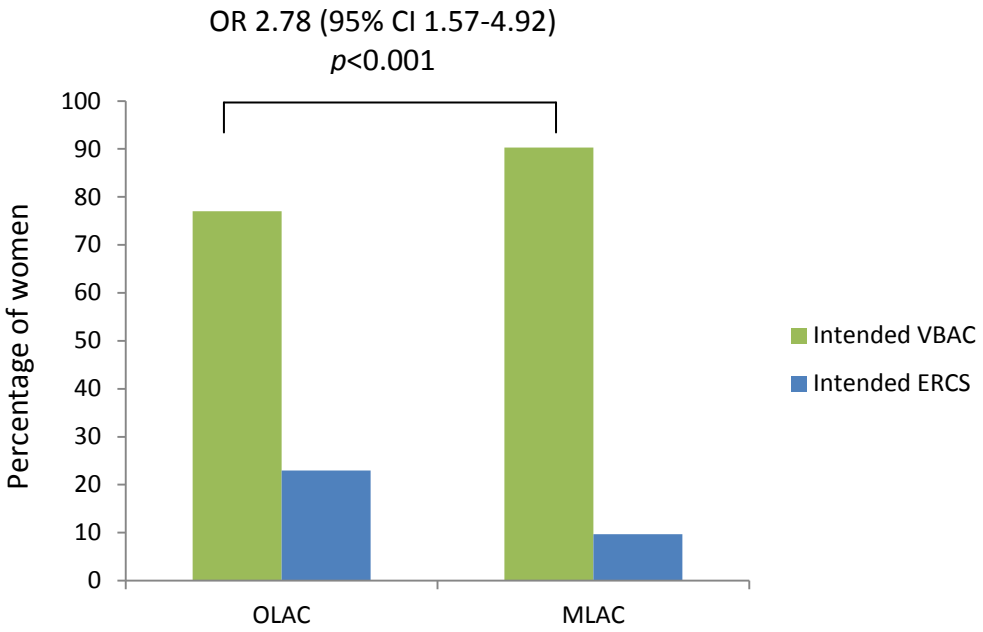
4.4 Primary outcome: the effect of antenatal care on intended and actual mode of birth

This research aimed to determine whether the type of antenatal care women received affected their intended and actual modes of birth. In this sample of 405 women 338 (83.5%) intended to birth by VBAC. There was a 13.8% higher rate of women who intended to birth by VBAC in the MLAC group compared to OLAC (see table 4.7 and figure 4.1). This difference was found to be statistically significant. The odds ratio (OR) (95% CI) for choosing VBAC if women received MLAC compared with OLAC was 2.78 (1.57-4.92); χ^2 (1 degree of freedom (df), n = 405) = 12.91, p <0.001. These results indicate a significant association between receiving MLAC and choosing VBAC.

Table 4-7**:** Contingency table intended mode of birth (n = 405)

	Obstetrician-led antenatal care		Midwife-led antenatal care		Total
	Count	%	Count	%	
VBAC	161	77.03%	177	90.31%	338 (83.46%)
Elective CS	48	22.97%	19	9.69%	67 (16.54%)
Total	209	100%	196	100%	405 (100%)

Figure 4-1: Proportion of women intending to birth by VBAC or ERCS



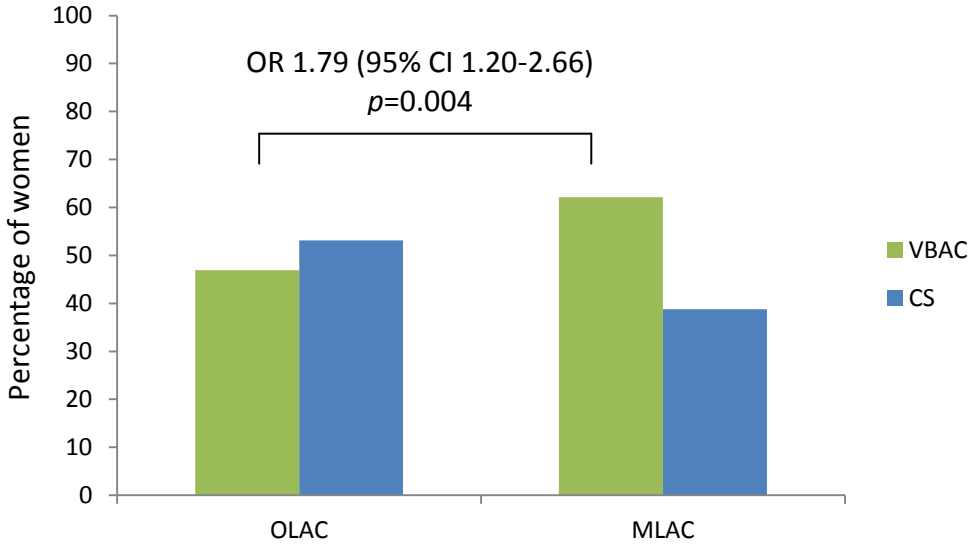
The actual mode of birth was also analysed. Three women who intended to birth by elective CS had a successful VBAC; 25 women who intended VBAC had an elective CS, 8 of which were reportedly due to choosing not to have induction of labour (IOL) and electing for CS at this point instead.

Women in the MLAC group were 14.33% more likely to give birth by VBAC than women in the OLAC group (see table 4.8 and figure 4.2). This difference was also found to be statistically significant. The odds ratio (OR) (95% CI) for having a successful VBAC if women received MLAC compared with OLAC was 1.79 (1.2-2.66); χ^2 (1df, n = 405) = 8.36, p = 0.004.

Table 4-8: Contingency table actual mode of birth (n = 405)

	Obstetrician-led antenatal care		Midwife-led antenatal care		Total
	Count	%	Count	%	
Vaginal Birth	98	46.89%	120	61.22%	218 (53.83%)
CS	111	53.11%	76	38.78%	187 (46.17%)
Total	209	100%	196	100%	405 (100%)

Figure 4-2: Proportion of women who birthed by VBAC or CS



Receiving MLAC was significantly associated with VBAC for this cohort. Given the higher rate of intended VBAC in the MLAC group it logically follows that more women in this group would achieve a successful VBAC, even with a success rate that was the same or slightly lower than the OLAC group. Given the evidence that failed VBAC is the strongest predictor of maternal and neonatal morbidity (section 2.3), knowing the VBAC success rate for each group of women is clinically important.

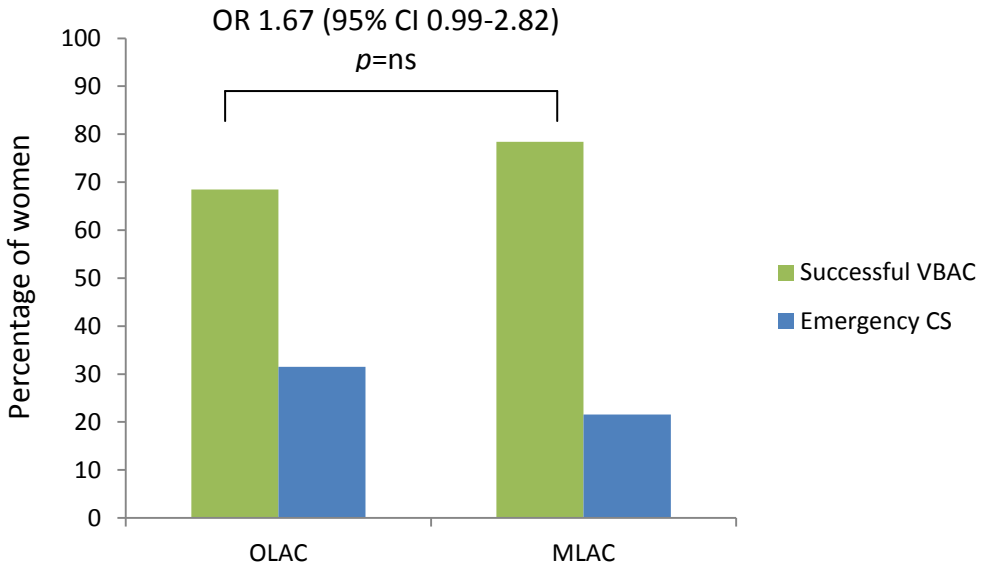
Analysing the data for only the subgroup of women who laboured demonstrated the success rates for intended VBAC (*n* = 296) (see table 4.9). The MLAC group had a 9.9%

greater successful VBAC rate than the OLAC group, which did not meet statistical significance: OR for successful VBAC 1.67 (95% CI 0.99-2.82), χ^2(1df, n = 296) = 3.73, *p* = 0.053. With a larger sample size this difference may have reached statistical significance.

Table 4-9: Contingency table successful VBAC rate, only women who laboured (n = 296)

	Obstetrician-led antenatal care		Midwife-led antenatal care		Total
	Count	%	Count	%	
Vaginal Birth	98	68.5%	120	78.4%	218 (73.6%)
CS	45	31.5%	33	21.6%	78 (26.4%)
Total	143	100%	153	100%	296 (100%)

Figure 4-3: Proportion of women who birthed by VBAC or emergency CS (only those who laboured)



4.5 Confounding factors for intended and actual mode of birth

The main outcomes were analysed using logistic regression (Burns & Burns, 2009; Field, 2009) to account for confounding factors that would be known at the time of booking: maternal age, number of previous vaginal births and VBACs, time since the previous CS, maternal BMI and the reason for the previous CS. These confounders were selected based on the background literature review (Bujold et al, 2005; Gyamfi et al, 2004; Landon et al, 2005; Srivinas et al, 2007) and the initial analysis. The ß statistic (standard error, SE) and *p* values are reported along with the adjusted OR (95%CI) for each variable (Field, 2009). Analysis for intended mode of birth is reported in table 4.10 and indicates a significant difference based on the type of antenatal care received only, when all other variables are held stable. Having adjusted for maternal age, BMI, time since the previous CS, previous vaginal birth, previous VBAC and the previous CS indication MLAC increases the odds of intending to birth by VBAC by a factor of 2.69, which is statistically significant ($p = 0.001$).

Table 4-10**:** Adjusted OR (95% CI) for intended VBAC (n = 401)

	ß (SE)	*P*	OR	95% CI	Reference (OR 1.0)
Midwife-led AN care	0.99 (0.3)	0.001*	2.69	1.48-4.87	Obstetric-led AN care
Maternal age (years)	-0.05 (0.03)	0.08	0.95	0.9-1.01	↑ by 1 year
Maternal BMI (kg/m²)	-0.01 (0.03)	0.82	0.99	0.94-1.05	↑ by 1 kg/m²
Time since CS (months)	-0.002 (0.005)	0.67	1.00	0.99-1.01	↑ by 1 month
Previous vaginal birth	1.45 (0.95)	0.13	4.28	0.67-27.45	↑ by 1 vaginal birth
Previous VBAC	0.83 (1.4)	0.55	2.3	0.15-35.71	↑ by 1 VBAC
Previous CS for dystocia	-0.85 (0.31)	0.79	0.92	0.5-1.7	Previous CS for other reason
Previous CS for breech	0.15 (0.42)	0.72	1.17	0.51-2.67	Previous CS for other reason
Constant	-2.8				

* Significant as $p < 0.05$. $R^2 = .087$ (Cox & Snell), .147 (Nagelkerke). Model $\chi^2(8) = 36.7$; $p < 0.001$

The same analysis was undertaken for actual mode of birth (see table 4.11). Even after adjusting for these confounders, the odds for giving birth by VBAC is significantly greater by a factor of 1.79 for women who received MLAC, which remained statistically significant ($p = 0.008$). The odds of a successful VBAC also increase with each additional previous vaginal birth by a factor of 2.59 ($p = 0.009$), which reflects findings from previous research (Landon et al, 2005). Other important confounders that may affect the successful VBAC rate, such as induction or augmentation of labour, may be influenced by the type of antenatal care received and are only applicable for those who intend to birth by VBAC. Therefore, they were excluded from this analysis and will be considered in the analysis of labour characteristics that influence VBAC rates (see section 4.10).

Table 4-11: Adjusted OR (95% CI) for birth by VBAC (n = 401)

	ß (SE)	*P*	OR	95% CI	Reference (OR 1.0)
Midwife-led AN care	0.58 (0.22)	0.008*	1.79	1.17-2.75	Obstetric-led AN care
Maternal age (years)	-0.03 (0.02)	0.21	0.97	0.93-1.02	↑ by 1 year
Maternal BMI (kg/m²)	-0.02 (0.02)	0.35	0.98	0.94-1.02	↑ by 1 kg/m²
Time since CS (months)	-0.001 (<0.01)	0.77	1.00	0.99-1.01	↑ by 1 month
Previous vaginal birth	0.95 (0.37)	0.009*	2.59	1.26-5.30	↑ by 1 vaginal birth
Previous VBAC	0.63 (0.56)	0.26	1.87	0.63-5.56	↑ by 1 VBAC
Previous CS for dystocia	-0.47 (0.25)	0.06	0.62	0.38-1.01	Previous CS for other reason
Previous CS for breech	-0.15 (0.3)	0.62	0.87	0.49-1.54	Previous CS for other reason
Constant	-1.27 (0.94)				

* Significant as $p < 0.05$. R^2 = .130 (Cox & Snell), .173 (Nagelkerke). Model $\chi^2(8)$ = 55.74; p <0.001

The type of care that women receive and a greater number of previous vaginal births are associated with an increased chance of having a successful VBAC. There is also a decreased odds of successful VBAC if the previous CS was for dystocia; however, this did not reach statistical significance.

4.6 Type of antenatal care and type of birth

Type of birth was compared by group, using adjusted residuals to demonstrate a significant difference in proportions. The MLAC group had a greater association with spontaneous vaginal birth and a lower association with elective CS (see table 4.12).

Table 4-12**:** Actual mode of birth (all categories) by type of antenatal care (*n* = 405)

Actual mode of birth	Obstetrician-led antenatal care		Midwife-led antenatal care		
	Count (%)	Adjusted residual	Count (%)	Adjusted residual	Total Count (total %)
Spontaneous vaginal birth*	67 (32.1%)	-2.3	85 (43.4%)	2.3	152 (37.5%)
Ventouse	13 (6.2%)	1.5	6 (3.1%)	-1.5	19 (4.7%)
Forceps	18 (8.6%)	-1.9	29 (14.8%)	1.9	47 (11.6%)
Emergency CS 1st stage	37 (17.7%)	0.9	28 (14.3%)	-0.9	65 (16%)
Emergency CS 2nd stage	8 (3.8%)	0.7	5 (2.6%)	-0.7	13 (3.2%)
Emergency CS no labour	11 (5.3%)	-0.4	12 (6.1%)	0.4	23 (5.7%)
Elective CS*	49 (23.4%)	2.2	29 (14.8%)	-2.2	78 (19.3%)
Elective CS as declined IOL	6 (2.9%)	1.3	2 (1%)	-1.3	8 (2%)
			χ^2(df) (*n* = 405)	15.99(7)	*p* = 0.03*

*Adjusted residual >2, denoting a significant difference between groups in this category

Although it did not reach statistical significance, there was a numerically greater rate of forceps birth in the MLAC group compared with the OLAC group, which was off-set by ventouse birth. The decision to use forceps or ventouse is based on professional judgement; therefore the overall instrumental birth rate provides a better variable by which to compare the two groups. The combined instrumental birth rate for the MLAC and OLAC groups were 35 (17.9%) and 31 (14.8%), respectively.

The reason for operative birth (CS or instrumental birth) was also analysed. The MLAC group was associated with a significantly decreased chance of operative birth for 'previous CS' and 'slow progress in the first stage of labour' (see table 4.13). The higher rate of 'previous CS' as the reason for operative birth is accounted for by the increase in ERCS in the OLAC group. The higher rate of 'slow progress' in the first stage of labour in the OLAC group is discussed further (section 5.2).

Table 4-13: Reason for operative birth by type of antenatal care

	Obstetrician-led antenatal care		Midwife-led antenatal care		
Variable	Count (%)	Adjusted residual	Count (%)	Adjusted residual	Total Count (total %)
Breech	9 (4.4%)	-0.4	10 (5.2%)	0.4	19 (4.8%)
Placenta praevia	1 (0.5%)	0	1 (0.5%)	0	2 (0.5%)
Intrauterine growth restriction	1 (0.5%)	1	0 (0%)	-1	1 (0.3%)
Failed IOL	3 (1.5%)	-0.8	5 (2.6%)	0.8	8 (2%)
Slow progress 1st stage*	31 (15%)	2.1	16 (8.3%)	-2.1	47 (11.8%)
Slow progress 2nd stage	18 (8.7%)	-0.6	20 (10.4%)	0.6	38 (9.5%)
Failed instrumental birth	2 (1%)	0.5	1 (0.5%)	-0.5	3 (0.8%)
Suspected fetal compromise	20 (9.7%)	-1.5	28 (14.6%)	1.5	48 (12.1%)
Previous CS*	45 (21.8%)	2.8	22 (11.5%)	-2.8	67 (16.8%)
Other	7 (3.4%)	0.5	5 (2.6%)	-0.5	12 (3%)

*Adjusted residual >2, denoting a significant difference between groups in this category. χ^2 not included: cannot be relied upon as all analyses included >20% cells with an expected count <5.

4.7 Maternal safety and type of antenatal care

Maternal safety was a secondary outcome. Whilst being very important, poor maternal safety outcomes are rare and the sample is not sufficiently powered to find statistical differences. As would be expected in a group of low risk women of this sample size, there were no uterine ruptures, hysterectomies, venous thromboemboli, eclamptic fits or maternal deaths within the sample during the study period. Other

maternal complications are presented in table 4.14. There were no significant differences between the groups.

Table 4-14**:** Maternal complications by type of care (*n* = 405)

	Total (%)	Obstetrician-led antenatal care (%)	Midwife-led antenatal care (%)	Odds ratio (95% CI)	*p* = (†Fisher's Exact Test)	χ^2(df) (n =)
Postpartum haemorrhage	184 (45.5%)	99 (47.6%)	85 (43.4%)	0.84 (0.57-1.25)	0.39	0.73(1) (404)
Placental complications	10 (2.5%)	7 (3.4%)	3 (1.5%)	0.44 (0.11-1.73)	†0.34	‡1.46(1) (399)
Infection	19 (4.8%)	8 (4%)	11 (5.6%)	1.45 (0.57-3.69)	0.43	0.62(1) (397)
Bowel complications	3 (0.8%)	1 (0.5%)	2 (1%)	2.09 (0.19-23.29)	†0.62	‡0.38(1) (394)
Bladder complications	10 (2.5%)	4 (2%)	6 (3.1%)	1.59 (0.44-5.72)	†0.54	‡0.51(1) (397)
ITU admissions	3 (0.8%)	1 (0.5%)	2 (1%)	2.1 (0.19-23.39)	†0.62	‡0.38(1) (397)
Postnatal readmissions	10 (2.6%)	4 (2%)	6 (3.2%)	1.61 (0.45-5.78)	†0.53	‡0.54(1) (391)

‡ χ^2 cannot be relied upon as expected counts too small (<5)

Placental complications included placenta praevia or accreta and manual removal of placenta. Infection was defined as antibiotic treatment for wound (abdominal or perineal) or genital tract infection (including uterine).

The estimated blood loss (EBL) was not significantly different between the groups (see table 4.15), even after exclusion of the outlier (9,000ml EBL). The excluded case was a known placenta accreta (in the MLAC group), which is a rare condition that is associated with previous CS birth (section 2.3.4). The large blood loss was anticipated irrespective of the type of antenatal care received. Length of postnatal stay in hospital was longer in the OLAC group. This finding was anticipated due to the increased rate of CS birth in this group.

Table 4-15: Maternal safety outcomes; comparison of means (*n* = 405)

	Obstetrician-led antenatal care			Midwife-led antenatal care			Difference	
Variable	Min	Max	Median & Mean (+/-SD)	Min	Max	Median & Mean (+/- SD)	Test statistic	*p*
Estimated blood loss (EBL) (mls)	100	3000	450	50	9000	400	18,927.0$^{\Psi}$	0.21
EBL excluding outlier	100	3000	450	50	2000	400	18,914.0$^{\Psi}$	0.21
Length of hospital stay	1	8	3.15 (1.35)	0	12	2.67 (1.39)	-3.448†	0.001*

*Significant as $p < 0.05$ †*t*-test statistic ΨMann-Whitney *U*-test statistic

Rates of perineal trauma were compared by group including only women who gave birth vaginally (*n* = 218) (see table 4.16). No differences between the groups reached statistical significance. There was a higher rate of 2nd degree tears in the MLAC group compared to the OLAC group (30% versus 23.7%), which appears to be offset by a decreased episiotomy rate (29.2% versus 40.2%).

Table 4-16**:** Perineal trauma only those who had a vaginal birth (*n* = 217)

	Total (%)	Obstetrician-led antenatal care (%)	Midwife-led antenatal care (%)	Odds ratio (95% CI)	*p* = (†Fisher's Exact Test)	χ^2(df) (n = 217)
Intact	43 (19.8%)	17 (17.5%)	26 (21.7%)	1.3 (0.66-2.57)	0.45	0.58(1)
1st degree	25 (11.5%)	11 (11.3%)	14 (11.7%)	1.03 (0.45-2.39)	0.94	0.006(1)
2nd degree	59 (27.2%)	23 (23.7%)	36 (30%)	1.38 (0.75-2.54)	0.3	1.07(1)
3rd degree	20 (9.2%)	11 (11.3%)	9 (7.5%)	0.63 (0.25-1.6)	0.33	0.95(1)
4th degree	1 (0.5%)	0 (0%)	1 (0.8%)	0.99 (0.98-1.01)	†0.49	‡0.81(1)
Labial	11 (5.1%)	6 (6.2%)	5 (4.2%)	0.66 (0.2-2.23)	0.5	0.45(1)
Episiotomy	74 (34.1%)	39 (40.2%)	35 (29.2%)	0.61 (0.35-1.08)	0.09	2.91(1)

Obstetrician-led care = reference (OR 1.0) ‡ χ^2 cannot be relied upon as expected counts too small (<5)

4.8 Neonatal safety and type of antenatal care

The mean gestation at birth (SD) was not significantly different between the two groups: MLAC 39.62 weeks (1.17); OLAC 39.49 weeks (1.23) (*t* = 1.10; *p* = 0.27). The women in this sample were more likely to have a male infant (54.6%) than a female (45.4%). The proportion of males to females did not differ significantly between the groups (OR 1.02, 95% CI 0.69-1.51). The mean birth-weight (SD) was 3519g (496g), with a range of 1870-5205g. The mean birth-weights (SD) between the groups were similar: OLAC 3500g (509g), MLAC 3539g (483g) (*t* = 0.79, *p* = 0.43).

Neonatal safety outcomes were also analysed by group. There were no neonatal deaths; however there was one intrauterine death within the MLAC group. The diagnosis was made antenatally following an episode of reduced fetal movements; labour was then induced. This research was not powered to detect a statistical difference between the type of antenatal care received and the risk of stillbirth, due to

the rarity of this event. Smith et al (2003) proffered that women who have previously given birth by CS are more likely to suffer a stillbirth in a subsequent pregnancy than women whose previous birth was not by CS (0.4% vs 0.2%, p <0.001, n = 120,633). Hence in a sample this size, at least one stillbirth would be expected; chance would determine in which group it occurred. Given the increased risk for women with a previous CS it is reassuring that the stillbirth rate for this research (0.3%) and for the MLAC group (0.5%) are broadly similar to the overall stillbirth rate in the UK (0.49%) (Office for National Statistics, 2013).

The five-minute Apgar was chosen as a score of neonatal wellbeing that is collected for all babies and provides a better insight into short-term prognosis for the neonate, compared to one-minute Apgar. Comparison showed that there was no significant difference between the groups (see table 4.17).

Table 4-17**:** Comparison of means 5 minute Apgar score (n = 405)

	Obstetrician-led antenatal care			Midwife-led antenatal care			Difference	
Variable	Min	Max	Median	Min	Max	Median	Mann-Whitney *U*	*p*
5 Minute Apgar	5	10	9	0	10	9	19,825	0.79

All other neonatal complications were compared according to type of antenatal care and are displayed in table 4.18. There were no significant differences between the groups.

Table 4-18**:** Neonatal outcomes related to safety

	Total (%)	OLAC (%)	MLAC (%)	OR (95% CI)	*p* = († Fisher's Exact Test)	χ^2(df) (n =)
Birth Trauma	11 (2.8%)	9 (4.4%)	2 (1.1%)	0.23 (0.5-1.1)	†0.06	3.99(1) (393)
Intrauterine death	1 (0.3%)	0 (0%)	1 (0.5%)	0.995 (0.99-1.01)	†0.49	‡1.06(1) (397)
Admissions to NNU	20 (5.1%)	10 (4.9%)	10 (5.2%)	1.06 (0.43-2.61)	0.9	0.02(1) (395)
Jaundice requiring treatment	11 (2.8%)	6 (3.0%)	5 (2.7%)	0.88 (0.27-2.94)	0.84	0.04(1) (388)
Respiratory distress	16 (4.1%)	7 (3.5%)	9 (4.7%)	1.35 (0.49-3.7)	0.56	0.34(1) (389)
Hypothermia requiring treatment	14 (3.6%)	4 (2.0%)	10 (5.3%)	2.71 (0.84-8.79)	0.09	2.97(1) (389)
Breastfeeding initiated at birth	312 (78.6%)	160 (78.4%)	152 (78.8%)	1.02 (0.63-1.65)	0.94	0.01(1) (397)
Breastfeeding exclusively at discharge	213 (56.3%)	102 (56.3%)	111 (59.4%)	1.27 (0.85-1.92)	0.24	1.36(1) (378)

NNU = neonatal unit; ‡ χ^2 cannot be relied upon as expected counts too small (<5)

None of the outcomes measured were significantly different between groups. There was an increased risk of birth trauma with OLAC, which did not reach statistical significance. The birth trauma suffered were cephalohaematoma caused by ventouse birth (n = 3), abrasions or bruising from fetal scalp electrode (n = 2), bruise of unknown origin (n = 1), swollen and bruised foot due to footling breech presentation (n = 1), shoulder dystocia (n = 3, including 1 brachial plexus injury) and unknown trauma (n = 1). These trauma were unlikely to be linked to the antenatal care received, as the events that precipitated the trauma were difficult to predict. The low positive predictive value of risk factors for shoulder dystocia is well-known (RCOG 2012). The main risk factors for instrumental birth are labour rather than antenatal characteristics (RCOG, 2011). Additionally, a previous CS may be considered a relative contraindication for external cephalic version to remedy breech presentation (RCOG,

2006), which may anyway be undiagnosed until established labour (Leung et al, 1999). Therefore, whether the woman received MLAC or OLAC is unlikely to have been related to these traumas, which were associated with breech presentation, shoulder dystocia and instrumental birth.

4.9 Antenatal care comparison between groups

The intervention being evaluated in this research was the antenatal care that women received during their pregnancy. Data have indicated that those who received MLAC were more likely to choose and achieve VBAC. This quantitative research cannot explore women's lived experiences of MLAC compared to OLAC. Therefore the organisation of antenatal care in each group has been compared to establish the differences between the two types of care. The findings may generate theories as to why the two types of care elicit different VBAC rates (see table 4.19), which may be tested in future research.

The majority of women in the MLAC group remained on the pathway (79.9%). 20.1% converted to OLAC during their pregnancy, either as a result of their mode of birth decision or due to complications that arose requiring obstetric expertise. Unfortunately, data were not accurately collected for comparison in the OLAC group. Women who developed complications in the OLAC group remained under obstetric-led care, hence it was not obvious to the DRAs that these women would no longer have been suitable for MLAC. All data were analysed on an intention to treat basis (i.e. based on the group in which they commenced their antenatal care).

Table 4-19**:** Organisation of antenatal care by group

	Obstetrician-led antenatal care			Midwife-led antenatal care			Difference	
Variable	Min	Max	Median	Min	Max	Median	Mann-Whitney *U*	*P*
Booking gestation (weeks)	6	38	10	6	32	10	18,759	0.21
No. of community AN appts	0	14	8	3	14	8	15,552	<0.001*
No. of AN Clinic appts	1	13	2	0	6	0	5,248	<0.001*
No. of antenatal carers	1	10	5	1	11	3	11,562	<0.001*
Gestation of 1st MOB discussion (weeks)	6	40	20	7	38	11	7,139	<0.001*
Gestation of birth plan (weeks)	13	41	34	9	41	36	15,241	0.03*
Time for MOB decision (weeks)	0	31	14	0	33	23	7,057	<0.001*
Unscheduled ANC: day unit (visits)	0	7	0	0	12	0	18,419.5	0.09
Unscheduled ANC: delivery suite (visits)	0	3	0	0	2	0	18,528	0.03*
AN inpatient admissions	0	4	0	0	4	0	18,806	0.04*

* significant as p <0.05. AN = antenatal; AN Clinic = hospital clinic with an obstetrician; MOB = mode of birth; ANC = antenatal care

Findings suggest that the organisation of antenatal care is significantly different between the two groups. Women receiving MLAC attended significantly more

community based antenatal appointments and fewer hospital based clinic appointments, as would be expected. They were also cared for by fewer clinicians throughout the antenatal period (mean 3.47 vs. 4.78 for MLAC and OLAC, respectively), indicating greater continuity of carer. Women in the MLAC group had their first discussion regarding mode of birth on average 7 weeks earlier than those in the OLAC group. They also made their final decisions regarding mode of birth slightly later. Women in the MLAC group therefore had significantly longer to consider their options and make a decision about mode of birth.

Episodes of unscheduled antenatal care via the day unit were similar between the two groups. However, there was a statistically significant difference between the groups in unscheduled antenatal care in delivery suite and antenatal inpatient admissions, in both cases episodes were fewer in the MLAC group. Significantly more women in the OLAC group (6.3%) presented for unscheduled antenatal care due to 'threatened preterm labour' compared to the MLAC group (1.5%): OR 0.23 (0.07-0.84), $\chi^2(1df) = 5.86$, $p = 0.02$. All other rates of presentation indications were similar between the groups.

4.10 Labour characteristics

A subset of women who laboured (n = 296) was analysed to compare outcomes by group for labour characteristics (see table 4.20).

The percentage of women who went into spontaneous labour was similar between the groups, as was the method of induction for those who were induced. Whilst the percentage of women in the MLAC group who were assessed in early labour was higher than women in the OLAC group, the percentage of women who were actually admitted into hospital during early labour was lower. This indicates that more women in the MLAC group were encouraged to stay at or return home during early labour following face-to-face assessment, as per NICE recommendations (NCCWCH, 2007). None of these variances were statistically significantly different.

The only labour characteristic that met statistical significance was intravenous access: significantly fewer women in the MLAC group had a cannula inserted. There were also more women in the MLAC group who used water (birth pool, bath or shower) as pain relief during labour, although it did not reach statistical significance due to the small numbers. These two characteristics may be linked, as women who use the pool during a VBAC labour are unlikely to have an intravenous cannula inserted, due to the infection risk.

Table 4-20: Intrapartum comparisons by group (only those who laboured)

	Obstetrician-led antenatal care	Midwife-led antenatal care				
Labour characteristic	Count (%)	Count (%)	Odds ratio (95% CI)	*p* = († Fisher's Exact Test)	χ^2(df) (n =)	Total (%)
Spontaneous onset	115 (82.1%)	127 (84.7%)	1.2 (0.65-2.23)	0.56	0.33(1) (290)	242 (83.4%)
IOL with prostaglandin	20 (14.2%)	17 (11.3%)	0.77 (0.39-1.55)	0.47	0.53(1) (291)	37 (12.7%)
IOL with ARM	20 (14.2%)	17 (11.3%)	0.77 (0.39-1.55)	0.47	0.53(1) (291)	37 (12.7%)
IOL with Syntocinon IVI	11 (7.8%)	10 (6.7%)	0.84 (0.35-2.05)	0.71	0.14(1) (291)	21 (7.2%)
Augmented labour	54 (38.3%)	61 (40.4%)	1.09 (0.68-1.75)	0.71	0.16(1) (292)	115 (39.4%)
Assessed in early labour	81 (57%)	93 (61.2%)	1.19 (0.74-1.89)	0.47	0.52(1) (294)	174 (59.2%)
Admitted in early labour	75 (52.8%)	67 (44.1%)	0.7 (0.45-1.12)	0.13	2.25(1) (294)	142 (48.3%)
TENS as analgesia	6 (4.7%)	2 (2.1%)	0.44 (0.11-1.81)	†0.32	‡1.36(1) (269)	9 (3.3%)
Water as analgesia	1 (0.8%)	6 (4.3%)	5.64 (0.67-47.54)	†0.12	‡3.2(1) (269)	7 (2.6%)
Entonox as analgesia	94 (73.4%)	107 (75.9%)	1.14 (0.66-1.97)	0.64	0.21(1) (269)	201 (74.7%)
Opiates as analgesia	6 (4.7%)	10 (7.1%)	1.55 (0.55-4.4)	0.41	0.69(1) (269)	16 (5.9%)
Epidural as analgesia	55 (43%)	58 (41.1%)	0.93 (0.57-1.51)	0.76	0.09(1) (269)	113 (42%)
Other analgesia	3 (2.3%)	2 (1.4%)	0.6 (0.1-3.65)	†0.67	‡0.32(1) (269)	5 (1.9%)
No analgesia	9 (7%)	14 (9.9%)	1.46 (0.61-3.49)	0.4	0.72(1) (269)	23 (8.6%)
IV access in labour	122 (86.5%)	112 (73.7%)	0.46 (0.24-0.8)	0.01*	7.5(1) (293)	234 (79.9%)
Continuous EFM	127 (90.1%)	129 (84.9%)	0.62 (0.31-1.26)	0.18	1.79(1) (293)	256 (87.4%)
Intermittent EFM	4 (2.8%)	9 (5.9%)	2.16 (0.65-7.16)	0.2	1.64(1) (293)	13 (4.4%)

Intermittent auscultation	9 (6.4%)	11 (7.2%)	1.14 (0.5-2.85)	0.77	0.08(1) (293)	20 (6.8%)
No Fetal monitoring	1 (0.7%)	2 (2.6%)	3.78 (0.42-34.27)	†0.37	‡1.61(1) (293)	5 (1.7%)

* significant as $p < 0.05$. ‡ χ^2 cannot be relied upon as expected counts too small (<5)

There was no statistical difference between any of the other labour characteristics, including continuity of care for women in labour (see table 4.21).

Table 4-21**:** Number of midwives providing care during labour

	Obstetrician-led antenatal care			Midwife-led antenatal care			Difference	
Variable	Min	Max	Median	Min	Max	Median	Mann-Whitney *U*	*p*
Number of midwives	1	8	2	1	6	2	18,928.5	0.34

4.11 Summary for comparison of MLAC and OLAC groups

Analysis demonstrates that the two groups are demographically similar. Women who received MLAC were more likely to intend VBAC than those in the OLAC group. Women in the MLAC group also had a numerically higher VBAC success rate than women in the OLAC group. Together these associations explain the finding that more women in the MLAC group had a successful VBAC than those in the OLAC group. These findings remained statistically significant even after adjustment for confounding factors. Women in the MLAC group were more likely to have a spontaneous vaginal delivery, which may explain their reduced length of hospital stay. Women in the OLAC group were more likely to have an elective CS with 'previous CS' cited as the clinical indication.

Reassuringly, the analysis has also suggested that MLAC and OLAC elicited similar results for maternal and neonatal safety. Antenatally, women in the MLAC group were less likely to require unscheduled antenatal care or inpatient admission. The only reason for unscheduled antenatal care that was different between the groups was threatened pre-term labour, which was lower in the MLAC group. Postnatally, women in the OLAC group had a slightly longer hospital stay. Additionally, the main neonatal safety outcomes were similar, including the 5 minute Apgar score.

The major difference between the groups was in the organisation of antenatal care. This may explain the differences in the intended and actual mode of birth between the groups. Most labour characteristics were comparable between groups. The main variance was the rate of women who had an intravenous cannula inserted during labour.

Theories explaining the link between these variances and the main outcomes are examined in chapter 5.

4.12 Successful VBAC versus birth by CS

This is the only study investigating a group of women who were at 'low-risk' of obstetric complications at booking other than their prior CS, to the author's knowledge. Therefore, this relatively large data set has also been analysed to add to the evidence-base regarding VBAC and CS. The limitations of such secondary analysis are recognised, including the retrospective cohort design of this research. However, this additional data analysis provides extra information for professionals when caring for this group of women. The findings of this analysis can also be compared to other research to help support the main findings and determine whether they are generalisible to other populations.

4.13 Intended mode of birth

The main data analysis indicated that the strongest indicator of intending to birth by VBAC was receiving MLAC. Removing this variable, the data were further analysed to discover whether anything else about this 'low-risk' cohort of women with a previous CS or the organisation of antenatal care made intended VBAC more likely.

There were no statistical differences in the age, BMI or time since the previous CS of women who intended to birth by either VBAC or elective CS (see table 4.22).

Table 4-22**:** Demographics by intended mode of birth, comparison of mean (n = 405)

	Intended elective CS			Intended VBAC			Difference	
Variable	Min	Max	Median & Mean (+/- SD)	Min	Max	Median & Mean (+/-SD)	Test statistic	*p*
Maternal age (years)	22	41	31.75 (4.48)	19	53	30.57 (4.98)	-1.8†	0.07
Maternal BMI (kg/m²)	19	40	25	18	40	25	11,122Ψ	0.88
Time since CS (months)	13	140	39	10	198	39	11,246Ψ	0.99

* Significant as $p < 0.05$ † *t* –test statistic ΨMann-Whitney *U*

Women who had previously given birth vaginally or by VBAC were significantly more likely to opt for a VBAC than an elective CS (table 4.23). The finding that age and BMI did not impact upon women's intended mode of birth was confirmed once women were categorised into groups: age under 35 years and BMI under 30 kg/m² (see table 4.23). The indication for the previous CS appeared not to have a statistically significant effect on the overall intended VBAC rate.

Table 4-23: OR for intended VBAC by maternal demographics (*n* = 405)

Maternal demographic	Total (%)	Elective CS (%)	Intended VBAC (%)	OR (95% CI)	*p* =	χ^2(df) (n =)
Previous vaginal birth	79 (22.8%)	2 (3%)	77 (22.8%)	9.59 (2.3-40.06)	<0.001*	13.96(1) (405)
Previous VBAC	54 (13.4%)	1 (1.5%)	53 (15.7%)	12.32 (1.67-90.69)	0.002*	9.78(1) (404)
Age </= 35 years	336 (83%)	54 (80.6%)	282 (83.4%)	1.21 (0.62-2.37)	0.57	0.32(1) (405)
BMI </= 30 kg/m²	322 (79.9%)	55 (82.1%)	267 (79.5%)	0.84 (0.43-1.66)	0.62	0.24(1) (403)
Previous CS for dystocia	161 (39.8%)	31 (46.3%)	130 (38.5%)	0.73 (0.43-1.23)	0.23	1.42(1) (405)
Previous CS for breech	93 (23%)	10 (14.9%)	83 (24.6%)	1.86 (0.91-3.81)	0.85	2.97(1) (404)

Gestation at booking, first 'mode of birth' discussion, birth planning and time for decision making were not significantly different between those who intended to birth by VBAC and by elective CS. However, the number of antenatal appointments in the community, in the hospital antenatal clinic and the total number of antenatal carers did differ significantly between those who intended VBAC and CS (see table 4.24). This finding would be expected given the variance between the MLAC and OLAC groups and the fact that the schedule of antenatal care for women receiving MLAC included a consultation with an obstetrician if ERCS was preferred. Given that the sample was at 'low risk' of additional obstetric complications and therefore unlikely to develop complications requiring the expertise of an obstetrician, this further supports the theory that the organisation of antenatal care may significantly influence women's decision making regarding mode of birth.

Table 4-24**:** Comparison of organisation of antenatal care by intended mode of birth (*n* = 405)

	Intended elective CS			Intended VBAC			Difference	
Variable	Min	Max	Median	Min	Max	Median	Mann-Whitney *U*	*P*
Community AN appts	3	10	7	0	14	8	6,396.5	<0.001*
AN Clinic appts	0	6	2	0	13	1	6,705	<0.001*
AN Carers	1	10	5	1	11	4	8,494	0.003*

* significant as p <0.05

4.14 Actual mode of birth

The whole sample was also analysed to compare the characteristics of women who achieved a successful VBAC compared to those who did not. This demonstrated that the women were similar in age, BMI and time since the previous CS (see table 4.25).

Table 4-25**:** Successful VBAC versus CS maternal characteristics (*n* = 405)

	CS			Successful VBAC			Difference	
Variable	Min	Max	Median & Mean (+/- SD)	Min	Max	Median & Mean (+/-SD)	t-test statistic	*P*
Maternal age	19	43	30.76 (4.91)	19	53	30.49 (4.95)	-1.23†	0.22
Maternal BMI	18	40	25	18	40	25	19,302Ψ	0.45
Time since CS (months)	10	184	35	10	198	41	18,043Ψ	0.07

† *t*-test statistic Ψ Mann-Whitney *U* test statistic

Women who had previously given birth vaginally and by VBAC were significantly more likely to give birth by successful VBAC than by CS (see table 4.26). When categorised into clinically significant groups (≥35 years and ≥30kg/m^2) age and BMI were still not statistically different between the VBAC and CS groups.

Table 4-26: OR for successful VBAC by age and BMI, all women (*n* = 405)

Maternal demographic	Total (%)	CS (%)	Successful VBAC (%)	Odds ratio (95% CI)	*p* =	χ^2(df) (n =)
Previous vaginal birth	79 (19.5%)	10 (5.3%)	69 (31.7%)	8.2 (4.08-16.47)	<0.001*	44.36(1) (405)
Previous VBAC	54 (13.4%)	4 (2.1%)	50 (23%)	13.7 (4.84-38.75)	<0.001*	37.9(1) (404)
Age ≤ 35 years	336 (83%)	153 (81.8%)	183 (83.9%)	1.16 (0.69-1.95)	0.57	0.32(1) (405)
BMI ≤ 30 kg/m²	322 (79.9%)	150 (80.6%)	172 (79.3%)	0.92 (0.56-1.5)	0.73	0.12(1) (403)

* significant as *p* <0.05

Women who gave birth by VBAC this time were significantly less likely to have previously birthed by CS due to 'dystocia' (see table 4.27). There was a greater odds of successful VBAC following previous CS for breech, however this did not quite reach statistical significance.

Table 4-27: OR for successful VBAC by reason for and type of previous CS (*n* = 405)

Labour characteristic	Total (%)	CS (%)	Successful VBAC (%)	Odds ratio (95% CI)	*p* =	χ^2(df) (n =)
Previous CS for dystocia	161 (39.8%)	90 (48.1%)	71 (32.6%)	0.52 (0.35-0.78)	0.001*	10.18(1) (405)
Previous CS for breech	93 (23%)	35 (18.7%)	58 (26.7%)	1.54 (0.99-2.55)	0.06	3.64(1) (404)

* significant as *p* <0.05

Results

All findings described above remained significant even after the sample was analysed including only those who attempted VBAC and actually laboured. In addition, women with a longer time since their previous CS were more likely to have a successful VBAC (table 4.28).

Table 4-28: Successful VBAC vs emergency CS maternal characteristics comparison of means, only those who laboured (*n* = 296)

	CS			Successful VBAC			Difference	
Variable	Min	Max	Median & Mean (+/- SD)	Min	Max	Median & Mean (+/-SD)	Test statistic	*P*
Maternal age	19	43	30.28 (4.96)	19	53	30.49 (4.95)	0.31†	0.76
Maternal BMI	19	40	25	18	40	25	7,780ψ	0.37
Time since CS (months)	10	184	33	10	188	41	6,735ψ	0.01*

* p <0.01 significant at the 1% level † t-test statistic ψ Mann-Whitney U test statistic

The χ^2 test demonstrated that, of those who laboured, significantly more women who had a previous vaginal birth or VBAC had a successful VBAC than CS. Analysis also confirmed that neither increased age nor BMI were associated with a reduced chance of achieving a successful VBAC in this sample of women who attempted VBAC (see table 4.29).

Table 4-29: OR for successful VBAC by age and BMI, only women who laboured (*n* = 296)

Labour characteristic	Total (%)	CS (%)	Successful VBAC (%)	OR (95% CI)	*p* =	χ^2(df) (n =)
Previous vaginal birth	71 (24%)	2 (2.6%)	69 (31.7%)	17.6 (4.2-73.74)	<0.001*	26.66(1) (296)
Previous VBAC	51 (17.3%)	1 (1.3%)	50 (23%)	23.05 (3.13-169.97)	<0.001*	19(1) (295)
Age </= 35 years	250 (84.5%)	67 (85.9%)	183 (83.9%)	0.86 (0.41-1.79)	0.68	0.17(1) (296)
BMI </= 30 kg/m²	217 (73.8%)	61 (79.2%)	172 (79.2%)	1 (0.53-1.9)	0.99	<0.001(1) (296)

* *p* <0.01 significant at the 1% level

The association between mode of birth and previous CS for dystocia was even stronger once calculated only for those women who attempted VBAC (see table 4.30). No association was found between VBAC and a previous CS for breech.

Table 4-30: OR for successful VBAC by reason for and type of previous CS, only those woman who laboured (*n* = 296)

Labour characteristic	Total (%)	CS (%)	Successful VBAC (%)	Odds ratio (95% CI)	*p* =	χ^2(df) (n =)
Previous CS for dystocia	113 (38.2%)	42 (53.8%)	71 (32.6%)	0.41 (0.24-0.7)	0.001*	11.02(1) (296)
Previous CS for breech	72 (24.4%)	14 (17.9%)	58 (26.7%)	1.67 (0.87-3.2)	0.12	2.4(1) (295)

* *p* <0.01 significant at the 1% level

4.15 Labour characteristics

Including only the women who laboured (*n* = 296), labour characteristics were compared by successful VBAC and emergency CS. Interestingly, there was no statistical difference in the CS rate between those who were induced (29.2%) and

those who were not (26.4%) (see table 4.31), although the CS rate was greater following augmentation (see table 4.32).

Table 4-31: Mode of birth by onset of labour

	Spontaneous labour		Induced labour	
	Count	%	Count	%
Spontaneous vaginal birth	126	52.1	22	45.8
Ventouse	17	7	1	2.1
Forceps	35	14.5	11	22.9
Emergency CS 1s stage	53	21.9	12	25
Emergency CS 2nd stage	11	4.5	2	4.2
Totals	242	100	48	100

Women whose labour was augmented were significantly more likely to have a CS (33%) than those whose labour progressed naturally (22%) (see table 4.32).

Table 4.32 also demonstrates that women who had an epidural during labour were significantly more likely to have a CS (49.6%) than those who did not (13.5%). This finding does not imply causation, rather it indicates an association. The mechanism behind that association cannot be determined by this retrospective research. Other types of analgesia were not associated with an increased risk of CS.

Women who were assessed in early labour were found to be more likely to give birth by CS compared to those who were not. Equally, those who were admitted into hospital during early labour were more likely to have a CS compared to those who were not (see table 4.32).

Table 4-32**:** OR for successful VBAC by labour characteristic (*n* = 296)

Labour characteristic	Total (%)	CS (%)	Successful VBAC (%)	Odds ratio (95% CI)	*p* =	χ^2(df) (n =)
Spontaneous Labour	242 (83.4%)	64 (82.1%)	178 (84%)	1.15 (0.58-2.27)	0.7	0.15(1) (290)
Augmented labour	115 (39.4%)	38 (49.4%)	77 (35.8%)	0.57 (0.34-0.97)	0.04*	4.35(1) (292)
Epidural analgesia	113 (42%)	56 (72.7%)	57 (29.7%)	0.16 (0.09-0.29)	<0.001*	41.79(1) (269)
Assessed in early labour	174 (59.2%)	60 (76.9%)	114 (52.8%)	0.34 (0.19-0.61)	<0.001*	13.83(1) (294)
Admitted in early labour	142 (48.3%)	54 (69.2%)	88 (40.7%)	0.31 (0.18-0.53)	<0.001*	18.63(1) (204)

* significant as *p* <0.05

4.16 Confounding factors for successful VBAC

Logistic regression was used to account for the confounding factors that could affect the mode of birth outcome, including only those who laboured. Selection of confounding factors was based on the literature review (discussed in detail section 2.3) and initial data analysis. Once all confounding variables were held stable, the only variables with a significant association with CS were previous CS for dystocia and epidural uptake (see table 4.33). When dystocia was the indication for the previous CS the odds for VBAC was 0.44 (0.21-0.92, *p* =0.03). Epidural analgesia was also associated with decreased odds of successful VBAC: OR 0.29 (0.14-0.57, *p* <0.001).

Table 4-33: Adjusted OR (95%CI) for VBAC for all confounding variables

	ß (SE)	P	OR	95% CI	Reference (OR 1.0)
Maternal age (years)	-0.1 (0.03)	0.69	0.99	0.93-1.05	↑ by 1 year
Maternal BMI (kg/m²)	-0.05 (0.03)	0.11	0.95	0.89-1.01	↑ by 1 kg/m²
Time since CS (Months)	-0.01 (0.01)	0.21	0.99	0.98-1.0	↑ by 1 month
Previous vaginal births	0.89 (0.62)	0.15	2.44	0.73-8.19	↑ by 1 vaginal birth
Previous VBACs	1.73 (1.23)	0.16	5.65	0.51-62.94	↑ by 1 VBAC
Previous CS for dystocia	-0.82 (0.37)	0.03*	0.44	0.21-0.92	Previous CS for other reason
Previous CS for breech	-0.44 (0.46)	0.35	0.65	0.26-1.6	Previous CS for other reason
Induced labour	-0.72 (0.55)	0.19	0.49	0.17-1.42	Spontaneous labour
Assessed in early labour	-0.31 (0.63)	0.62	0.74	0.22-2.51	Not assessed in early labour
Admitted in early labour	-0.99 (0.54)	0.07	0.37	0.13-1.07	Not admitted in early labour
Labour augmented	0.18 (0.37)	0.63	1.19	0.58-2.48	Not augmented
Epidural in labour	-1.25 (0.35)	<0.001*	0.29	0.14-0.57	No epidural in labour
Constant	4.62				

* Significant as $p<0.05$. R^2 = .238 (Cox & Snell), .341 (Nagelkerke). Model $\chi^2(12)$ = 71.043 p <0.001

4.17 Maternal and neonatal safety outcomes

Maternal postnatal and neonatal outcomes were analysed including the whole sample to add to the evidence base regarding the safety of VBAC. There was a significantly lower estimated blood loss (EBL) following VBAC compared to CS, even after exclusion

of the outlier (9,000ml EBL) (see table 4.34). This correlates with the findings of Rouse et al (2006) who demonstrated that the risk of requiring a blood transfusion increases with increasing numbers of CSs. The postnatal length of stay was significantly longer following CS.

Table 4-34**:** Maternal outcomes following successful VBAC and CS maternal characteristics comparison of means (*n* = 405)

	CS			Successful VBAC			Difference	
Variable	Min	Max	Median & Mean (+/- SD)	Min	Max	Median & Mean (+/-SD)	Test statistic	*P*
Estimated blood loss (EBL) (mls)	100	9000	500	50	2900	400	17,083.5	0.006*
EBL (excluding outlier)	100	3000	500	50	2900	400	17,301.5	0.01*
Length of stay (days)	1	12	3.61 (1.29)	0	8	2.31 (1.17)	-10.56	<0.001*

* Significant as p <0.05

There were no differences in rates of placental, bowel and bladder complications, intensive treatment unit (ITU) admissions or postnatal readmissions (see table 4.35). Given the sample size and the rarity of these events this would be expected. The risk of suffering a PPH (defined as blood loss >500mls) was higher for those who gave birth by CS. Analysis also revealed a significantly higher rate of infection following CS. Infection was defined as antibiotic treatment for a wound (abdominal or perineal) or genital tract infection (including uterine).

Table 4-35: Safety outcomes by mode of birth (*n* = 405)

Safety outcome	Total (%)	CS (%)	Successful VBAC (%)	Odds ratio (95% CI)	*p* = († Fisher's Exact Test)	χ^2(df) (n =)
Postpartum haemorrhage	184 (45.5%)	100 (53.8%)	84 (38.5%)	0.54 (0.36-0.8)	0.002*	9.39(1) (404)
Postnatal readmission	10 (2.6%)	6 (3.4%)	4 (1.9%)	0.55 (0.15-2)	†0.52	‡0.84(1) (391)
Placental complication	10 (2.5%)	5 (2.7%)	5 (2.3%)	0.84 (0.24-2.96)	†1.0	‡0.07(1) (399)
Infection	19 (4.8%)	14 (7.7%)	5 (2.3%)	0.29 (0.1-0.82)	0.01*	6.11(1) (397)
Bowel complications	3 (0.8%)	3 (1.7%)	0 (0%)	1.02 (1-1.04)	†0.1	‡3.57(1) (394)
Bladder complications	10 (2.5%)	5 (2.7%)	5 (2.3%)	0.85 (0.24-2.99)	†1.0	‡0.06(1) (397)
Maternal ITU admission†	3 (0.8%)	3 (1.6%)	0 (0%)	1.02 (1-1.04)	†0.1	‡3.54(1) (397)

* significant as $p < 0.05$. ‡ χ^2 cannot be relied upon as expected counts too small (<5)

Mean birth weights did not differ between neonates born by CS and VBAC. Relating to neonatal wellbeing, the mean 5-minute Apgar score was statistically significantly lower in babies born by CS than vaginally (see table 4.36).

Table 4-36: Neonatal outcomes following successful VBAC and CS (*n* = 405)

	CS			Successful VBAC			Difference	
Variable	Min	Max	Median & Mean (± SD)	Min	Max	Median & Mean (± SD)	Test statistic	*p*
Birth weight (g)	2110	3505	3555.95 (533.79)	1870	4655	3487.8 (460.26)	-1.38†	0.17
5 minute Apgar	2	10	9	0	10	9	17,998ᴪ	0.04*
5 minute Apgar (excl IUD)	2	10	9	5	10	9	17,998ᴪ	0.04*

† *t*-test statistic ᴪ Mann-Whitney *U* test statistic

Importantly, there was no significant difference in the number of babies born with a 5-minute Apgar score <7 between VBAC and CS. Babies born by CS were more than twice as likely to require admission to the neonatal unit. This difference was statistically significant (see table 4.37). This finding concurs with those of Kamath et al (2009), who demonstrated that babies born by CS were more likely than those born by successful VBAC to require NNU admission, regardless of their mothers' intended mode of birth. There were no differences in the rates of babies who suffered birth trauma, required treatment for jaundice or hypothermia, suffered respiratory distress or initiated breastfeeding at birth. There were more babies born by VBAC exclusively breastfeeding at discharge compared to those born by CS, although this did not reach statistical significance. The research of Leung et al (2002) also demonstrated that CS was a risk factor for reduced overall breastfeeding duration.

Table 4-37**:** Neonatal outcomes by mode of birth (*n* = 405)

Safety outcome	Total (%)	CS (%)	Successful VBAC (%)	OR (95% CI)	*p* = (†Fisher's exact test)	χ^2(df) (n =)
5-minute Apgar score <7 (excluding IUD)	10 (2.5%)	6 (3.2%)	4 (1.9%)	0.57 (0.16-2.04)	0.52†	0.78(1) (400)
Birth trauma	11 (2.8%)	4 (2.2%)	7 (3.3%)	1.51 (0.44-5.25)	0.51	0.43(1) (393)
Admission to NNU	20 (5.1%)	14 (7.6%)	6 (2.8%)	0.36 (0.13-0.95)	0.03*	4.64(1) (395)
Jaundice requiring treatment	11 (2.8%)	5 (2.8%)	6 (2.9%)	1.02 (0.31-3.39)	0.98	0.001(1) (388)
Respiratory distress	16 (4.1%)	7 (3.9%)	9 (4.3%)	1.09 (0.4-2.98)	0.87	0.03(1) (389)
Hypothermia requiring treatment	14 (3.6%)	8 (4.5%)	6 (2.9%)	0.63 (0.21-1.85)	0.4	0.72(1) (389)
Breastfeeding initiated at birth	312 (78.6%)	143 (77.3%)	169 (79.7%)	1.15 (0.71-1.87)	0.56	0.34(1) (397)
Breastfeeding exclusively at discharge	213 (56.3%)	90 (51.1%)	123 (60.9%)	1.49 (0.99-2.24)	0.06	3.64(1) (378)

*significant as *p* <0.05

The finding that more babies born by CS were admitted to NNU is not unexpected, given that a proportion will have been an emergency CS for suspected fetal compromise. Using a successful VBAC as the reference (OR 1.0), the odds of requiring NNU admission were greater for all other types of birth, although this only reached statistical significance with emergency CS (see table 4.38). Of note, the difference in NNU admission between babies born by emergency and elective CS did not reach statistical significance: OR 3.34 (0.9-12.39), *p* = 0.06, although this may not have been the case with a larger sample size.

Table 4-38: Odds of NNU admission (*n* = 395)

	Count (%)	OR	95% CI	*p* (†Fisher's Exact)	χ^2(df)
Spontaneous vaginal birth	2 (1.3%)	1.0	Reference		
Operative vaginal birth	4 (6.5%)	5.07	0.9-28.43	0.06†	4.14(1)
Emergency CS	11 (11%)	9.08	1.97-41.93	0.001*	11.28(1)
Elective CS	3 (3.6%)	2.72	0.45-16.63	0.35†	1.27(1)

* Significant as <0.05

4.18 Safety outcomes by intended mode of birth

Analysis by intended mode of birth was undertaken to provide more useful information to women and clinicians in their decision making for mode of birth following a previous CS. The majority of safety outcomes showed no significant difference between intended VBAC and elective CS. However, two safety outcomes were improved for those who intended VBAC: length of hospital stay and exclusive breast feeding at discharge from midwifery care (see tables 4.39 and 4.40).

Table 4-39: Safety outcomes by intended mode of birth (*n* = 405)

	Intended elective CS			Intended VBAC			Difference	
Variable	Min	Max	Median & Mean (± SD)	Min	Max	Median & Mean (± SD)	Test statistic	*p*
EBL (mls)	100	9000	500	50	2900	400	9,982Ψ	0.13
EBL (mls) (excl. outlier)	100	3000	500	50	2900	400	9.982Ψ	0.18
Length of hospital stay (days)	2	12	3.63 (1.45)	0	8	2.78 (1.33)	-4.66†	<0.001*
5 minute Apgar (excl IUD)	6	10	9	0	10	9	10,582Ψ	0.66

*Significant as *p* <0.05 † *t*-test statistic ΨMann-Whitney *U* test statistic

Table 4-40: Safety outcomes by intended mode of birth

Safety outcome	Total (%)	Intended elective CS (%)	Intended VBAC (%)	Odds ratio (95% CI)	*p* = († Fisher's Exact Test)	χ^2(df) (n =)
Postpartum haemorrhage	184 (45.5%)	36 (53.7%)	148 (43.9%)	0.67 (0.4-1.14)	0.14	2.17(1) (404)
Postnatal readmission	10 (2.6%)	3 (4.8%)	7 (2.1%)	0.44 (0.11-1.73)	†0.21	‡1.46(1) (391)
Placental complication	10 (2.5%)	4 (6.2%)	6 (1.8%)	0.28 (0.08-1.02)	†0.06	‡4.23(1) (399)
Infection	19 (4.8%)	2 (3.1%)	17 (5.1%)	1.67 (0.38-7.4)	†0.75	‡0.46(1) (397)
Bowel complications	3 (0.8%)	0 (0%)	3 (0.9%)	0.99 (0.98-1)	†1.0	‡0.59(1) (394)
Bladder complications	19 (2.5%)	3 (4.6%)	7 (2.1%)	0.45 (0.11-1.77)	†0.22	‡1.39(1) (397)
Maternal ITU admission	3 (0.8%)	2 (3.1%)	1 (0.3%)	0.1 (0.01-1.07)	†0.07	‡5.58(1) (397)
Birth trauma	11 (2.8%)	1 (1.6%)	10 (3%)	1.94 (0.24-15.41)	†1.0	‡0.41(1) (393)
IUD	1 (0.3%)	0 (0%)	1 (0.3%)	1 (1-1)	†1.0	‡0.19(1) (397)
Admission to NNU	20 (5.1%)	3 (4.6%)	17 (5.2%)	1.12 (0.32-3.95)	†1.0	‡0.03(1) (395)
Jaundice requiring treatment	11 (2.8%)	0 (0%)	11 (3.4%)	0.97 (0.95-0.99)	†0.22	‡2.2(1) (388)
Respiratory distress	16 (4.1%)	3 (4.7%)	13 (4%)	0.85 (0.23-3.1)	†0.73	‡0.06(1) (389)
Hypothermia requiring treatment	14 (3.6%)	3 (4.8%)	11 (3.4%)	0.7 (0.19-2.58)	†0.48	‡0.29(1) (389)
Breastfeeding initiated at birth	312 (78.6%)	46 (70.8%)	766 (80.1%)	1.67 (0.92-3.03)	0.09	2.83(1) (397)
Breastfeeding exclusively at discharge	213 (56.3%)	27 (42.9%)	186 (59%)	1.92 (1.11-3.32)	0.02*	5.6(1) (378)

*Significant as $p < 0.05$

4.19 Summary of VBAC vs CS

The findings of this sub-analysis confirm the previous finding that the organisation of antenatal care appears to impact on maternal intention for VBAC. Unlike previous research, these findings do not support the evidence that maternal age and BMI affect VBAC success rates; however, important population differences may account for this variance. In clear agreement with other research into VBAC, increased parity and previous vaginal births and VBACs have a positive influence on intending to birth by VBAC and success rates. The previous indication for CS may also impact on VBAC success. Unlike previous research, IOL did not have a negative effect on VBAC success; however labour augmentation did. Women with an epidural were more likely to birth by CS, as were those who were admitted to hospital in early labour.

Women who birthed by CS were more likely to have a greater EBL, suffer a PPH, infection and have a longer postnatal length of stay. Neonatal outcomes were similar. When intended mode of birth was compared safety outcomes were largely similar. Differences were a longer length of stay and fewer babies exclusively breastfeeding with intended elective CS.

The findings of this sub-analysis were largely similar to previous research and variances may be explained by differences in populations. This suggests that the main findings of this research may be extrapolated to other similar populations of women. These results also support the main finding that the organisation of antenatal care can significantly impact upon intended and actual mode of birth following a previous CS.

The results of this extensive data analysis are discussed in detail, with reference to relevant literature in chapter 5.

5. Discussion

5.1 Introduction

Data analysis has indicated that receiving MLAC is significantly associated with both choosing and achieving VBAC. Indeed, receiving MLAC as opposed to OLAC was the main determining factor for intended VBAC. Importantly, comparisons between the groups also indicated that safety outcomes between MLAC and OLAC were similar. The MLAC group had fewer unscheduled antenatal care episodes in the delivery suite, inpatient admissions and a shorter postnatal length of stay compared with the OLAC group. There were no significant differences in any neonatal outcomes.

This chapter highlights the main findings of this research and discusses them in relation to previous research to generate hypotheses that may explain the differences between outcomes following MLAC and OLAC. Initially the main outcomes of this research are compared with other published research and reasons for any differences are theorised. The association between MLAC and higher intended and actual VBAC rates is discussed. It is postulated that differences in the philosophy and organisation of care between MLAC and OLAC explain the variance in intended and actual VBAC rates.

The safety of MLAC compared with OLAC is presented in the light of previous research findings, demonstrating the validity of this research in that the findings were similar. Additional research that proposes explanations for these findings is analysed and discussed. Finally, conclusions from the findings of this research are displayed along with the recommended future steps for MLAC in clinical practice.

5.2 Data comparisons with previous research

Notably, the overall intended VBAC rate in this research was significantly higher than the rates reported in similar previous research, in both MLAC and OLAC groups (table 5.1). As previously discussed (sections 2.1 and 3.3) CS rates and ERCS rates vary considerably between regions and units. The healthcare professional, organisation of

care and philosophy of the unit can significantly impact on the uptake of VBAC (section 5.3). Therefore, it should not be surprising that intended VBAC rates vary so considerably between studies carried out in different regions or units. The high VBAC rate in this research may reflect the commitment within the unit in which this research took place to reduce the CS rate and appropriately encourage women to attempt VBAC.

The actual VBAC rates reported in previous research vary in a similar way to intended VBAC rates (table 5.2). Given that VBAC success rates do not vary so drastically between studies, similarly variable intended and actual VBAC rates are expected.

Table 5-1**:** Intended mode of birth for women with one previous CS

Study (n)	**Research design**	**Population (study country)**	**Findings**
This research (405)	Retrospective, comparative study, using case-notes for data collection.	Women with one previous CS and no other medical, obstetric or psychological complications (England).	Overall intended VBAC rate: 84%. Midwife-led care is associated with higher rates of intended VBAC compared with OLAC: 90% vs. 77%, respectively; OR (95% CI) 2.78 (1.57-4.92), *p*<0.001. MLAC was the only factor associated with intended VBAC following adjustment.
Knight et al, 2014 (143,970)	Retrospective, observational, cohort study, using database for data collection.	Women with one previous CS (between April 2004 and 2011) and who give birth to their second child before April 2012 (England).	Overall intended VBAC rate: 52%. Women more likely to attempt VBAC were found to be: - Younger: (<24 yrs) OR 1.15 (1.10-1.20), *p*<0.001. - Of non-white ethnicity: (Black) OR 1.51 (1.36-1.68); (Asian) OR 1.66 (1.53-1.82), both *p*<0.001. - Living in more deprived areas: (most deprived) OR 1.20 (1.10-1.31), *p*<0.001.
Metz et al, 2013 (3,120)	Retrospective, observational, cohort study, using electronic medical records for data collection.	Women with one previous CS in their next pregnancy, who had a ≥70% chance of successful VBAC (US).	Overall intended VBAC rate: 30%. Women who received care from a certified nurse-midwife were more likely to choose VBAC: OR 5.02 (2.69-9.38). Women with a history of vaginal birth were also more likely to choose VBAC: OR 2.99 (2.49-3.59).

Table 5-2**:** Actual VBAC rate for women with one previous CS

Study (n)	**Research design**	**Population (study country)**	**Findings**
This research (405)	Retrospective, comparative study, using case-notes for data collection.	Women with one previous CS and no other medical, obstetric or psychological complications (England).	Overall actual VBAC rate: 54%. MLAC is associated with higher rates of actual VBAC compared with OLAC: 61% and 47%, respectively OR 1.79 (1.20-2.66), *p*=0.004. Previous vaginal birth was also associated with increased rates of actual VBAC: OR 2.59 (1.26-5.30), *p*=0.009.
Knight et al, 2014 (143,970)	Retrospective, observational, cohort study, using database for data collection.	Women with one previous CS (between April 2004 and 2011) and who give birth to their second child before April 2012 (England).	Overall actual VBAC rate: 33%.
Metz et al, 2013 (3,120)	Retrospective, observational, cohort study, using electronic medical records for data collection.	Women with one previous CS in their next pregnancy, who had a ≥70% chance of successful VBAC (US).	Overall actual VBAC rate: 25%.

The successful VBAC rate (VBAC rate / women who attempted VBAC) does not vary so considerably between studies, and is approximately 75% (table 5.3). This research studies a population of women who, other than their previous CS, are at low risk of medical, obstetric and psychological complications. As can be seen in table 5.3, the populations of women in the comparative studies are not dissimilar; comprising women with one previous CS who either are explicitly reported to have a good chance of successful VBAC (Metz et al, 2013) or who have attempted VBAC, presumably with the support of their health professional. Notably, women in this research who received MLAC had a greater than average successful VBAC rate, whereas the rate for women who received OLAC was lower than average; the possible reason for this is discussed in section 5.3.

Various factors that can influence the rate of successful VBAC are also compared in table 5.3. Previous research has indicated that increasing BMI and age are risk factors for failed VBAC (Bujold et al, 2005; Srivinas et al, 2007); however, this was not a finding of this research. The reason for this difference may be the different populations under investigation. The Bujold et al study included 217 women (*n* = 6718, 3.23%) with a BMI over 40kg/m², whereas women with a BMI over 40kg/m² were excluded from this study as they are considered 'high risk' and are not suitable for MLAC. Thirty-nine percent of women in the Bujold study (2607 of 6718) had a BMI over 30kg/m² compared to 20% (81 of 405) in this study. In this study 17% (69 of 405) of women were aged over 35 years, compared to 27% of women (6739 of 25,076) in the Srivinas et al study. Had this study been sufficiently powered to compare these variables and included similar proportions of women, associations between increased age and BMI with unsuccessful VBAC may have been found.

In agreement with other research (Landon et al, 2005), this study found that women who have previously given birth vaginally (including by VBAC) have a greater chance of successful VBAC. Conversely, women whose previous CS was due to 'dystocia' were found to have a reduced chance of successful VBAC compared to those with a previous

CS for another indication. The influence of the previous birth experience, including the indication for the previous CS will be discussed in more detail in section 5.3.6.

Certain labour characteristics have been shown to impact on VBAC success rates. This research found that women who were assessed in early labour were more likely to give birth by CS compared to those who were not. Equally, those who were admitted into hospital during early labour were more likely to have a CS compared to those who were not. This supports previous findings of Landon et al (2005), who also found that women admitted with a cervical dilation less than 4cms were less likely to have a successful VBAC (table 5.3). In this research, there was no significant difference in successful VBAC rates between women who were induced and those who were not. In contrast, IOL was found to be a significant risk factor for emergency CS by Rageth et al (1999) and Landon et al (2005). However, this research did find that augmentation of labour was a risk factor for failed VBAC. This supports the findings of Landon et al (2005), who also found that augmentation was a risk factor for emergency CS. In contrast, Rageth et al (1999) found that augmentation of labour was associated with a decreased risk of emergency CS: OR 0.67 (95% CI 0.63-0.7) p <0.001. The disparity in these large studies indicates that local practices, which cannot be accounted for in such research, may have a significant effect on the likelihood of successful VBAC. Finally, this research found that epidural use was associated with an increased risk of CS. However, Landon et al (2005) found that having an epidural was associated with an increased chance of successful VBAC (p <0.001).

Table 5-3**:** Successful VBAC rate and influencing factors. Cell colours denote direction of influence with each factor [green: increased chance of successful VBAC, red: reduced chance of successful VBAC, yellow: no significant difference]

Author (year)	**This study**	**Knight (2014)**	**Metz (2013)**	**Srinivas (2007)**	**Landon (2005)**	**Bujold (2005)**
Study design (n)	Retrospective, comparative cohort (n=405)	Retrospective, observational, cohort (n=143,970)	Retrospective, observational, cohort (n=2,195)	Retrospective cohort (n=25,005)	Prospective, multi-centre, observational (n=29,661)	Retrospective cohort (n=25,005)
Population	Women with one previous CS (LSCS) and no other medical, obstetric or psychological complications	Women aged 15-45, first birth by CS between 1 April 2014 - 31 March 2011, with a second birth before March 2012; excluded women with preterm birth, indications for ERCS, emergency CS prior to labour or missing delivery information	Women with a singleton pregnancy, delivering at the research hospital, between June 2000 and July 2008, with a ≥70% chance of successful VBAC (Grobman et al, 2007) and who attempted VBAC.	Women with 'prior caesarean delivery' who have subsequently 'delivered', identified by International Classification of Disease (ICD-9) codes.	Women with one previous CS (LSCS or unknown), 37 weeks gestation, undergoing TOL.	Women with one prior CS and no prior vaginal deliveries, at term, singleton pregnancy, with no pre-existing diabetes, placenta praevia or neonates with IUGR or lethal abnormalities.
Overall VBAC rate	54%	33%	25%	41%	36%	56%
Successful VBAC rate	74%	63%	85%	75%	74%	71%
Age (increasing)	≤35 years: 0.86 (0.41-1.79), NS	<24 years : 1.23 (1.17-1.29), p<0.001		Increasing age associated with failed VBAC (p<0.05)	No significant difference	
Ethnicity (non-White)		(White=reference) Black: 0.54 (0.50-0.57), p<0.001			Non-white ethnicity reduced odds p<0.001.	

Author (year)	This study	Knight (2014)	Metz (2013)	Srinivas (2007)	Landon (2005)	Bujold (2005)
BMI (increasing)	≤30 kg/m^2: 1 (0.53-1.9), NS				>30: 0.55 (0.51-0.60), *p*<0.001	Increasing BMI associated with failed VBAC (*p*<0.05)
Longer time since previous CS	*t*=6,735, *p*=0.01	≥3 years: 0.91 (0.88-0.95), *p*=0.012			≤2 years: 0.70 (0.64-0.76), *p*<0.001	
Previous vaginal birth	17.6 (4.2-73.74), *p*<0.001				None: 0.24 (0.22-0.26), *p*,0.001	
Previous VBAC	23.05 (3.13-169.97), *p*<0.001				None: 0.21 (0.19-0.23), *p*,0.001	
Previous CS for dystocia	0.41 (0.24-0.7), *p*=0.001				0.34 (0.30-0.37), *p*<0.001	
Assessed in early labour	0.34 (0.19-0.61), *p*<0.001					
Admitted in early labour	0.31 (0.18-0.53), *p*<0.001				0.39 (0.36-0.42), *p*<0.001	
IOL	0.86 (0.46-1.60), NS				0.5 (0.45-0.55), *p*<0.001	
Augmentation of labour	0.57 (0.34-0.97), *p*=0.04				0.68 (0.62-0.75), *p*<0.001	
Epidural	0.16 (0.09-0.29), *p*<0.001				No epidural: 0.37 (0.33-0.41, *p*<0.001	

Statistical analysis results are odds ratios (95% CI), unless stated

CS, caesarean section; IOL, induction of labour; LSCS, lower segment caesarean section; NS, non significant; VBAC, vaginal birth after caesarean

There are similarities and differences between the findings of this and previous research. As discussed, the dissimilarities may reflect different obstetric practices within different units, regions and countries where the research took place. Reassuringly, the comparison of successful VBAC rates suggests only a small variation in rates between different units, regions and countries. The practice implication here is that increasing the intended VBAC rate in an appropriate group of women is likely to safely increase the overall successful VBAC rate, reduce the CS rate and optimise safety outcomes for mothers and babies. This also supports the underpinning premise of implementing this innovation: providing MLAC to women who are suitable for VBAC increases the uptake of VBAC and safely reduces the CS rate. The following sections discuss theories about why MLAC may increase the intended VBAC rate.

5.3 Midwife-led care and the association with higher intended and actual VBAC rates

The primary objective of this research was to discover if there was any difference in women's intended and actual VBAC rate if they received MLAC as opposed to OLAC. Robust data analysis indicates that MLAC is significantly associated with higher intended VBAC rates, compared with OLAC: OR 2.78 (95% CI 1.57-4.92); χ^2 (1 degree of freedom (df), n = 405) = 12.91, p <0.001. Indeed, over 90% of women in the MLAC group planned VBAC, which is a high proportion compared with previous studies, such as Grobman et al (2011) and Knight et al (2014) where the VBAC rates for women with one previous CS who were suitable for VBAC were 55.3% and 52.2%, respectively. However, it should be noted that these studies were carried out in the United States, where VBAC rates are lower and, notably, autonomous midwifery is uncommon. However, intended VBAC rates alone are of limited clinical significance as a high intended VBAC rate with a high failed VBAC rate may actually elicit worse health outcomes for the mother and baby, as outlined in section 2.2. Therefore intended and actual mode of birth were included as the primary outcomes. The successful VBAC rate for women who attempted VBAC in the MLAC group was 78.4%, which was

numerically higher compared with 68.5% in the OLAC group. The MLAC rate was a little better than, although broadly in line with, previous research (Bias et al, 2001; Kwee et al, 2007; Landon et al, 2005; Tan et al, 2007; Turner et al, 2006) where a success rate of about 75% is reported. Due to the higher intended and successful VBAC rates, the actual VBAC rate was significantly higher for women who received MLAC compared to OLAC: OR 1.79 (95% CI 1.2-2.66); χ^2 (1df, n = 405) = 8.36, p = 0.004.

The rate of CS due to 'slow progress in the first stage of labour' was significantly lower in the MLAC group compared with the OLAC group. Given the maternal and neonatal health benefits of successful VBAC this finding is clinically significant. NICE guidance on management of slow progress in labour did not change during the study period (2008-2011) (NCCWCH, 2007), however, it is not possible to state with certainty that clinical practice itself did not change during this time. One possible explanation is that women in the MLAC group progressed quicker in the first stage of labour compared with women in the OLAC group. The impact of MLAC on women's self-confidence and empowerment will be discussed in section 5.3.4. It is postulated that being less anxious and more confident in their ability to birth may reduce women's chances of progressing slowly in labour. Another potential explanation is that clinicians had a higher tolerance for 'slow progress' in women with a previous CS in the MLAC group compared with the OLAC group. The issue of the different time periods in which the two groups gave birth means that other external influences cannot be discounted as the reason for fewer CS for 'slow progress'. However, it is also possible that the Trust-wide consensus that led to the implementation of MLAC also subtly changed intrapartum practice, despite guidance remaining the same. MLAC was based on a philosophy of normality in the antenatal period and this 'expect normal' philosophy may have increased the confidence of HCPs during intrapartum care to intervene less readily in 'slow labours'. This finding links with the Birthplace study (Birthplace in England Collaborative Group, 2011), which found links between midwife-led places of birth and fewer labour interventions. Given the design of this research, it is not possible to state with certainty which, if any, of these theories are correct, however, this does raise an interesting research question.

Both OLAC and MLAC are compound packages of care with multiple, differing components. As described in detail in section 3.4.3 the care received by each group differed in terms of the lead professional, the environment in which the care took place, the time women had to make their mode of birth choice and the number of HCPs each woman may have to see during her antenatal care. The lead professional in the OLAC group was the obstetrician and was the midwife in the MLAC group. Women in the OLAC group were required to attend the hospital for up to three routine clinic appointments with the obstetrician, whereas women in the MLAC group received all of their routine care from their midwife in a community setting, such as the GP surgery, a Children's Centre or at home. Women in the OLAC group had their first scheduled discussion about their mode of birth choice at 20 weeks, whilst women in the MLAC group had this first discussion at their booking visit, typically between 6-12 weeks. Finally, women receiving MLAC would meet fewer different HCPs throughout their antenatal care compared with women receiving OLAC if they followed the routine schedule of care. There is no certainty about which component of MLAC may have influenced women to make a different mode of birth decision to those who received OLAC, however, the literature strongly suggests that midwife-led models of care do elicit different outcomes to other models of care. This section discusses the different components of care and how each factor may have impacted on women's decision making process. In addition to analysis of these external influences on mode of birth choice, this section will also consider the internal influence of women's own previous birth experiences.

5.3.1 Healthcare professional and rates of intended VBAC

Logistic regression clearly demonstrated that the strongest influence on the intended VBAC rate in this research was the type of antenatal care received. Even following adjustment for all confounding factors MLAC was significantly associated with higher intended VBAC rates than OLAC: aOR 2.69 (95% CI 1.48-4.87), p = 0.001. This section discusses this finding in relation to previous research suggesting that HCP interactions impact strongly on women's decision making about mode of birth.

Metz et al (2013) aimed to discover whether, within a group of women who had a good chance (>70%) of having a successful VBAC, there were certain characteristics that increased their likelihood of choosing VBAC. The population in Metz et al's study was similar to this research: women with one previous CS, no other risk factors and a good chance of achieving a successful VBAC. A retrospective cohort methodology was used, observing characteristics and outcomes for women who had their primary CS and subsequent birth within two US hospitals. Women who received care from a registered nurse-midwife were significantly more likely to choose VBAC compared to those whose care was from a family practitioner or Ob-Gyn (doctor) (OR 5.02 (95% CI 2.69-9.38)). These findings agree with the results of this research and appear to confirm association. However, it is important to consider the difference in healthcare contexts between the Metz et al study and this one. Women in the US pay for and self-select their HCP, whereas women in the UK receive care from the recommended HCP unless they expressly request an alternative. The HCP selection American women make is likely to be based on their preferences for pregnancy and birth. Therefore, women who are keen for VBAC are perhaps more likely to view their pregnancy as 'normal' and opt for a nurse-midwife who has the same philosophy and the willingness to support their choices. Information about the organisation of care is not explicit in the Metz et al (2013) study; hence it is not possible to ascertain whether important differences exist in obstetrician and nurse-midwife-led care, such as the environment or the time women have to discuss their options. Whilst the methodology and context of Metz et al's research means that the direction of the association between VBAC and care from a nurse-midwife cannot be inferred, the study does highlight an important link and supports the findings of this research.

This theory is supported by research suggesting that the HCP has the biggest external influence on decision making for or against VBAC. Ridley et al's (2002) US study in a rural south-eastern hospital recruited 5 white, English-speaking, women to take part in their phenomenological research about what influenced them to choose VBAC. Despite being small this is a good study. Information saturation was reached and the nurse-researcher acknowledged her own preconceptions about VBAC, having recognised the influence she may have on the interpretation of the findings thus

increasing their validity. The triangulation of data collection methods (video-taped semi-structured interviews, the researcher's field-notes and diary) led to rich, in-depth data. They found that most women cited the encouragement of their physician as the main reason they opted for a VBAC, with one woman stating this was the only reason. In their concluding comments the researchers reiterate the importance of HCPs' recommendations and advised that they cultivate women's confidence to aim for VBAC. This encouragement through confidence building was the original philosophy behind MLAC.

McGrath et al (2010) conducted an in-depth exploration of women's lived experiences of decision making in relation to VBAC, using open-ended interviews and a descriptive phenomenology approach to analysis. This research took place in Australia, within an environment of high CS rates where few women have a VBAC. Of the 20 women interviewed, four aimed for VBAC and two were successful; this paper focussed on those four women. Whilst this limits the applicability of this research in the everyday practice of caring for all women with a previous CS, it does provide useful information about the experiences of those who opted for VBAC in this healthcare context. There was minimal discussion about the influence of midwives, but some women reported the support they got from their midwife to be invaluable. Although this research was conducted within a very different context (i.e. not pro-VBAC), it is an important and valid finding that the support of the HCP is influential. The findings of this research are supportive of the implementation of MLAC for such women, given that the encouragement of midwives for VBAC is so valuable to them.

In the same way that support for VBAC from HCPs can influence women to choose VBAC, pressure to choose ERCS can be equally persuasive. Gamble and Creedy (2001) intended to find out more about the preference to birth by CS and the factors associated with this. The study took place in Brisbane, Australia in a large teaching hospital, with a mix of public and private care patients. Women were recruited from the antenatal clinic when they were between 36-40 weeks pregnant and provided with a questionnaire. Of the 310 women recruited, 40 had previously birthed by CS. Of

these, 13 preferred an ERCS this time. The main reasons for women with a previous CS opting for CS again were 'safety of the baby' and 'recommendation by a doctor'. In their discussion the authors comment that it is difficult for women to disagree with their doctor, especially if they are informed that it is the safest method for the baby. The findings of McGrath et al (2010) agree with this, as the women described the recommendation by their doctor as a 'powerful one'.

Fenwick et al's (2007) large, Australian qualitative study recruited, through a local newspaper, women who had experienced a CS. Telephone interviews were conducted with women who contacted the researchers and this paper focuses on those who have had a VBAC or who were planning a VBAC for their next baby. The validity of this research may be questioned as telephone interviews lack the potential for clarification of meaning through body language and facial expression. The authors acknowledged this limitation as they were unable to re-contact women to elucidate certain comments or seek further information. The prima facie findings suggest that the women in this research felt significant pressure from their doctor to choose ERCS. Women inferred from their discussions that if they were to continue with their plan for a VBAC and something went wrong it would be their fault. This message was considered hard to ignore and women found it difficult to stand up to this kind of pressure. This is a weak study that does not provide generalisible results as the recruitment strategy utilised adds significant bias; it is possible that only women with rancour about being pressurised into ERCS responded, hence omitting the views of women who were happy with their mode of birth choice or who felt pressurised to attempt VBAC. However, in this context women had to be extremely motivated towards VBAC to have this mode of birth. Whilst this research does not reflect the overall context of maternity care in the UK, which is relatively pro-VBAC, this may describe the experiences of some women within this country.

This research suggests that the lead professional in the antenatal care of women with a previous CS has a significant influence on women's intended mode of birth, which is in agreement with previous research in this area. Previous literature indicates that the

support or otherwise of the healthcare professional is very powerful and that women find it difficult not to be influenced by this. For this reason, MLAC was implemented by the Trust with a Unit-wide consensus to appropriately promote VBAC to women who were suitable, which in addition may have influenced individual clinicians, particularly midwives, to be more pro-VBAC.

5.3.2 Healthcare professionals' personal preference

This discussion asserts the theory that important differences between midwives and obstetricians may explain the finding that MLAC elicits higher rates of intended VBAC compared with OLAC. This section outlines the influence of the individual healthcare professional's personal preference on women's decision making.

As described above, previous evidence appears to indicate that the influence of the HCP on women's mode of birth decisions is a strong one, even when professionals' recommendations differ from the preference of the woman. Eden et al (2004) reported that several studies cited the healthcare professional's personal preference as a strong influence in the woman's decision. The implementation of MLAC in the Trust ensured that all health professionals' knowledge regarding VBAC was up to date and gave them the opportunity to discuss VBAC versus ERCS with their colleagues. Obstetricians and midwives are reflective practitioners (NMC, 2009) and inevitably this encouraged them to examine their own personal preferences. This research was not designed to determine whether the implementation of MLAC increased health professionals' preference for VBAC, however this was a potential outcome of MLAC implementation and may have influenced the findings of this research.

The women in Emmett et al's (2006) study said that they could infer the doctor's own mode of birth preference, even though it was rarely explicitly stated. Confirming this finding, Frost et al (2009) described the results of the qualitative part of their study using semi-structured interviews in the ante- and postnatal periods. This was a well-conducted study, and whilst the main focus was the influence of a decision aid on women's decision making processes, themes were identified relating to the influence

of the HCP. In particular, some women commented that they sensed the HCP had a 'hidden agenda' in preference for a particular mode of birth and that they provided information in such a way as to encourage women to make a certain decision. Bernstein et al (2012) carried out a prospective observational study that investigated the concept of informed choice for women making a decision about mode of birth. Data were collected via a questionnaire, which was given out to 155 women when they were admitted into hospital either in VBAC labour or for their ERCS. This recruitment method renders this a weak study, as these women were vulnerable and unlikely to provide considered, honest feedback; however it does provide some useful information on this issue. Only 4% of women opted for VBAC once they knew that their HCP had a personal preference for ERCS, compared to 43% if they felt their HCP preferred VBAC.

An interesting and important finding was that women were able to infer the HCP's personal preference about mode of birth and that this significantly affected their own decision making. There are distinct professional differences between midwives and doctors, including their training and their professional experiences of caring for women in childbirth. One theory that might explain the significantly greater intended VBAC rates with MLAC is that the personal preference of midwives and obstetricians for VBAC differs. Indeed there is research evidence of variable quality that suggests that midwives have a stronger preference for VBAC and vaginal birth in general than obstetricians (Dickson and Willett, 1999; Al-Mufti et al, 1997; Groom et al, 2002; Sur et al, 2009). Furthermore, there is some evidence that midwives' and obstetricians' attitudes about mode of birth differ according to where they work. Swedish midwives who worked in an antenatal clinic were found to be more accepting of 'high' CS rates compared with their colleagues who mainly provided intrapartum care, in a large exploratory survey (Gunnervik et al, 2010). In a confidential survey of obstetrician's views, McGurgan et al (2001) found that Irish obstetricians were less likely than those working in London (Al-Mufti et al, 1997; Groom et al, 2002) to prefer a CS with no clinical indication. There was also a significant association between preferring CS and working within a hospital with a CS rate >16% (McGurgan et al, 2001). The authors note that such an association may hamper the efforts of hospitals with a high CS rate

to reduce them. The theory that individual professionals are influenced by the collective attitude of the unit in which they practice may explain the reduction in the CS rate for women with a previous CS at the Trust where this research took place once MLAC had been implemented. Equally, the difference may be to do with the women's inference about the preference of the Trust rather than of individuals, based on the organisation of their care. The impact of a Trust-wide consensus will be discussed in chapter 6.

5.3.3 The philosophy of midwife-led care

The philosophy of midwife-led care as a social rather than a medical model of care was a driver for the implementation of MLAC for women with a previous CS. As previously mentioned, the professional training and experiences of midwives and obstetricians are very different. Indeed, the differences may pre-date training as the very individuals attracted to each profession may differ based on the underpinning social or medical philosophies inherent in each respective field, especially given that academic entry requirements for midwifery and medical training are now broadly similar in the UK. It is worth exploring the theory that the different philosophies of care may be the reason for the significant difference in VBAC rates between MLAC and OLAC.

As Sandall et al (2009) comment, the premise of midwife-led care is woman-centred based on the belief that pregnancy and birth are normal life events. Browne et al (2013) set out in the introduction to their qualitative investigation into midwives' strategies to care that the antenatal period is the prime opportunity to set the tone and focus of care. Semi-structured focus groups with two sets of experienced midwives (3-40 years' experience) determined that midwives speak in terms of wellness, rather than risk. The midwives described their approach to care as calm and unhurried, using strategies to normalise pregnancy for women by instilling them with confidence that their experiences are natural and that the range of 'normal' in pregnancy is broad and individual. This was a well-conducted study, maximising the validity of the findings through the use of focus groups. This enabled the researchers

to access the norms of the groups of midwives they interviewed, by understanding their views and social processes. The authors, however, did not acknowledge the possible limitation of the focus group, that some individuals who do not subscribe to the ideals described by the majority would feel unable to present their opposing strategies if they considered them to be inferior. The findings of this research cannot be considered generalisable to describe the strategies of all midwives. However, the study does provide good data on aspirational midwife-led care and the philosophies that this is built on.

Wang et al (2012) identify the need to focus on the woman's 'psyche', including emotional wellbeing, companionship, confidence and encouragement, as one of the four elements the midwife must recognise in order to promote normal birth (with 'power', 'passage' and 'passenger'). Hermansson and Martensson (2011) conducted a concept analysis of empowerment in the midwifery context. The study was conducted via a theoretical phase, involving an in-depth analysis of the literature, and a fieldwork phase, in which midwives and parents were asked about their experiences of and opinions about empowerment in midwifery. The study took place in the researchers' native Sweden, hence the findings may be considered to have limited applicability in the UK context. However, many of the themes identified are similar to the aims of midwifery care within the UK, based on professional experience. The fieldwork phase indicated that developing a trusting relationship was one of the main strategies in empowering women. This was done by giving women enough time, creating a nurturing and caring environment, being committed, and minimising anxiety, among other strategies. With particular pertinence to the aims of antenatal care for women with a previous CS, midwives empowered women by enabling them to make informed decisions through facilitating their sense of control, giving appropriate information and strengthening their role to actively participate in decision making (Hermansson and Martensson, 2011). The authors argue that women who are empowered are better prepared to deal with new and unexpected situations. The authors also assert that the midwives' role in empowering women is strengthened by their own professional training, as midwives themselves are empowered throughout their journey into midwifery (Hermansson and Martensson, 2011). Again, whilst the context of

midwifery training may be different in Sweden and the UK, both follow the International Confederation of Midwives (ICM) guidelines of midwifery education (ICM, 2013) and definition of the midwife (NMC, 2009) hence some degree of commonality would be expected. Concepts of professional reflection, empowerment and emotional intelligence are strong overarching themes in midwifery education guidelines (NMC, 2009) and in the three higher education institutions that I have had professional links with.

Focussing on pregnancy and birth as normal life events and empowering women to be active participants in their maternity care are two underpinning aims of the philosophy of midwife-led care. Women with a previous CS have the potential to significantly benefit from this approach to antenatal care, given that their previous birth was highly medicalised and that they have a choice regarding mode of birth. It is possible that the normalisation and empowerment approaches to antenatal care provide the explanation for the higher intended and actual VBAC with MLAC compared to OLAC.

Research evidence has indicated that HCPs have a significant influence on women's mode of birth decision. Midwifery practice philosophy centres on the premise that pregnancy and birth are normal life events. MLAC empowers and enables midwives to hold numerous discussions with women about their mode of birth choice. This may be the key to differences in intended and actual VBAC between women who received MLAC and OLAC.

5.3.4 Continuity of care

MLAC is based on the philosophies of midwife-led care, care provision close to home and continuity of care. The operational organisation of MLAC is described in sections 3.4 and 4.8. In this context, continuity of care refers to care provision by the same individual as far as possible and continuity of information and philosophy of care. The philosophy of continuity of information was embedded MLAC during its implementation (section 3.4.3) through consistency of pro-VBAC messages to HCPs

and women. The large amount of data collected enabled comparison of continuity of carer between the MLAC and OLAC groups.

Women in the MLAC group saw the same HCP on more occasions during their antenatal care compared with those in the OLAC group, as demonstrated by the number of different HCPs women in each group saw: OLAC range 1-10 (median 5); MLAC range 1-11 (median 3); p <0.001. This difference may explain the significant variance in intended VBAC rates.

Previous qualitative research has investigated women's experiences of decision making and highlighted the organisation of care as an influencing factor. Emmett et al (2006) carried out a two-centre exploration of women's decision making about mode of birth, using semi-structured interviews in the UK. Twenty-one women who had previously given birth by CS were interviewed in the postnatal period. Most women were given information mainly by a hospital doctor. Few women found that their community midwife also played a helpful role in information provision, in some cases their input was contradictory and in others the midwife was reluctant to get involved. This study was part of a larger piece of research into decision aids for women. The methodology, sampling, data collection and analysis all appeared suitable. The authors acknowledge the small sample size and the fact that the planned VBAC rate among their sample was low. Nevertheless this was a well-conducted study providing saturation of themes and in-depth knowledge about decision making for VBAC. The context of care researched by Emmett et al (2006) is likely to most strongly reflect OLAC in this study. Conflicting information may be detrimental to the decision making process. This finding may provide insight into why OLAC elicited a lower intended VBAC rate.

Lundgren et al (2012) conducted an interpretive meta-ethnography on eight qualitative articles, which were robustly checked for quality. The authors claim that their review does not merely summarise findings, rather it generates new knowledge based on the interpretation of the previous evidence. The extent to which this aim is met is unclear, however, the resulting analysis does provide a very useful résumé of good quality evidence and strengthens the findings of previous research through synergy. The subject of conflicting information was highlighted in seven of the eight

articles reviewed. Women described the differing opinions of HCPs, the lack of a medical consensus about important interventions such as IOL, and the difficult issue of conflicting and sometimes contradictory information from HCPs (Lundgren et al, 2012).

In their Cochrane systematic review of RCTs of interventions to support decision making about mode of birth following a CS, Horey et al (2013) commented that reducing the level of conflicting information would support women. Indeed, conflicting information may increase women's decisional conflict and anxiety related to her mode of birth choice making her less likely to have the confidence to opt for VBAC. The findings of Dilks and Beal (1997) underpin this theory from their study to determine whether differences in self-efficacy play a role in women's decision making for VBAC or ERCS. This is an old study that looks specifically at this aspect of decision making. The authors used a validated survey tool (Childbirth Self-Efficacy Inventory) to determine women's level of self-efficacy and compared this with their childbirth choice. The research was based on the theory that self-efficacy plays an important role in making personal choices, coping with the decision-making process and the persistence required to reach their desired outcome and have the mode of birth they choose. The authors found that women who requested a CS had lower mean efficacy scores than women who intended VBAC and primiparous women (p = 0.011) (Dilks and Beal, 1997). This research was conducted in the US, in a context of high CS rates. However, the findings are useful as they suggest that women who choose ERCS may do so as they have low confidence in their ability to achieve VBAC. More recently, Scaffidi et al (2014) found that decision self-efficacy was not a predictor of mode of birth choice. However, knowledge about VBAC and ERCS was a factor, with a higher proportion of women deemed to have high levels of knowledge choosing VBAC compared with ERCS. Thus, because the organisation of MLAC may lead to increases in women's confidence, in themselves and in the maternity service caring for them, and provide more opportunities to enhance women's knowledge, this may be an explanatory factor for higher VBAC rates with MLAC compared with OLAC.

This research is retrospective and includes a time gap between the two groups (section 3.3). Therefore, it is important to acknowledge that a prospective study or RCT may elicit different results. However, it remains the case that the process of implementing

MLAC, including updating the guideline, providing all HCPs with up to date information and a consistent encouragement for VBAC where appropriate, appears to have elicited higher VBAC rates. In support of this theory, a RCT has been planned to specifically evaluate this in Australia (Homer et al, 2013). The intervention is based on the philosophy that consistent antenatal information will be provided by a small group of midwives, who provide care throughout the ante-, intra- and postnatal periods. Indeed, the initial work suggests that the intended and actual VBAC rates are increased compared to standard care. These initial findings correspond with the findings of this research, particularly with regard to VBAC success rates. The theory that midwife-led care can increase women's confidence and ability to progress well in labour, and that the normalisation of VBAC within the Trust may influence clinicians' attitudes during labour, has been discussed (section 5.3). Homer et al's (2013) intervention is based on the same philosophies as MLAC: midwife-led care, continuity and care closer to home.

The women who received MLAC saw fewer antenatal carers overall and were cared for by midwives who have attended the evidence update workshops and who utilise the same aide-memoire and documentation aids. This research and the previous literature support the theory that continuity of care, in terms of both consistency of information and fewer antenatal carers, can positively impact on intended VBAC rates.

5.3.5 Environmental factors within midwife-led care (space and time)

Statistical analysis revealed that the major difference between the MLAC and OLAC groups was the organisation of their antenatal care. The first major difference was that, as expected, women in the MLAC group received more of their antenatal appointments in the community compared to the OLAC group: MLAC range 3-14 (mean 8.35); OLAC range 0-14 (mean 7.56); p <0.001. Additionally, women receiving MLAC had far fewer appointments in the hospital setting compared to women in the OLAC group: MLAC range 0-6 (median 0); OLAC range 1-13 (median 2); p <0.001. Based on this it is theorised that the setting of antenatal care may influence women's

feelings about their own health or risk status, which in turn may affect their mode of birth decision.

In their extensive discussion and study of midwives opinions on the importance of the environment in which maternity care is provided, Davis and Walker (2010) highlight the constraints imposed within a hospital setting. The authors mainly discuss the effect of the environment on the birthing experience, however they successfully argue that each element of the hospital setting itself can serve to undermine women's and midwives' confidence in the female body to successfully labour and birth. Elements including that maternity units are often within a general hospital for sick people and that there is a clear hierarchy between the personnel who work within them. The case put forward by Davis and Walker may be just as valid in reference to antenatal care.

Research into midwife-led compared to other models of antenatal care cites the provision of care within the community as opposed to the hospital setting as one of the benefits of midwife-led care (Biro et al, 2000 and 2003; Hicks et al, 2003; Homer et al, 2001; North Staffordshire Changing Childbirth Research Team, 2000; Turnbull et al, 1996; Waldenstrom et al, 2001). The overall consensus from systematic reviews of such research is the acceptability of midwife-led care and that this model should be available to most pregnant women (Sandall et al, 2013; Sutcliffe et al, 2012) (section 5.4). It is not possible to separate the provision of care within the community from the overall philosophy of care that is midwife-led. However, the strong implication from this and other research (Birthplace in England Collaborative Group, 2011) is that provision of care in a community setting, when appropriate, may be beneficial for women.

The other significant difference between the MLAC and OLAC groups was the amount of time that women had between their first discussion about mode of birth with a HCP and their birth planning appointment. Women in the MLAC group had significantly longer to consider their mode of birth decision: MLAC range 0-33 weeks (median 23 weeks); OLAC range 0-31 weeks (median 14 weeks); p <0.001. Women in the MLAC group were also more likely to see a HCP who was able to discuss their options with

them on more occasions during this time than those in the OLAC group. This is because with OLAC it was not standard practice for the community midwife to hold discussions about mode of birth; this was considered more the role of the hospital doctor.

Frost et al (2009) identified the paradox that women with a previous CS generally feel they need more opportunities to discuss their mode of birth decision, but because they are multiparous the national schedule of care states that they actually receive fewer appointments with their midwife (NCCWCH, 2008). Acknowledging this as a significant flaw in the traditional model of care for women with a previous CS, the MLAC care schedule follows the same pattern of care as for primiparous women (10 appointments, rather than seven) (see table 3.3).

By altering the antenatal care schedule for women with a previous CS, MLAC intended to provide women with more opportunities to discuss mode of birth and more time to make their decision. Previous literature suggests that women have lamented the lack of this in the past (Emmett et al, 2006; Fenwick et al, 2003). This is the only research that has evaluated the effect of more opportunities and time to discuss mode of birth on women's intended and actual mode of birth. It is possible that a care structure that enabled obstetricians to positively discuss VBAC earlier in pregnancy may elicit similar results. However, obstetricians conducting women's booking appointment is not a good use of resources or expertise and hence is not tenable in the UK maternity system. MLAC is a compound intervention; the increased time that women have to make their decision cannot be separated from the inherent midwifery philosophy of normality and the environment of care. It appears that, together, they have the potential to elicit higher intended and actual VBAC rates.

5.3.6 Previous childbirth experience

The retrospective design of this research means that it is imperative that any differences between the MLAC and OLAC groups are acknowledged and accounted for. The two groups of women were demographically similar. However, one important

variance between the groups was the reason for the previous CS. The MLAC group included more women whose indication for the previous CS was 'breech' and fewer 'suspected fetal compromise': breech MLAC 28.6%, OLAC 17.8%; suspected fetal compromise MLAC 16.8%, OLAC 25.5%. Research evidence has indicated that this may be clinically significant in terms of mode of birth in subsequent pregnancies (Coughlan et al, 2002; Landon et al, 2005; Shipp et al , 2000), and therefore must be addressed in this research. Based on the literature review, 'previous CS for breech' and 'previous CS for dystocia' were included in the logistic regression for intended and actual VBAC. No significant association was found for either characteristic for intended VBAC: breech aOR 1.17 (95%CI 0.51-2.67), p = 0.72; dystocia aOR 0.92 (95% CI 0.5-1.7), p = 0.72. Neither was there an association determined with actual VBAC: breech aOR 0.87 (95% CI 0.49-1.54), p = 0.62; dystocia aOR 0.62 (95% CI 0.38-1.01), p = 0.06. However, the trend towards a lower chance of VBAC success with a previous CS for dystocia nearly reached significance and may have done so with a larger sample size.

These results do not reflect the findings of several large previous studies. Coughlan et al (2002) conducted a small comparative study (n = 315) of women whose previous elective CS was for breech or for another reason. Women in the previous breech group were less likely to have a second CS (RR 0.72 (95% CI 0.58-0.89)). Despite an increased rate of another breech presentation in their next pregnancy, women in the previous breech group had lower elective CS and emergency CS for dystocia rates. These findings concurred with those of Shipp et al (2000) who demonstrated that women with one prior CS for breech and no other children had a similar CS rate in the next pregnancy to primiparous women (OR 0.95 (95% CI 0.7-1.3)). Conversely, those whose only other birth was a CS for either dystocia or suspected fetal compromise were significantly more likely to have a CS compared to primiparous women (OR 4.5 (95% CI 3.6-5.5) and 2.2 (95% CI 1.6-2.0) respectively). Landon et al's (2005) large retrospective study verified both studies by demonstrating that, in women who attempt VBAC, success was more likely in those whose previous indication for CS was malpresentation (OR 1.0) compared to dystocia, suspected fetal compromise or 'other' (OR 0.34 (95% CI 0.3-0.37), 0.51 (95% CI 0.45-0.58), 0.67 (95% CI 0.58-0.76) respectively). The effect of the indication for the previous CS, as highlighted in

previous research, has not been confirmed by this research. However, it is possible that the provision of MLAC mitigated this effect.

The overall VBAC rate is influenced in two different ways: by women's intention for VBAC and success rates in labour. The following sections discuss how the previous childbirth experience may affect women's intention for VBAC.

Research evidence portrays in different ways how a previous negative experience can impact on women's decision making about mode of birth. Ryding et al (2003) conducted an evaluation of a midwife-led counselling service for women with a fear of childbirth. They identified that the chance of delivering by CS was greater for women who had a fear of labour, identified by those who accessed the midwife-counselling service, compared to those without (OR 2.63 (95%CI 1.12-6.17)): over 50% were elective CS. Fisher et al (2006) used telephone interviews to explore the knowledge and attitudes of women who were identified as being fearful in pregnancy. Women with a previous negative experience did not believe in the uniqueness of birth, believing that their next birth would be equally as negative. In their longitudinal study of women's preferences for vaginal birth or elective CS, Pang et al (2008) discovered that 23.8% of women who originally preferred vaginal birth (n = 235) stated they would prefer an elective CS in the future, most commonly due to acquired fear of vaginal birth (24.4%). Interestingly given the focus of this research, of those who subsequently preferred elective CS, 23.2% had previously given birth by elective CS and 41.1% by emergency CS. This research may have limited applicability in this country due to the context of care in Hong Kong, where women can pay for private care if they wish an elective CS. However, it confirmed the findings of Gamble and Creedy (2001), who found that women who had experienced a previous emergency CS and, to a lesser extent, elective CS were more likely to prefer CS next time than those who had no such experience ($\chi^2(2) = 44.4$ ($p < 0.001$) and 12.48 ($p = 0.002$) respectively; n = 310).

Empirical evidence suggests that women with an acquired fear of labour and childbirth are more likely to intend to birth by CS in the future. This and clinical experience led to the hypothesis that women whose previous CS was an uncomplicated elective

procedure for breech (for example) are unlikely to have an acquired fear of childbirth and therefore more likely to intend VBAC. Based on this evidence, it is notable that 'previous CS for breech' was not itself an independent characteristic for intended VBAC in this research, suggesting that acquired fear of vaginal birth was not associated with a decreased intention for VBAC. This research finding implies that MLAC may have mitigated the negative effect of the previous birth experience, theoretically due to the increased continuity of care, carer and information and due to important differences in the organisation of care as discussed in this chapter.

The alternative influencing factor from a previous childbirth experience is that this was a positive experience that the woman wishes to repeat. A proportion of women in this research had previously given birth vaginally (19.5%) and a smaller proportion had previously given birth by VBAC. Importantly, the proportions between the groups were not statistically different. Following the hypothesis described above, it may be expected that women with a previous experience of vaginal birth (including VBAC) would be more likely to intend to birth by VBAC this time. Indeed, without taking into consideration the type of antenatal care received, a previous vaginal birth or previous VBAC were strong predictors of intending to birth by VBAC this time: OR for previous vaginal birth 9.59 (95% CI 2.3-40.06), p <0.001; OR for previous VBAC 12.32 (95% CI 1.67-90.69), p = 0.002. However, once the data were adjusted for confounding factors previous vaginal birth and VBAC were no longer independent factors for intended VBAC: aOR for previous vaginal birth 4.28 (95% CI 0.67-27.45), p = 0.13; aOR for previous VBAC 2.3 (95% CI 0.15-35.71), p = 0.55. The only independent factor was type of antenatal care, indicating that this is a stronger predictor of intended mode of birth than previous vaginal births, including VBAC.

Previous evidence concurs with the finding of this research that, without considering the type of antenatal care that women receive, having had a previous vaginal birth increases their chance of intending to birth by VBAC. Eden et al (2004) conducted a metasynthesis of randomised controlled trials, case-control and observational studies to summarise the evidence about women's preference for mode of birth following CS.

They found that a greater percentage of women choosing VBAC had a previous vaginal birth compared to those choosing ERCS (40% compared to 11%, $p = 0.007$). In their more recent, large retrospective study of women with a good chance of having a successful VBAC, Metz et al (2013) confirmed this finding. They demonstrated that women who have previously had a vaginal birth were much more likely to choose VBAC than ERCS: (OR 2.99 (95% CI 2.49-3.59). This increases the significance of the main finding of this research that, regardless of women's previous experience of vaginal birth, receiving MLAC is the factor most strongly associated with intending to birth by VBAC this time. It is postulated that this is because MLAC increases women's self-belief and empowers them to choose VBAC, thus reducing the influence of the previous mode of birth experience.

This research found that a previous vaginal birth and previous VBAC were also found to be significantly associated with actual VBAC: OR for previous vaginal birth 8.2 (95% CI 4.08-16.47), $p < 0.001$; OR for previous VBAC 13.7 (95% CI 4.84-38.75), $p < 0.001$. These findings concur with previous research. Landon et al's (2005) large multicentre, prospective study including 14,539 women with a term singleton pregnancy and one previous CS demonstrated that women who had not previously birthed vaginally or by VBAC were significantly less likely than those who had to have a successful VBAC (OR no previous vaginal birth 0.24, 95% CI 0.22-0.26; OR no previous VBAC 0.21, 95% CI 0.19-0.23; $p < 0.001$). Regan et al (2012) confirmed this in their population based retrospective cohort study in Ohio (US), finding that previous vaginal birth was significantly associated with successful VBAC (OR 2.73 (95% CI 2.23-3.33)). Indeed, this research found that even after adjustment for confounders, previous vaginal birth was significantly associated with actual VBAC: aOR 2.59 (95% CI 1.26-5.30), $p = 0.009$. Receiving MLAC and having had a previous vaginal birth were the two strongest predictors of actual VBAC. Given the strength of the previous evidence as to the beneficial effect of a previous vaginal birth, the fact that the only other predictor was MLAC is a significant finding.

Research evidence indicates that the previous experience of childbirth can significantly influence women's intended and actual mode of birth. These findings agree with this research. However, it is significant that following adjustment for confounding factors the only independent factor associated with intended VBAC was MLAC. This suggests that, whilst previous childbirth experience can have a significant influence, the type of antenatal care provided has a stronger impact on intended mode of birth.

5.3.7 Summary of MLAC and greater rates of intended and actual VBAC

The findings of this research indicate that receiving MLAC is the most significant predictor of intending to birth by VBAC and, along with having had a previous vaginal birth, is also a significant predictor of actual VBAC. Previous research evidence provides information that may explain this association. The main differences between MLAC and OLAC are the lead professional, the environment of care and the time women have to make their decision. Qualitative literature confirms the impact that the lead health professional can have on women's mode of birth choice. Therefore the HCPs' personal preference and the organisational preference for a particular mode of birth are likely to influence women in their decision making. Additionally, the philosophy of empowerment, continuity of care and carer, and the environmental and time factors that underpin MLAC are all likely to impact on women's decision making. Finally, the results of this research appears to suggest that despite the strong influence of a previous childbirth experience, that is either positive or negative, MLAC appears to mitigate this and is a more powerful predictor of intended VBAC.

5.4 Safety of MLAC

The secondary aim of this research was to evaluate the safety of MLAC compared with OLAC. This was an important aspect of this study, as a finding that MLAC was associated with worse maternal or neonatal safety outcomes would have warranted the cessation of MLAC provision and further evaluation, despite any benefits in terms

of higher VBAC rates. Data collection included all major maternal and neonatal safety outcomes, including mortality, serious and minor morbidity. This study was not powered to detect statistical differences in safety outcomes.

5.4.1 Intrapartum outcomes

The population in this study were women with one prior CS who were otherwise low-risk. Most risks for these women would be expected to manifest during the intrapartum period, hence there is clinical value in comparing maternal and neonatal safety outcomes between the two groups of women despite the fact that clinical guidance with regard to intrapartum care was not different. Robust data analysis demonstrated that MLAC and OLAC were very similar in terms of maternal and neonatal safety outcomes. There were no cases of severe maternal morbidity or mortality in this research, including no uterine ruptures, hysterectomies, venous thromboemboli, eclamptic fits or maternal deaths. This would be expected given the sample size and is broadly in line with or better than outcomes that are reported in previous evidence (Guise et al, 2010). There were no statistically significant differences between the groups in rates of maternal postnatal complications including PPH, placental complications, infection, bowel and bladder complications, ITU admissions and postnatal readmissions. The median estimated blood loss was similar between the groups. The only significant difference was that women in the OLAC group had a longer average postnatal length of stay in hospital. This finding was expected given that more women in this group gave birth by CS. Data analysis was also undertaken on the subgroup of women who gave birth vaginally, to compare rates and severity of perineal trauma. There were no statistically significant differences between the groups; however, there was a trend towards fewer episiotomies in the MLAC group.

There were no statistically significant differences between the groups in neonatal safety outcomes. This included antenatal stillbirth, neonatal death, five-minute Apgar

score, birth trauma, admissions to NNU, jaundice or hypothermia requiring treatment, respiratory distress, and breastfeeding.

Intrapartum safety outcomes were expected to be similar as local and national guidelines regarding the intrapartum care of women with a previous CS did not substantially change in the period of time between the two groups, including the recommendation to birth in an obstetric-led setting (RCOG, 2007). The majority of women received care in the obstetric delivery suite, with the obstetrician as the lead professional and midwives providing care and referring to the obstetrician in the case of complications. Two women planned a homebirth, one in a standalone MLU and one woman had an unexpected homebirth, all within the MLAC group; however, the difference in place of birth did not reach statistical significance. All four of these women had uncomplicated VBACs with good maternal and neonatal safety outcomes. There were no statistically significant differences between groups in the number of women who had continuous electronic fetal monitoring, intermittent electronic fetal monitoring, intermittent auscultation or no fetal monitoring during their labour. The only difference between the groups was that fewer women in the MLAC group had IV access gained during labour compared with women in the OLAC group: OR 0.46 (95% CI 0.24-0.8), $p = 0.01$. This may have been a clinically significant finding if the rate of PPH was found to be higher in the MLAC group; however, this was not the case.

Comparison of maternal and neonatal outcomes with large, national databases is difficult as reported outcomes and, crucially, the populations under investigation are different. The Birthplace study (Birthplace in England Collaborative Group, 2011) (discussed in 3.3.1) included a population of 'low-risk' women with no previous CS. The Birthplace rate of maternal ITU admission was 0.6% (95% CI 0.4-1.0%) compared with 1.0% (2 cases) for MLAC in this study. The two ITU admissions were due to anaphylaxis and a 9000ml EBL following CS for placenta accreta; neither were influenced by the nature of antenatal care the women received. Notably, the MLAC rate of maternal ITU admission is within the 95% CI for a completely low-risk group of women, which is clinically reassuring for MLAC, given that women with a previous CS are considered at higher risk of intrapartum complications. The reported rate of admission to UK critical care units (CCU) of women currently or recently pregnant is

290 per 100,000 maternities (0.29%) (Intensive Care National Audit and Research Centre, 2013), which is considerably lower than either the MLAC or Birthplace rates. These differences emphasise the problem of comparing large epidemiological studies. Different ITU admission criteria, data collection methods and populations mean that direct comparison is inadvisable. However, finding a similar proportion of ITU admissions as a very low-risk population is clinically reassuring for MLAC. The Birthplace NNU admission rate was 2.7% (2.1-3.4%) compared with 5.2% for MLAC. However, the MLAC group in this research had a much higher CS rate compared with the Birthplace study (38.8% versus 9.9%), which is known to lead to increased risk of maternal morbidity and NNU admission. Studies included in the Guise et al (2010) systematic review comparing VBAC and ERCS reported rates of NNU admission ranging from 3.2% to 26.2% for VBAC and 5.6 to 17.6% for ERCS. For the same reasons as maternal ITU admissions, caution should be exercised when comparing NNU admission rates.

These findings are important, as they demonstrate intrapartum safety for women who received MLAC in the antenatal period similar to those who received OLAC. These findings also demonstrate the safety of VBAC and of MLAC as a method for safely reducing the CS rate, as MLAC elicited greater intended and actual VBAC rates than OLAC and resulted in a similar safety profile.

5.4.2 Antenatal outcomes

Data were collected pertaining to the antenatal period for women receiving MLAC and OLAC. Many safety outcomes were compared and were similar between the groups with the exception of episodes of unscheduled antenatal care, reasons for accessing unscheduled antenatal care and inpatient admissions. Women in the OLAC group were about twice as likely to access unscheduled antenatal care in the delivery suite (mean episodes OLAC 0.25; MLAC 0.13; p= 0.03) and to require antenatal inpatient hospitalisation (mean admissions OLAC 0.18; MLAC 0.09; p=0.04) than women in the MLAC group. The reasons for accessing unscheduled antenatal care were similar

between the groups, with the exception of 'threatened preterm labour', which was significantly more likely in women in the OLAC group compared with MLAC: OR 0.23 (0.07-0.84), χ^2(1df) = 5.86, p = 0.02.

Previous literature has demonstrated the safety of midwife-led models of antenatal care (Begley et al, 2011; Sandall et al, 2013; Khan-Neelofur et al, 1998; Sutcliffe et al, 2012; Turnbull et al, 1996). These trials and meta-analyses often include women who are considered to be at low-risk of obstetric complications, which usually excludes women with a previous CS. However, in arguably the most influential meta-analysis (Sandall et al, 2013) five out of 13 trials included women at 'high risk' of obstetric complications, including women with a previous CS. This was a well conducted, robust analysis of previous RCTs comparing midwife-led models with other models of care using Cochrane procedures for selection and assessment of trials and appropriate data analysis procedures. The review concluded that midwife-led care confers significant benefits and is associated with no adverse outcomes. In the previous iteration of this meta-analysis and in agreement with the findings of this research, Hatem et al (2008) found that midwife-led models of care were associated with lower rates of antenatal hospitalisation (OR 0.9, 95% CI 0.81-0.99). The review that supersedes this did not find a statistically significant difference in antenatal hospitalisation between midwife-led and other models of care (RR 0.93, 95% CI 0.83 to 1.05, n=8807). However, important differences in the additional study included in the analysis may have influenced the findings and make the Hatem et al (2008) review more relevant to this research. Six studies were included in the Sandall et al (2013) analysis for antenatal hospitalisation, compared with five in the Hatem et al (2008) review. The additional study in the Sandall review was Begley et al (2011), which accounted for 27% of the weighting of the analysis. This study excluded women with a previous CS and compared midwife-led team-caseloading with standard obstetric care. Importantly, both groups received their antenatal care in a hospital environment, albeit in a low-risk midwife-led unit within the hospital for the midwife group. The fact that women attended the hospital for their routine antenatal care may account for the fact that this study had the highest antenatal hospitalisation rate of all of the six studies: Begley et al (2011) 44% compared with 10-38%. Importantly, one of the differences between MLAC and OLAC

in this study was that women in the MLAC group did not attend hospital for their routine antenatal care, instead they received it in a community setting: in a GP surgery, a Children's Centre, or at home.

Sutcliffe et al (2012) conducted a systematic review of reviews, which included Hatem et al's review. This meta-review was well conducted, ensuring that no trials were included in the subsequent analysis more than once. In addition to finding no evidence of difference in neonatal safety outcomes, fewer interventions and no difference in the main maternal safety outcomes, this review also found that antenatal hospitalisation rates were lower with midwife-led models of care. One of the trials included in the Hatem et al (2008) review was Homer et al (2001). This was a good study because of the large sample size (n = 1089), the randomisation and allocation concealment procedures were appropriate, and the treatment groups were clearly described. Findings included that the rate of antenatal hospitalisation was numerically lower for women in the midwife-led group (9.6%) compared with the control group (13.4%), although this did not reach statistical significance. The inclusion criteria for this study incorporated women with one previous CS, hence it is applicable to this research. The primary outcome in that study was CS rate, which was found to be significantly lower in women who received midwife-led care, as in this research. No definitive explanation is proffered for these differences as this trial and the others included in the systematic reviews were quantitative in design and hence did not seek to provide reasons. As with this research, theories are asserted to explain the differences. Homer et al (2001) believe that the continuity of care achieved with their midwife-led model of care contributed to fewer women being hospitalised during their pregnancy, despite similar expected rates of pregnancy-related complications. Similarly in this research, the MLAC model of care was shown to provide greater continuity of care. This and the other organisational and environmental factors associated with MLAC, including more care in the community and the philosophy of midwife-led care, are also likely to be influential in the lower rates of unscheduled antenatal care in the delivery suite and antenatal hospitalisation. In agreement with this study and in contrast to their finding of no significant difference in antenatal hospitalisation rates, Begley et al (2011) found that low-risk women who were

randomised to receive care throughout their pregnancy, labour and postnatally by a small group of midwives had fewer ultrasound scans and antenatal electronic fetal heart rate monitoring than those who were randomised to standard consultant-led care. This was a reasonably well-conducted, large (n=1,653 women) study. The authors acknowledged the main limitation as the lack of blinding of the women or health professionals, as all women receiving midwife-led care were known to be the study intervention group.

The literature and this research are in agreement that women who receive a midwife-led model of care are less likely to require or seek unscheduled antenatal care. An explanation may be that women receiving MLAC are likely to feel more empowered, confident and less anxious during their pregnancy as a result of the differences in the organisation and environment of care. Women may be more informed about the spectrum of 'normality' and what to expect in their pregnancy and hence have less need for additional reassurance through unscheduled care episodes. Specifically related to the findings of this research, previous studies have linked maternal anxiety with increased likelihood of accessing their HCP for additional appointments (Andersson et al, 2004) and preterm birth (Copper et al, 1996; Dayan et al, 2002; Lobel et al, 1992). Providing some explanation for the link between anxiety and preterm birth, Buss et al (2009) conducted a study finding that high cortisol levels upon waking, especially in the third trimester, was associated with a shorter gestation. The authors conclude that in women who do not experience the natural dampening of their physiological responses to stress during their pregnancy are at greater risk of preterm birth compared with those who do. The reductionist approach used in this research limits its applicability in clinical practice. The study would have been strengthened by an element of triangulation with a self-report questionnaire about the levels of stress or anxiety that the women felt during the observation period. However, the findings do provide useful context, explaining the physiology behind the link with anxiety and preterm birth. This research suggests that receiving MLAC may mitigate women's antenatal anxiety, hence resulting in fewer antenatal admissions to the delivery suite, especially for threatened preterm birth. Where this anxiety is not mitigated, women may be more likely to access additional appointments entering the medical model of

care, which may generate further anxiety and stimulate the signs and symptoms of preterm labour, thus resulting in further intervention. In a large survey (n = 790) of Dutch and Belgian women, Christiaens et al (2011) found that women who received midwife-led care experienced less overall anxiety than those receiving obstetrician-led care. This was a good study, using a pre-validated data collection tool. However, as this study was conducted in a different healthcare context extrapolation to this research must be undertaken with caution.

This research has indicated that MLAC is safe for women with one prior CS in the antenatal period and confers benefits on them and the maternity service by reducing unscheduled antenatal care, specifically that which is sought for threatened preterm labour. This research did not demonstrate any difference in the gestation of birth between the two groups: MLAC 39.62 weeks (1.17); OLAC 39.49 weeks (1.23) (t = 1.10; p = 0.27). However, more women in the OLAC group sought antenatal care for threatened preterm labour. Previous literature validates this finding and strengthens the theory that the reduced anxiety that women receiving MLAC may experience has a beneficial effect for women, in terms of reduced unscheduled antenatal care and threatened preterm labour. Additional benefits are to the maternity service, as the resources used in caring for women who attend hospital due to threatened preterm labour can be effectively utilised elsewhere within the service.

5.5 Summary

This chapter has outlined the main findings of this research in relation to the previous literature and hypothesised explanations for the findings. Despite being the first research to investigate the effect of MLAC on women's intended and actual VBAC rate and safety outcomes, previous research has validated its findings and offered reasons for them. This research has indicated that MLAC is associated with higher intended and actual VBAC rates than OLAC and is just as safe. In addition, potential benefits of MLAC over OLAC are anticipated as the women in this research were less likely to seek

unscheduled antenatal care in the delivery suite or require antenatal hospitalisation, especially for threatened preterm labour.

Implementation of MLAC will mean a significant change in practice. The barriers and facilitators to implementing such a change are discussed in the following chapter.

6. Implications, application and implementation

6.1 Introduction

This research has demonstrated the efficacy and safety of midwife-led antenatal care (MLAC) for women who have previously birthed by CS, compared with obstetrician-led antenatal care (OLAC). Additionally, the operational and organisational characteristics of MLAC suggest that it may be a more economic and appropriate use of clinician resources; however, a full evaluation of this is required using health economic methodology. These positive results are likely to be of national and international interest, as safely reducing CS rates, especially for the large group of women who have previously given birth by CS, is a priority (ACOG, 2010a; House of Commons Health Committee, 2003; NHS Institute for Innovation and Improvement, 2007; Gibbons et al for WHO, 2010). Based on the results of this research, other health care organisations who are interested in safely reducing their CS rate may judge that this model of antenatal care should be implemented locally. While further research is required to provide stronger evidence for its efficacy, safety and cost-effectiveness, implementation of MLAC with continual audit and evaluation may be considered good practice in light of these results and the endorsement of MLAC (NHS Institute for Innovation and Improvement, 2007).

This chapter outlines the implications of this research, in terms of the further research needs that have been highlighted. The local and regional application of this research will also be discussed. Issues related to implementation of MLAC will be addressed in detail. Clear recommendations are made to conclude the chapter.

6.2 Implications of this research

As with most research, the process has highlighted additional research implications. The efficacy of MLAC in increasing the VBAC rate compared with OLAC has been

strongly suggested through this research, with statistically and clinically significant results. Safety outcomes were similar to OLAC. Benefits to women and the entire service were demonstrated, including reduced unscheduled antenatal care in the delivery suite, inpatient admissions and postnatal hospital stay. The research was only carried out in one Trust and it could be argued that the Trust-wide focus on VBAC could have positively influenced the results as much as the intervention itself. Therefore, further research is required before MLAC could be integrated into national recommended antenatal care for women with a previous CS, through organisations such as NICE, RCM or RCOG (NICE, 2005). Arguably the only way to determine with certainty whether MLAC causes increased intended and actual VBAC rates and is just as safe as OLAC is through a randomised controlled trial. However, women in the UK expect choice as this is enshrined in government policy (DH, 2007). This, along with the time and expense of such a research undertaking, may render an RCT unfeasible. Therefore in the absence of a RCT good quality, multicentre, longitudinal studies of MLAC in clinical practice or at least replication of this research in other Trusts is warranted.

Since completing the research, I have considered additional potential confounders that could provide useful information and which may generate additional theories that explain the efficacy of MLAC. These include identifying whether the following factors affect intended and actual VBAC rates: the grade of doctor that women receiving OLAC saw, whether women were referred to see the consultant midwife, whether women received traditional or case-loading midwife care and whether women were cared for in labour by a midwife that they knew. Such information may indicate whether other 'interventions' within the model of antenatal care can influence VBAC rates in addition to MLAC. Future research should include analysis of these variables, to build on the theories already generated by this research.

Following confirmation of the superiority of MLAC over OLAC in terms of increasing VBAC rates with an equivalent or better safety profile, the next most important research priority should be women's experiences of and satisfaction with MLAC.

Satisfaction surveys in maternity care can be inherently biased by 'gratitude bias', due to the outcome of the pregnancy in the vast majority of cases being very positive (Bélanger-Lévesque et al, 2014). Van Teijlingen et al (2003) discuss the need to use maternity satisfaction surveys with caution, viewing results critically and, preferably, in conjunction with an array of other methodological tools to provide context to the findings. Based on the findings of this research, a qualitative exploration of women's satisfaction with MLAC, including their perception of the information and support they received to make a decision about mode of birth, is recommended. It may also be considered appropriate to conduct a comparative study of maternal satisfaction of MLAC and OLAC. Such research was undertaken in conjunction with the wide implementation of midwives' examination of the newborn (see section 6.4.2).

Additionally, the views of health professionals should also be taken into consideration, including investigating the potential of MLAC to increase midwives' job satisfaction and clinical autonomy and conversely to add to their workload and impact on other aspects of their role.

Finally, midwife-led models of care are considered to be more economical (Sandall et al, 2013). This research has indicated potential health economic benefits in terms of reduced routine obstetric appointments, unscheduled antenatal care, antenatal admissions and postnatal length of stay. Implementation of MLAC, however, may warrant increased time for education and optimisation of the women to midwife ratio, which may have cost implications. A full health economic evaluation is therefore warranted using a validated model.

Further research into MLAC is clearly implicated and is recommended. However, as previously indicated, implementation of MLAC into clinical practice may be considered by other healthcare organisations in light of these positive results prior to publication of further research. Clinical governance is essential within health care, particularly in maternity services. This research provides a benchmark by which other Trusts implementing MLAC can judge themselves, with the clinical expectation to elicit similar efficacy and safety outcomes as this research. Any deviations from this expectation

can be addressed through audit and feedback to clinicians. Audit, evaluation and feedback provide meaningful information to clinicians about the safety and efficacy of current practice and can lead to clinically significant improvements in practice (Ivers et al, 2012). As with any health service development, involving those who use the service and gaining their feedback is imperative (DH, 2008a; 2012; Francis, 2013). Any Trust that implements MLAC should also create provision for ongoing local review of the model of care.

6.3 Application of this research

This research provides a thorough evaluation of MLAC in clinical practice, in addition to making a unique contribution to the knowledge base about VBAC and midwife-led models of care. The evidence from this research indicates that MLAC is safe and is efficacious in increasing the VBAC rate at this Trust. Therefore, the initial application of this research will be to reinforce the use of this innovative model of care at the Trust, before considering the wider application of MLAC.

6.3.1 Local application

Research ethics dictate that results must be shared (Chalmers 1990; 2013), especially with those who have been involved with the research. The initial steps will be to share the results of this research with the clinicians and managers at the Trust, to ensure that the MLAC model of care continues to form part of routine practice. The results of the data analysis will be used locally as part of the continuing professional education of midwives and obstetricians. This education can be delivered as part of the preceptorship programme for new midwives and as part of the annual updates for midwives and obstetricians. It would also be prudent to include this as part of the undergraduate education of student midwives who practice within the Trust and who

are likely to have experienced MLAC as part of their clinical practice training. Given the positive results, feeding back this information is likely to bolster the clinicians' resolve to continue to provide MLAC as part of their routine practice.

The findings should also be made public to the women who use the maternity service at this Trust and the HCPs who care for them in the community, including GPs and health visitors. Publication via VBAC parent education workshops, posters at Trust open days, Trust communications with primary care, via local women's support groups, social media and the local press would fulfil this aim. Analysis of the results has led to the development of the theory that boosting women's confidence in their ability to have a VBAC following a CS can increase intended and actual VBAC rates. Therefore, local publication of these findings to the women who may benefit from MLAC may reinforce this message and build their confidence in the care they are receiving as well as their own ability to have a vaginal birth.

6.3.2 Regional application

Where good practice exists, it is imperative that this is shared between healthcare organisations so that more women can benefit. Strategic, regional, inter-professional maternity networks exist for this purpose, as proposed in the Government White Paper "Equity and Excellence: Liberating the NHS" (DH, 2010a). With good inter-professional working, such networks provide an optimal forum for sharing these results and providing support to other local Trusts who may plan to replicate the model of care. Initially the results of this research will be shared with the senior clinicians and decision makers who form the network. Region-wide plans can then be made to coordinate local implementation in conjunction with prospectively planned research, such as a multi-centre RCT or cohort study.

6.4 Implementation of this research

This research provides evidence that MLAC is an effective and safe method for increasing VBAC rates, which may have national influence and strengthen the case for implementation. The success of MLAC within a large Trust within the United Kingdom also provides a practical exemplar, with key clinicians who may provide support and advice. Looking ahead, it is important to consider the issues related to implementation of MLAC by healthcare organisations who wish to replicate the results, with ongoing audit and feedback, or who wish to implement MLAC in a research context.

Implementing research into practice is a complex process, requiring full evaluation of drivers and barriers. This section discusses these in relation to the implementation of MLAC within the current climate of maternity services in the UK. This is based on professional experience and knowledge, as well as literature review. Professional issues that exist in developing the midwife's role to lead the antenatal care of women with a previous CS are discussed. The traditional role of the midwife is defined, in reference to statute and the internationally accepted definition. The context in which modern midwives practice is described with reference to the potential barriers to MLAC. The need for caution and the positive aspects of extending the role of the midwife are evaluated, alongside presentation of a successful precedent for extending the midwife's role. Finally important considerations for implementation are presented, including the value of multidisciplinary 'buy-in' and principles for achieving this.

6.4.1 The role of the midwife and MLAC

The role of the midwife in the UK is enshrined in statute, through the Nursing and Midwifery Order (Great Britain, 2001). Secondary legislation provides detail to this Act in the form of Nursing and Midwifery Council documents, including The Midwives Rules and Standards (NMC, 2012) and The Code: Professional standards of practice and behaviour for nurses and midwives (NMC, 2015). The midwife is considered to be the expert in *normal* pregnancy, childbirth and the postnatal period (NMC, 2009;

2012). Midwives also care for a significant proportion of women with medical, obstetric and social complexities. In these instances, midwives are expected to recognise deviations from normal and refer to an appropriate specialist with whom they will share care provision (NMC, 2012). In all pregnancies, midwives are considered the coordinator of care referring to other appropriate professionals when required (DH, 2010). Midwives traditionally refer women to obstetrician-led care if they have previously given birth by CS. The midwife continues to provide care, under the auspices of the obstetrician who is the lead clinician. Being the lead professional throughout the antenatal care of women who have previously given birth by CS may, therefore, be considered an extension of the role of the midwife. In the current maternity context where one in four women give birth by CS, the modern definition of 'normal pregnancy' may need revisiting.

MLAC was founded on the midwifery expertise emphasised in the definition of the midwife adopted by the International Confederation of Midwives (ICM) and the International Federation of Gynaecologists and Obstetricians (FIGO) in 1972 and 1973 respectively, and also by the WHO. The definition states that midwifery care includes promoting normal birth, detecting complications and accessing appropriate assistance (NMC, 2009). The focus on the promotion of normal birth remains appropriate for this group of women, as women who are suitable for MLAC are also suitable to plan VBAC. Just like all women receiving midwifery care, the women receiving MLAC were continually assessed by their midwife to detect any problems or concerns. The agreed MLAC guidelines included clear referral pathways to appropriate specialist care or advice for women in whom complications arose. In this way, whilst technically being considered an extension to the role of the midwife, MLAC appears to correspond with the accepted function of the midwife. The opposing view is that *all* women who have previously given birth by CS require care that can only be provided by an obstetrician, albeit in conjunction with midwives. Some professionals, and equally the women and their families themselves, may consider that this group of women are inherently 'high-risk' and therefore need obstetrician-led care. However, it is accepted that the additional risk for women with a prior CS is during the intrapartum period rather than

antenatally, hence why intrapartum guidance remains unchanged. Furthermore, concern may be expressed about eroding the professional identity of midwifery through this extension to their role. Some critics may object to MLAC on the basis that it threatens midwives' ability to maintain their focus and expertise in 'normality'. As a counter to such an argument, MLAC has the potential to enhance this expertise and ability. Rather than taking the focus away from normality, MLAC extends the group of women who stand to benefit from the expertise of midwives in maintaining and promoting normal birth.

National documents provide some strength to the case for MLAC. The influential document 'Maternity Matters' states that "*all women will need a midwife and some need doctors too*" (DH, 2007, page 15). The Midwifery 2020 report (DH, 2010) into the core role of the midwife discusses the coordinating role that midwives have in caring for all women. For healthy women with a normal pregnancy, the midwife is the lead and coordinator of care; for women with complex physical, mental or social needs the midwife remains the coordinator of care, using a multidisciplinary and multiagency approach to ensure that each woman receives the care that she and her family need. MLAC concurs with this, ensuring that any women who require additional obstetric expertise receive it in a timely, coordinated manner; those that do not will remain on the MLAC pathway. MLAC constitutes an inter-professionally agreed pathway, with continual risk assessment and clear referral pathways providing women with the opportunity to benefit from midwife-led care.

6.4.2 Caution and precedents in extending the role of the midwife

The RCM urge caution when considering extending the role of the midwife (RCM, 2011). Care must be taken not to extend the midwife's role to the detriment of their core function. In acknowledgement of this, action has already been taken to preserve the core role of the midwife by delegating certain tasks to support staff, under the auspices of the midwives, to enable them to concentrate on the roles that only they can do (RCM, 2010). However, some would argue that such delegation has already

gone too far and that the midwife's role and provision of high quality care for women is being eroded, particularly in relation to postnatal care (RCM, 2010a; 2014). There are precedents for midwives taking on extended roles as part of their routine practice that were originally considered the role of doctors, including intravenous cannulation, perineal suturing and the first examination of the newborn (which will be discussed further below). Having been appropriately tutored in theoretical knowledge and given the opportunity to safely gain practical experience, midwives have successfully integrated these roles into their daily work for the benefit of women and their babies.

Some midwives' routine role now includes carrying out the initial physical examination of the newborn, which is an integral part of the universal Child Health Promotion Programme in the UK (UK National Screening Committee (NSC), 2008). The UK NSC (2008) states that the examination should be conducted by a suitably trained and competent HCP who has appropriate levels of ongoing clinical experience. This was traditionally carried out only by doctors; but with appropriate training, on-going support and audit advanced nurse practitioners and midwives have successfully taken on this role. This additional role requires extra midwifery resources and was hence evaluated to ensure that, on balance, the benefits outweigh potential negatives. This evaluation has taken the form of qualitative research into the views of women and midwives. Richards and Williams (2007) asserted that midwives conducting the initial newborn examination provide a better opportunity for communication that can encourage and promote public health, compared with examination by a doctor. Enhancing communication between women and HCPs is one of the fundamental elements of MLAC. Importantly, research also indicated that the midwife-led neonatal examinations were of higher quality, with increased rapport with women and were associated with better maternal satisfaction compared with senior house officer examinations (Bloomfield et al, 2003; 2003a; Townsend et al, 2004). Midwives were more likely than doctors to discuss other healthcare issues and provide better continuity of care (Wolke et al, 2002). Research evidence indicates that extending midwives' role to include examination of the newborn enhances 'patient' centred-care, a key recommendation of the Mid-Staffordshire inquiry (Francis, 2013). Furthermore, despite concern that midwives themselves may be sceptical about this additional role,

they reported increased job satisfaction relating to their ability to give continuity of care to women and a strengthened sense of being an autonomous practitioner (Rogers et al, 2003). In the same way, MLAC has the potential to provide such benefits to midwives. With the on-going support of the whole maternity team (as discussed in section 3.4.3), it is likely that midwives providing MLAC will feel similarly positive about the advantages it brings to their role. Such advantages are not only in their ability to provide better continuity of care, carer and information to women, but also in their professional autonomy. Professional rigidity and preference for the traditional demarcation of roles may inhibit midwives' ability to respond to the needs of women appropriately and stifle professional development and role satisfaction.

Conversely, despite the lack of published research to demonstrate this point, it is important to acknowledge that MLAC may not be viewed positively by all. Section 6.4.3 discusses the problem of an overstretched maternity service from a national perspective. The impact of this can be felt keenly by individual midwives and women, as highlighted by professional experience and media reporting of the problem (Anonymous, 2014; Borland, 2010). Hence, it is understandable that some women, midwives and policy decision-makers would be sceptical of any innovation that requires extra midwifery time. Such concerns should be welcomed and addressed. MLAC has the potential to increase normalcy in pregnancies that were previously considered high risk, thus reducing antenatal and intrapartum complications and the associated resource and monetary costs.

There are many parallels between MLAC and midwives' initial examination of the newborn. Both require midwives to have enhanced knowledge and clinical experience, have the potential to keep high quality care within the community setting, maximise continuity of care and carer and increase opportunities for communication and discussion with women. From an operational perspective, both appear to require additional resource. However, offset with the resulting reduced antenatal and intrapartum complications, and the increased capacity of doctors to care for women

with complex needs, MLAC has the potential to be cost effective without additional midwifery resource. This is discussed further in section 6.4.3.

6.4.3 The modern context of maternity services in the UK and the rationale for MLAC

The decision to implement MLAC must take account of the modern milieu of maternity services in the UK. Trusts may be concerned about the impact that MLAC may have on their service, given the perceived extra midwifery resource that is required. In their report on the state of maternity services in the UK, the RCM outline the rising birth rate, particularly in England where the birth rate rose 23% between 2001 and 2012 (RCM, 2013). Although the number of midwives has also risen over the same time period there remains a significant shortfall. Calculations by the RCM indicate that in order to provide good quality care to women with the current number of midwives in employment the birth rate would need to drop by over 130,000 births (RCM, 2013). With this in mind, MLAC may be viewed as a model of care that is untenable in this environment. However, this research demonstrated that women who received MLAC only saw their midwife on one additional occasion to the traditional OLAC model (mean community appointments: OLAC 7.56 (SD 2.12); MLAC 8.35 (SD 1.9); mean difference 0.79 visits). In addition, findings indicate that MLAC reduced unscheduled antenatal care, antenatal admissions and postnatal length of stay. Therefore, it is likely that some of the additional midwifery resource used to provide MLAC is off-set by the subsequent reduction midwifery time in providing these services. Further research is required to fully assess the impact of MLAC on maternity resources.

The context in which midwives practise has also changed dramatically in recent decades as they regularly care for women with additional medical, obstetric and social needs (section 2.2). Hence midwives have developed the requisite knowledge, skills and experience to care for women with a previous CS. This fact is acknowledged in key midwifery documents (DH, 2010; NMC, 2009) and the need for the continual development and evolution of the midwifery role is made explicit. Indeed, in the NMC

document outlining the requirements of all pre-registration midwifery education programmes it is stressed that due to the changing nature and context of midwifery practice, all midwives must be prepared for and understand the need to update and enhance their skills and knowledge in direct response to the changing needs of women and their families (NMC, 2009); MLAC constitutes such a practice development.

Taking into consideration the stretched resources of the maternity services, the King's Fund report into staffing and professionals' roles in maternity wards recommends considerable changes from traditional service models (Sandall et al, 2011). The report focuses specifically on labour and birth, however extrapolating their recommendations to antenatal care appears reasonable given the pressure that the entire maternity service is under from the rising birth rate and limited number of midwives (RCM, 2013). Their strong recommendation is that midwife-led models of care are deployed across the maternity service for women of low- and medium-risk. 'Medium-risk' is not defined in this report; however, it could be argued that women with a previous CS and no other complications fit this category in the antenatal period. The report states that midwife-led models are cost-effective; releasing obstetricians to focus their time and attention on women with complex needs (Sandall et al, 2011). The alternative strategy of increasing midwife and obstetrician numbers to account for service need is not feasible with current limited NHS resources. Equally, providing poor care or delegating roles without robust prior evaluation is not ethical and should not be tolerated in an era where high quality, patient-centred care is prioritised (Francis, 2013).

The modern context of maternity care demands that services continually develop to make better use of resources through innovation (Sandall et al, 2011). MLAC is an innovative development that meets this need.

6.4.4 Implementation and change management

Further research into MLAC is recommended (section 6.2); however, in light of the results of this research and in order to enable further research, MLAC is likely to be implemented in other healthcare organisations. The RCM consider the careful balance

that needs to be struck when contemplating any extension to the role of the midwife (RCM, 2011). The College states that it is *"entirely appropriate"* for midwives to gain competence in additional skills that offer choice to women, as long as this is undertaken in accordance with NMC requirements (RCM, 2007, page 2). Based on the results of this study and professional experience it is agreed that every 'good idea' to develop or extend the role of the midwife should be subject to careful scrutiny and evaluation prior to acceptance into practice (RCM, 2011). This research amounts to a significant contribution to the necessary evaluation of MLAC and provides evidence that strengthens the case for its implementation. Despite this, it is essential that discussion about implementation takes place at a local level and includes women, midwives, obstetricians, unions (such as the RCM), commissioners and other multidisciplinary stakeholders in the local provision of maternity services. The RCM recommends that certain questions are posed in order to make the decision (table 6.1).

MLAC constitutes a considerable change in practice; hence Trusts considering this must undertake a period of planning and development that is individual to that Trust and its unique context. There is a plethora of literature underlining the complex nature of implementing change in healthcare (Greenhalgh et al, 2009). Based on professional experience and a thorough understanding of change theory it is apparent that the process of implementing a change in practice cannot be transferred 'wholesale' from one area to another. The route by which successful change is achieved within one Trust is unlikely to follow that of another. The process of change itself influences the level of engagement gained and subsequent sustainability. However, there are principles of change management that can be used where any change is proposed including multidisciplinary team 'buy-in' (discussed below) and other tools for successful change (appendix 8).

Table 6-1: Questions to be considered locally prior to implementation (adapted from RCM, 2011)

• Does the proposed activity entail essential midwifery skills?	• i.e. skills that are a requirement for entry to the register, such as full clinical assessment of the woman and history taking of social, physiological and physical circumstances; determination of risk factors.
• Does the proposed activity entail generic skills? • Is the proposed activity the responsibility of the wider maternity care team?	• i.e. those that could be effectively carried out by others, despite also being essential midwifery skills. In this case the task could be effectively delegated to another member of the maternity team, such as the maternity support worker.
• What are the implications for workforce planning and employment relations?	• i.e. will the reform affect working conditions for midwives?
• What are the implications for multidisciplinary working?	• i.e. has a partnership approach been used in developing the project?
• What are the implications for continuity of care and carer?	• i.e. does the reform reduce the number of health professionals a woman is required to see or disrupt continuity of care?
• What are the implications for clinical effectiveness?	• i.e. has an evaluation of the proposed reform been undertaken?
• What are the implications for cost-effectiveness?	• i.e. do the potential improvements represent value for money
• Is the proposed reform sustainable?	• i.e. does it fit with current Trust and national objectives? Has scope for funding (if needed) been established?
• How will the proposed reform be monitored, evaluated and reviewed?	• i.e. is internal monitoring enough or should external evaluation be commissioned?
• Overall, will the proposed reform improve the quality and continuity of care?	• i.e. what are the outcomes it is intended to improve? • What is the evidence base for this course of action? • Do users understand and support the initiative? • Has a similar initiative been piloted elsewhere?

6.4.4.1 Multidisciplinary 'buy-in'

The Trust where this research took place successfully implemented MLAC into clinical practice. The initiative had the backing of a Trust-wide strategy to safely and appropriately increase the VBAC rate. MLAC was launched with the support of midwives and obstetricians as well as other important members of the multidisciplinary team, including anaesthetists, primary care, students and faculty from the local university. The importance of 'buy-in' from the entire team must not be underestimated, as the literature demonstrates the significant influence that an individual HCP's personal opinion on mode of birth can have on the woman's eventual decision (Bernstein et al, 2012) (section 5.2.4). There is also previous research evidence to suggest that the organisational support of VBAC may be recognised by women and influence their decision. The research carried out by Metz et al (2013) found that one particular group of Ob-Gyn (doctors) had a much higher rate of planned VBAC than the others; a finding that was attributed to the consistent effort within that group to enhance planned VBAC rates. This research was discussed earlier (section 5.2.1), but here the important point is that the consensus opinion that brought about the group effort to promote VBAC appears similar to the consensus opinion behind the implementation of MLAC within the Trust where this research took place. Whilst the driving force for MLAC may have originated from a small number of midwives, early discussion with senior members of the multidisciplinary team and continual involvement of all professions ensured commitment to the initiative throughout the development process. The findings of this research confirm those of Metz et al (2013): that a group of professionals can elicit a higher planned VBAC rate, with a Unit-wide vision that all professionals 'buy-into'. Both this research and that of Metz et al (2013) demonstrate the importance of establishing a cohesive approach at the outset of the implementation of MLAC.

Given the importance of the change process when any innovative model of care is implemented, it is recommended that healthcare organisations wishing to implement MLAC make use of appropriate and evidence-based change theory. Many midwives have expertise in change management, which should be utilised. Where consultant

midwives are employed, their expertise in service development, research and leadership make them optimally placed to lead a change in practice such as MLAC.

6.5 Recommendations

This chapter has outlined the implications, application and implementation issues related to MLAC highlighted by this research. The detailed recommendations borne from this research are outlined in table 6.2.

Table 6-2: Recommendations

Research and audit	• Regionally coordinated RCT, led by strategic maternity network (including consultant midwives within region). Primary and secondary endpoints to be aligned with this research, to demonstrate efficacy and safety. • Good quality, prospective, multicentre longitudinal cohort study coordinated by strategic maternity network. Research aims as above. • In-depth investigation of women's experiences of MLAC (potentially in comparison to OLAC) and professional's views of MLAC, using qualitative and quantitative methodology. • Where MLAC is being implemented outside of a research context, ongoing audit and feedback to clinicians is warranted. Consideration of VBAC rates, safety outcomes and operational differences (e.g. unscheduled antenatal care, continuity of carer etc.) is recommended.
Dissemination	• Sharing results with the clinicians and women at the Trust where the research took place. • Wider dissemination of findings through journal publication and conference presentation (discussed further in 7.4)
Education	• Use the findings of this research to augment the education of undergraduate student midwives and for the ongoing education of midwives and obstetricians who provide and support MLAC.
Implementation	• Senior clinicians to use the results of this research to make an evidence-based, local decision about implementation of MLAC within their healthcare organisation, in a research context or not. • Prior to implementation, multidisciplinary discussion and agreement must be sought. Clinicians with change management expertise should lead the service development.

6.6 Summary

This research strongly suggests that MLAC is efficacious in terms of increasing the VBAC rate and is safe for women who have previously birth by CS and have no other risk factors. Hence the innovative model of care should be continued in the Trust where it has been established. This chapter outlined the research implications borne from these results. Given such positive results, local and regional application have also been considered in order that more women can benefit and further research can be planned. This chapter also described and analysed the complex context of modern maternity services and how this influences the future for MLAC. The case for MLAC is strengthened by its coalition with the defined role of the midwife, high profile government policy, documents outlining the aspirations for midwifery care and previous successful precedents in extending the midwife's role. Importantly this chapter discussed the potential barriers, including concerns about the professional identity of midwives, maintaining their focus and expertise on 'normal pregnancy', national and local midwifery resource, the increasingly complex health and social status of women giving birth in this country and local barriers that may exist. The process of implementation into practice and how this is accepted by HCPs, women and other stakeholders is crucial to ensure success. Change management and implementation theory contain useful principles to consider. How these steps are taken by each individual Trusts implementing MLAC will influence the level of engagement and hence successful initiation and sustainability of MLAC.

7. Conclusion and reflection

This research has generated new knowledge about the efficacy and safety of an innovative midwife-led model of antenatal care (MLAC) for women with one previous CS and no other risk factors. Women who received MLAC were statistically more likely than those who received obstetrician-led antenatal care (OLAC) to plan to birth by VBAC and were numerically more likely to be successful; hence the provision of MLAC resulted in a statistically higher actual VBAC rate. In this conclusion, the process by which this research was conceived and conducted is discussed and critiqued. In light of the positive results, the future clinical practice and research implications are outlined. Finally, I share my personal reflection on the process of conducting the research and writing this thesis.

7.1 Evaluating midwife-led antenatal care for women with one previous CS and no other risk factors

The aim of this research was to compare the innovation of MLAC with the previous standard of care, OLAC. As previously described, the innovation was implemented in an effort to safely reduce the Trust's CS rate, by increasing the VBAC rate. Women with a previous CS account for a large proportion of the population being served by maternity services, up to 11% (Bragg et al, 2010; The Information Centre, 2011; Thomas et al, 2001). Women with one previous CS and no other risk factors are suitable candidates for VBAC, have a good chance of being successful and are at low risk of morbidity (Bias et al, 2001; Kwee et al, 2007; Landon et al, 2005; Tan et al, 2007; Turner et al, 2006). Hence maximising the number of this group of women who successfully attempt VBAC has the potential to considerably reduce the CS rate and improve outcomes for mothers and babies.

The model of MLAC was based on clinical experience and research evidence. Professional experience demonstrated that midwives have the inherent skills required

to care for women with a prior CS in the antenatal period. The skills required are those that are expected of midwives at the point of admission to the Nursing and Midwifery register (NMC, 2009); they include ongoing risk assessment and identification of any complications or deviation from a normal pregnancy; providing evidence-based, up-to-date information; focussing on the emotional and social aspects of pregnancy and childbirth; and sign-posting or referring to an appropriate professional in a timely manner. A 'needs analysis' demonstrated that because these skills are inherent and used daily by midwives, all they required was informational support and confidence building to empower them to hold discussions with women about their previous experience and mode of birth options (see section 3.1.3.).

The research aim was clear from the outset (section 3.1): to find out if MLAC can lead to higher VBAC rates compared with OLAC and whether it is safe. MLAC was proposed as a model of care that would optimise VBAC rates. Therefore, comparing the intended and actual VBAC rates between MLAC and OLAC was essential to determine whether or not MLAC was efficacious. Given that the ideology of research is to generate new knowledge, it was not enough just to answer this question. Rather, this research also aimed to generate theories that might explain any association between MLAC and a change in VBAC rates. Therefore, the collection of a large amount of data was required to put forward hypotheses to explain the association and to account for confounding factors. Additionally, the safety of MLAC needed to be evaluated, given that this is a new model of care. Hence outcomes that demonstrated maternal and neonatal wellbeing were collected.

7.2 Critique and justification of the research process and methodological approach

As described above, this research stemmed from both clinical practice and in-depth literature review. The search terms used to undertake the literature review were predefined and updated during literature searches (appendix 1). Large databases were searched and hand searching through reference lists ensured that all relevant evidence

was reviewed. One strength of this research is that the literature review was an ongoing process from conception of the research question until completion of writing up. VBAC and care following a previous CS remain contemporary issues in maternity care, as does the aim of safely reducing the CS rate. Therefore, the evidence base relevant to this research has been continually updated, which is reflected in the literature cited in this thesis.

This research employed a quantitative, retrospective, cohort study approach to compare the efficacy and safety of MLAC and OLAC. As discussed (chapter 3) various research methodologies were considered and the resulting design was based on ethics, suitability to answer the research question and pragmatism.

A strength of this study is the pre-defined sample size, which enabled statistically significant results to be found for the primary endpoints; intended and actual mode of birth. Despite being completed as part of a Doctorate in Clinical Practice, aiming for statistically significant findings was considered an important aspiration. This is the first evaluation of MLAC and has the potential to influence clinical practice, nationally and internationally. Therefore, it was imperative that the findings had both clinical and statistical significance, to provide robust evidence about the value of implementing MLAC in other Trusts or maternity services. The sample size (section 3.5.1) was defined prospectively, with assistance from a statistician. Other sample sizes were considered with slightly different methodological aims; however, a sample based on a non-inferiority hypothesis was considered clinically relevant, to determine whether MLAC elicited the same or greater intended and actual VBAC rates compared with OLAC. Collection of the data from this sample size was made possible by a bursary awarded for this research from the Royal College of Midwives (RCM).

Given the retrospective design of this research, it was essential to ensure that the two groups of women were homogenous, so that the outcomes could be accurately compared. Strict inclusion and exclusion criteria were hence determined prospectively. The Trust obstetric database was used to determine whether women were eligible for study inclusion; this was then verified by the DRAs based on records in

the case-notes. These measures strengthen the external validity of this research, as the population of women to whom the findings can apply is clear.

The prospective selection of primary and secondary endpoints and confounders is another strength of this research. Having determined that the clinical priority was to evaluate the efficacy and safety of MLAC, the literature review and clinical judgement were used to determine the primary endpoints of intended and actual VBAC rates. In-depth clinical knowledge also informed decisions about the organisational data that should be collected, with which to generate hypotheses about the reason for any differences between MLAC and OLAC. As Hess et al (2004) point-out, one of the disadvantages of retrospective studies is the difficulty in controlling confounders. However, this challenge was recognised and measures were incorporated into the research design to address this. All potential confounding factors that may have independently affected the primary endpoints were identified prospectively. As the data were to be collected from the maternal case-notes, all important confounders could be collected as they are routinely documented as part of standard record keeping. Following data collection I recognised some additional variables that could have provided useful information about the contexts of OLAC and MLAC and that may have led to further theory generation (section 6.2).

The data analysis strategy was also determined prospectively, with advice from a statistician. All potential confounders that would be known at booking and that would not be affected by the type of antenatal care received were identified and planned to be inserted into a multiple logistic regression model. Thereby, it was possible to state that MLAC was independently associated with an increase in intended VBAC, and an increase in actual VBAC along with the presence of a previous vaginal birth.

The prospective and purposeful design of the data collection and analysis strategies are both strengths of this research. They address many of the recognised limitations of retrospective studies. Such limitations include the inability to collect all of the relevant data and to account for confounders. The nature of maternity records is that full records are routinely collected, in part for communication between healthcare professionals and women and in part for medico-legal purposes. This was beneficial

for this research, as all of the rich information that was required to fully answer the research question and generate feasible hypotheses for the superiority of MLAC could be collected and robustly analysed.

A limitation of this study is that the two groups received their care at different times; OLAC in 2008 and MLAC in 2011. As with any non-randomised, controlled study, it is not possible to state with certainty that the two groups were not different in any way that may have affected the results. However, the time lag of three years between the groups adds to this limitation. National and local practice guidelines regarding VBAC did not change in the three years between the groups (RCOG, 2007). However, findings from this research have indicated that practice did change in terms of increased used of forceps for instrumental birth in 2011. Nevertheless, the comparison of maternal and perinatal outcomes at the Trust in 2008 and 2011 demonstrate that outcomes were broadly similar (section 3.2). Indeed, the small differences in the CS and IOL rates indicate an increase in intervention in 2011, which would bias in favour of the OLAC group. Furthermore, this research could not account for societal differences that may exist between the two timescales. For example, media attention about the safety, or otherwise, of VBAC compared with ERCS may have influenced women's opinions. It is also possible that the women in the two groups were inherently different in ways that may remain unknown and that could not be accounted for. Section 3.2 discusses these potential limitations and justifies why this design was used despite them. Within the constraints of this research, this design risked the least bias. A two-centre study comparing MLAC at one Trust with OLAC in another would bring significantly more potential for bias in terms of different obstetric practices resulting in different CS and VBAC rates (Bragg et al, 2010; Coonrod et al, 2008; Paranjothy et al, 2005).

In hindsight, this research could have avoided the criticism that the results cannot be generalised beyond one Trust by conducting the research concurrently in other Trusts. The potential of good practice sharing and research collaboration within strategic maternity networks have already been discussed (section 6.3.2.) and could have been

used for this research. However, such collaboration was beyond my expertise and status at the point I was at in my career when I commenced this research. This insight may shape future research into MLAC.

Another limitation is the fact that the Trust obstetric database was used to identify women who were eligible to be included, as the database was not analysed for accuracy and internal validity for this research. That said, the Trust database is used for all maternity data reporting and for income generation therefore there are robust governance and management systems in place to ensure accuracy. Women were excluded on the basis that the database indicated they did not fit the inclusion criteria or had medical, obstetric or psychological complications that would exclude them from MLAC and the research. However, this limitation was mitigated by the additional process of checking the inclusion and exclusion criteria against the maternal case-notes. This led to four additional cases being excluded from the final sample. Therefore, it is more likely that women who should have been included in the final sample were excluded due to random errors in the database than women being erroneously included.

Strengths that may also be considered limitations are the Trust-wide positive focus on VBAC and its readiness for service development. This cohesive drive to safely reduce the CS rate meant that MLAC was well implemented and this study was supported. However, it may be argued that this ambition itself influenced the VBAC rate. The pro-VBAC and 'change-ready' context within the Trust cannot, and perhaps should not, be separated from the compound intervention of MLAC.

As with all research designs limitations were inherent, but these were mitigated as far as possible. The design was pragmatic given the resources available, but appropriate allowing the collection of rich data that were robustly analysed. Just as importantly, the design was ethical. It would have been possible to answer the research question

using a questionnaire or by interviewing women about their experiences of MLAC. However, there is a risk in directly involving women in research, even that which may be considered benign. The rationale behind this research was to explore models of antenatal care that elicit the best outcomes for mothers, babies and their families. This research concurs with the midwife-led care philosophy of being woman-centred and interested in the respect, understanding and empowerment of women. This philosophy naturally suggests involving women directly in the research, in order that their voices are heard. However, the methodology should be appropriate to meet the aims of the research and not automatically involve women directly in the research just because the research is about women, for example through questionnaire or interview (Letherby, 2004; Oakley, 1998). It was possible to avoid harm to women and achieve the aims of this research using the women's case-notes. Nevertheless it would have been a significant strength to involve women in the research design, as this may have informed aspects of the design or highlighted additional variables to strengthen the analysis and generate further theories that explain the benefit of MLAC. Patient involvement is acknowledged to generate better quality research that is more likely to be implemented and is an aspiration in research governance (Boote et al, 2002; Crawford et al, 2002; Whitstock, 2003).

A secondary outcome of this research was that a database of evidence relating to the antenatal care of women with a previous CS has been created. The clear inclusion and exclusion criteria means that the results are generalisable to the population of women with one previous CS and no other risk factors, although care must be taken in extrapolating the findings to other locations, given endemic differences in practice between Trusts. Despite this caution, the indication from this research that MLAC is efficacious in increasing intended and actual VBAC rates and is safe has the potential to influence practice nationally and internationally.

7.3 Practice and research implications

The model of antenatal care that women receive in their pregnancy following a previous CS was found to be significantly associated with their intended and actual mode of birth through this research. Specifically, those women who received care led by a midwife were significantly more likely to choose and achieve successful VBAC than those who received traditional antenatal care from an obstetrician. Finding ways to address high CS rates is a clinical priority throughout the UK and internationally (ACOG, 2010; House of Commons Health Committee, 2003; NHS Institute for Innovation and Improvement, 2007; Gibbons et al for the WHO, 2010). Therefore, the results of this research are likely to be of interest to senior policy makers within maternity services. This section will discuss practice and research implications, specific to the UK.

Research implications, local and regional applications and implementation considerations have already been discussed at length (chapter 6), outlining the drivers and barriers to implementing MLAC nationally. The stretched resources within maternity services (RCM, 2011; Sandall et al, 2011) may be considered a barrier to extending the role of the midwife to include MLAC. However, MLAC has the potential to more appropriately use the limited resources within the service for the benefit of all women and the service itself. Precedents, including midwives' examination of the newborn, have demonstrated the value in appropriately extending the midwife's role. Where the midwife uses professional expertise, increases opportunities for continuity of care, carer and information, provides high quality care in the community, maximises women's opportunities for normal birth and better maternal and perinatal outcomes, such an extension to their role is beneficial. Therefore, the results of this research must be disseminated widely across the UK to have the potential to change practice. Dissemination is planned via publication in a widely read, credible medical journal with a high impact factor (17.215 [ISI Web of Science, 2012]); the British Medical Journal. This publication will bring the findings of this research to the attention of senior clinical decision makers within maternity services, across the UK and potentially internationally. It is intended that publishing in a non-midwifery journal will highlight

the results to the widest possible multidisciplinary audience, to begin the debate about implementing MLAC into routine clinical practice. It is also intended that the results will be presented at national and international midwifery conferences; such as the RCM conference and the International Normal Birth Conference. The results will also be shared promptly with the Trust where this research took place and the RCM, in gratitude for the invaluable assistance I gained from each in order to carry out this research.

This research has shown that for this group of women the type of antenatal care received influenced their intended and actual mode of birth, and that the midwife-led model of care is safe. It has also highlighted important questions that need to be answered through additional research. Recommended research priorities are laid out in chapter 6, including consideration of a regionally coordinated RCT, prospective, multicentre cohort studies, research to investigate the views and opinions of women and healthcare professionals and health economic evaluation.

7.4 Personal reflection on learning

This research constituted a large project, spanning nearly 6 years since its conception. Completion of this research and Doctoral thesis have required me to develop in many areas; here I reflect on my learning process using Borton's simple reflective model (Rolfe et al, 2001). The research process has been described in detail throughout this thesis; therefore I will refer only to salient events within the process which led to reflection.

The process of literature search and review was ongoing throughout the research. On reflection, this discipline has strengthened the research itself as well as increasing my knowledge base and developing my expertise in this area. My understanding of VBAC, midwife-led care, decision-making, service development and the research process

itself have grown immensely. My developing understanding of each element shaped the research at every level, including the research design, data collection, analysis and the generation of theories.

Through continual literature review, my critical and analytical skills have developed. By re-reviewing the literature that I critiqued early on in the research process I could see how far my skills had advanced. I believe that this development has enabled me to critique my own research objectively.

I have always ascribed to the philosophy of evidence-based practice and the belief that professional development should be a continuum; this reflection has strengthened my resolve. I understand that to be considered an expert in any field, one must have an in-depth knowledge of the subject area based on evidence which has been reviewed critically. I take this refreshed understanding with me into my future career, to forge expertise in certain areas and to help me acknowledge areas where I am not an expert and need to consult with someone who is.

Project management skills were necessary to ensure the smooth running of the research. This was especially important at the outset of initiating the research itself, when LREC, Trust sponsorship and Research and Development Department agreement were needed, funding was sought and DRAs were employed. I learnt the need for detailed forward planning, the use of project management tools such as Gantt charts, and the need for clarity when requesting help from others. Development of these skills has also been beneficial in my employment, for smaller scale evaluation projects, service development and academic style writing.

Tenacity is a trait I have perceived in myself, especially when I faced challenges in this process. The decision from the LREC that I was not able to access the maternal records myself for data collection was initially a set-back. However, the result was that I identified the need to source funding and employ research assistants to complete this part of the research process for me. This turned out to be positive; developing my skills in seeking and gaining funding, screening and employing suitable assistants and

ensuring that they had the relevant training required to undertake their role. Therefore my people management skills also developed. If I had been put off continuing with the research or redesigned it so that I no longer needed assistance I would have missed out on developing these skills.

Despite being a research project for an academic programme, this was not a small undertaking and required the support and assistance of many other people, including individuals from the Trust, University, LREC and the Royal College of Midwives. I therefore needed to develop my communication and persuasion skills to ensure I gained the support I needed. I became proficient at describing the aims, design and value of the research, either informally or formally through poster and oral presentations. Being clear, succinct and persuasive were vital in generating the much needed support of others and are skills that I have and will continue to use in my working life.

The biggest challenge in completing this research has been doing so along-side the rigours of a high-pressured full-time job and the other requirements of the Doctorate programme. Time-management, prioritisation and negotiation were essential skills to ensure that commitment to my other duties were not to the detriment of this research. I learnt the need to be honest about the pressures that I was faced with in order to gain the support and understanding that I required to move the research forward. Being honest about my need for help felt uncomfortable, as my natural tendency is to carry on believing that I should be able to cope with the situation with which I am faced without help from others. However, the value of seeking help is something that I will take forward in my career, when I will inevitably experience similarly competing pressures and limited time.

The most valuable thing that I have learnt during this process is the strength of my respect for and enjoyment of the research process; in particular the writing of research. This should have been of no surprise to me, given my belief in the importance of evidence-based care determined through good quality research. Communication of this evidence, in the right way, to the right people is an essential

element of research that should never be overlooked. I believe that researchers have a moral and ethical obligation to report all research findings honestly, taking account of the research design that led to the findings and without over-inflating their importance. I have learnt that this can be difficult, especially when the research is your own. Writing critically and honestly is a discipline that I have developed throughout the research process, but mostly in the final stages of writing this thesis. I intend that this critical and honest writing style will shape any future writing to enable readers to come to their own informed opinion of the data I am presenting.

This research project has not always been easy or straight-forward. However, keeping sight of my aim from the outset has kept me on track and ensured that I completed. I have developed professionally, personally and academically and feel that the resulting evidence is valuable not only to me but to the wider maternity service. I now acknowledge my duty to communicate this appropriately to the right people, to ensure its value is achieved.

7.5 Summary

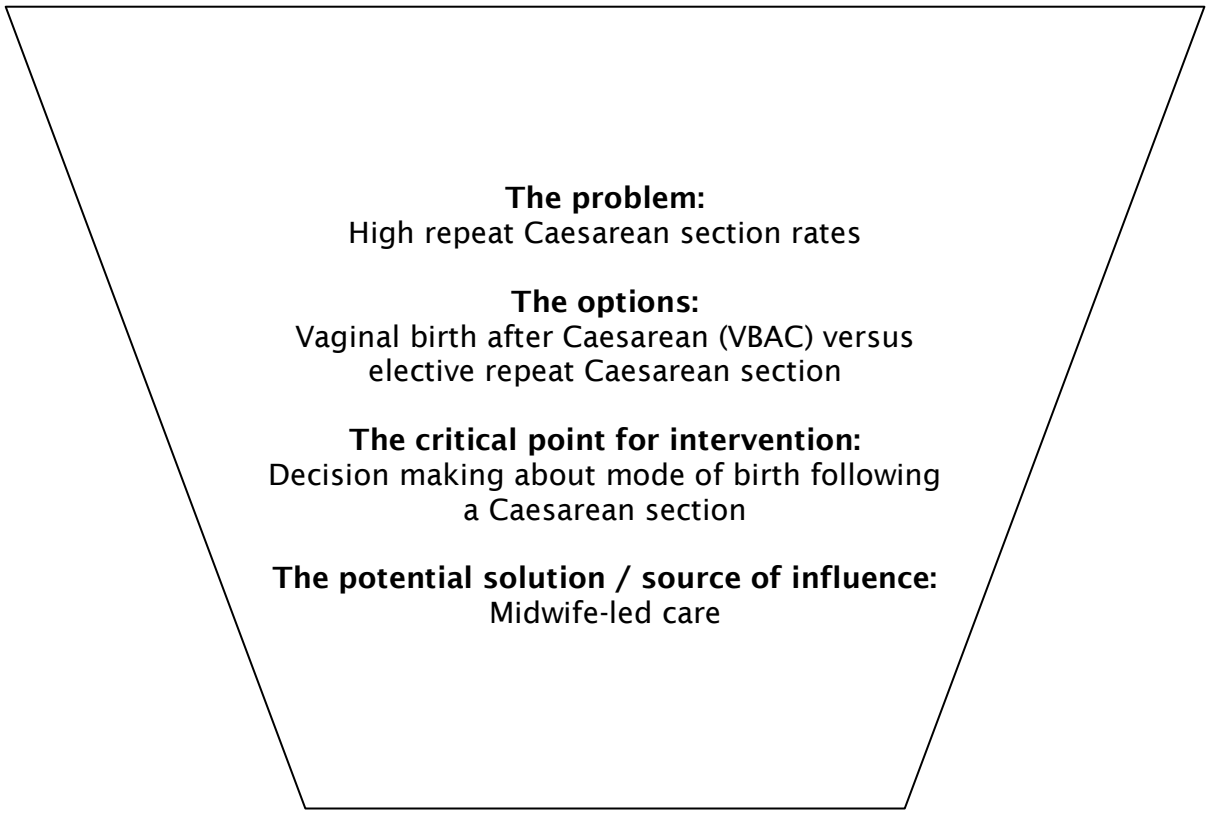
The aim of this research was to find out whether a midwife-led model of antenatal care for women with one previous CS can increase VBAC rates compared with an obstetrician-led model, and whether it is safe. This aim has been achieved, through the successful completion of a pragmatically designed study based on clinical experience. The results strongly indicate that MLAC elicits higher rates of intended and actual VBAC compared to OLAC and is safe for this group of women. Given the need for the most appropriate use of resources within our stretched maternity service (Sandall et al, 2011), MLAC has potential benefits for the whole maternity service if it were to be implemented in clinical practice across the UK. This research has generated original knowledge about the use of a midwife-led model of care with a specific group of women. In doing so, further research priorities have been highlighted. MLAC appears to have the potential to reap benefits for women, by optimising the

opportunity for successful VBAC and hence the best maternal and neonatal health outcomes; and for the maternity service as a whole, through the most appropriate use of resources.

Word count: 49,965

Appendices

Appendix 1: Literature search criteria



Based on the above 'story-flow' a search of evidence-based electronic databases (Amed, Ovid, Embase, Medline, Cinahl, Web of Knowledge (Science), PubMed, Athens, Cochrane Library) from 1950 to 2014 was carried out to identify literature relevant to this research. Search terms included 'caesarean section', 'vaginal birth after caesarean section', 'trial of labour', 'elective repeat caesarean section', 'midwife-led care', 'antenatal care', 'decision making'. Further identification of evidence came from hand searching for papers referenced in other papers. Inclusion criteria included papers in English language where full-text was available.

Appendix 2: Local research ethics committee agreement correspondence

NHS
National Research Ethics Service

[redacted]

28 September 2011

Miss Helen K Barnes

[redacted]

Dear Miss Barnes,

Study title:	**Comparing Obstetrician-led and Midwife-led antenatal care for women with one previous Caesarean section: A retrospective, comparative study of outcomes of Consultant Obstetrician-led and Midwife-led antenatal care for women with one previous Caesarean section and no other risk factors.**
REC reference:	**11/SC/0378**

The Research Ethics Committee reviewed the above application at the meeting held on 20 September 2011.

The Committee has considered and reviewed the project as research and given the ethical opinion detailed below. However, we are of the view that the project would be more appropriately classified as audit rather than research. We suggest that you discuss the matter with the sponsor and lead R&D office, and following that discussion advise the REC how it is intended to manage the project. If the sponsor and R&D office advise that the project can now be considered not to be research the application should be withdrawn. If it will continue to be managed as research, the opinion given below will remain in place.

Ethical opinion

1. The Committee was concerned that the CI would be in receipt of identifiable data without patients' consents. The Committee discussed the need for NIGB approval or alternatively a third party involvement to anonymise the data before the CI uses it.

The members of the Committee present gave a favourable ethical opinion of the above research on the basis described in the application form, protocol and supporting documentation, subject to the conditions specified below.

[redacted]

Ethical review of research sites

NHS Sites

The favourable opinion applies to all NHS sites taking part in the study, subject to management permission being obtained from the NHS/HSC R&D office prior to the start of the study (see "Conditions of the favourable opinion" below).

Conditions of the favourable opinion

The favourable opinion is subject to the following conditions being met prior to the start of the study.

1. The Committee requests that in date insurance documents be provided.
2. The Committee is happy to approve this study subject to one of the following conditions being adhered to –
    a. A third party is employed to anonymise the data so that the CI is not in receipt of named data, OR
    b. The CI seeks NIGB approval.

Management permission or approval must be obtained from each host organisation prior to the start of the study at the site concerned.

Management permission ("R&D approval") should be sought from all NHS organisations involved in the study in accordance with NHS research governance arrangements.

Guidance on applying for NHS permission for research is available in the Integrated Research Application System or at http://www.rdforum.nhs.uk.

Where a NHS organisation's role in the study is limited to identifying and referring potential participants to research sites ("participant identification centre"), guidance should be sought from the R&D office on the information it requires to give permission for this activity.

For non-NHS sites, site management permission should be obtained in accordance with the procedures of the relevant host organisation.

Sponsors are not required to notify the Committee of approvals from host organisations

It is responsibility of the sponsor to ensure that all the conditions are complied with before the start of the study or its initiation at a particular site (as applicable).

You should notify the REC in writing once all conditions have been met (except for site approvals from host organisations) and provide copies of any revised documentation with updated version numbers. Confirmation should also be provided to host organisations together with relevant documentation

Approved documents

The documents reviewed and approved at the meeting were:

Document	*Version*	*Date*
Covering Letter		19 August 2011
Investigator CV	Barnes	19 August 2011
Investigator CV	Cluett	
Investigator CV	Le May	20 July 2011
Letter from Sponsor		12 July 2011
Protocol	2.0	05 July 2011
REC application		28 July 2011
Referees or other scientific critique report	University of Southampton Peer Review	15 June 2011

Membership of the Committee

The members of the Ethics Committee who were present at the meeting are listed on the attached sheet.

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees (July 2001) and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

After ethical review

Reporting requirements

The attached document "After ethical review – guidance for researchers" gives detailed guidance on reporting requirements for studies with a favourable opinion, including:

- Notifying substantial amendments
- Adding new sites and investigators
- Notification of serious breaches of the protocol
- Progress and safety reports
- Notifying the end of the study

The NRES website also provides guidance on these topics, which is updated in the light of changes in reporting requirements or procedures.

Feedback

You are invited to give your view of the service that you have received from the National Research Ethics Service and the application procedure. If you wish to make your views known please use the feedback form available on the website.

Further information is available at National Research Ethics Service website > After Review

11/SC/0378	Please quote this number on all correspondence

With the Committee's best wishes for the success of this project

Yours sincerely

[redacted]

Chair

[redacted]

Enclosures: *List of names and professions of members who were present at the meeting and those who submitted written comments*
After ethical review – guidance for researchers

Copy to: [redacted]

Helen Barnes

[Withheld for confidentiality]

13th February 2012

Chair of [withheld for confidentiality] Research Ethics Committee

[Withheld for confidentiality]

Dear [*Chair*],

Reference: 11/SC/0378 Short title: Comparing Obstetrician-led and Midwife-led antenatal care following previous Caesarean Section

Following my email to [*withheld*] dated 7th January 2012, detailing a proposed minor change to my research protocol, I am very pleased to hear that you are happy for this change to be accepted as a minor amendment.

To confirm, the proposed change is to the inclusion dates for the 'Midwife-led care' group. Originally the inclusion dates was from the start of 2010 onwards, until the sample size was reached. The proposed change is to commence collection at the end of 2011 (i.e. 31st December 2011) working backwards until the sample size is reached. Therefore, the new inclusion dates for both groups are:

- Obstetrician-led group: end of 2008, working backwards until 212 reached;
- Midwife-led group: end of 2011, working backwards until 212 reached.

No documents will change as a result of this minor amendment.

With many thanks for your ongoing help and support,

Yours sincerely,

Helen Barnes

NHS
Health Research Authority

[redacted]

11 April 2012

Miss Helen K Barnes

[redacted]

Dear Miss Barnes,

Study title:	**Comparing Obstetrician-led and Midwife-led antenatal care for women with one previous Caesarean section: A retrospective, comparative study of outcomes of Consultant Obstetrician-led and Midwife-led antenatal care for women with one previous Caesarean section and no other risk factors.**
REC reference:	**11/SC/0378**
Amendment number:	**AM01: Minor Amendment: 1. Change to the inclusion dates for data collection for the Midwife-led care group.**
Amendment date:	**13 February 2012**

Thank you for your letter of 13 February 2012, notifying the Committee of the above amendment.

The Committee does not consider this to be a "substantial amendment" as defined in the Standard Operating Procedures for Research Ethics Committees. The amendment does not therefore require an ethical opinion from the Committee and may be implemented immediately, provided that it does not affect the approval for the research given by the R&D office for the relevant NHS care organisation.

Documents received

The documents received were as follows:

Document	Version	Date
Notification of a Minor Amendment		13 February 2012

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

11/SC/0378:	**Please quote this number on all correspondence**

Yours sincerely,

[redacted]

Committee Co-ordinator

[redacted]

Copy to: [redacted]

Appendix 3: Letter to and response from Head of Midwifery at Trust

Helen Barnes

(Address withheld for confidentiality)

9th December 2011

Head of Midwifery

(Address withheld for confidentiality)

Dear _____,

I am planning research as part of my Doctorate studies through the University of Southampton, which I hope to conduct at *[Trust]*. I am writing to ask for your support in doing this.

As you know, rising Caesarean section rates are a national and international focus. Vaginal birth after Caesarean (VBAC) has long been purported to be an acceptable option for reducing the global Caesarean section rate. Based on the recommendations in the NHS Institute for Innovation and Improvement 'Focus on Normal Birth and Reducing Caesarean section Toolkit' [*Trust*] introduced Midwife-led antenatal care for women with one previous Caesarean section and no other risk factors. There are many perceived benefits of this type of care; including optimising chances for continuity of midwife, care and information; truly informed choice; increased availability of Obstetrician antenatal clinic appointments; and potentially reduced cost. It is also possible that this type of antenatal care may increase the VBAC rate, thus reducing the Caesarean section rate. This research intends to compare the intended and actual VBAC rates and other safety outcomes for women who received Obstetrician-led and Midwife-led antenatal care at your Trust. For further information please see the 'outline of the study', below. If you would like any further information I would be very happy to provide it or discuss it with you.

This research is being carried out as part of a Doctorate in Clinical practice. As such I have received specific research training through two Doctoral level modules. The research protocol has been through a peer review process through the University and has received ethical approval from the Local Research Ethics Committee. I have two research supervisors who oversee the research at every stage through planning, data collection, analysis and final write-up; [*Supervisors*]. I also have the support of a

statistician from the University who provides guidance and tutoring for statistical analysis of the findings.

I applied for and was successful in being awarded a £5,000 bursary from the Royal College of Midwives to undertake this research.

I hope that you will agree that this research will be invaluable to generate more knowledge about Midwife-led antenatal care for women with a previous Caesarean section and no other risk factors. It will also contribute to the growing body of evidence around birth after a previous Caesarean section.

I would therefore be grateful if you would let me know if you can support this research, either by letter or by email.

Yours sincerely,

Helen Barnes

Outline of the Study

The planned design of this research is a retrospective, comparative study of Obstetrician-led and Midwife-led antenatal care for women with one previous Caesarean section and no other risk factors. It will employ a quantitative methodology to objectively compare the intended and actual VBAC rates for mothers who have received Obstetrician-led and Midwife-led antenatal care.

The research evidence demonstrates that successful VBAC leads to the best maternal and neonatal outcomes. Therefore, this research intends to compare the intended and actual mode of birth in two groups of women who received either Obstetrician-led or Midwife-led antenatal care. Secondary outcomes will also be analysed; these relate to antenatal and intrapartum events and care; and maternal and neonatal outcomes. These analyses will contribute to the body of evidence around birth after a previous Caesarean section.

The case-notes of two retrospective groups of women will be used to collect the data. The inclusion and exclusion criteria will be those used by the Trust currently to determine which women are suitable for Midwife-led antenatal care. The sample size has been calculated with advice from a statistician. To test the non-inferiority hypothesis that Midwifery-Led antenatal care will either elicit the same or greater vaginal birth rate than Obstetrician-led care, a sample size of 212 per group is required; 80% statistical power and 5% significance. This sample size was decided upon pragmatically, given the confines of this research.

Cases that fit the inclusion and exclusion criteria will be indentified using the obstetric database at this Trust. The group of case-notes that will make up the Consultant-led group will be all consecutive women who fit the inclusion criteria and gave birth starting at the end of 2008 and working backwards until a total of 212 is reached. The data from 2009 will not be used in the research as this was the transition period between providing Consultant-led and Midwifery-led antenatal care for this population within the Trust. The training period for the Midwives to provide Midwife-led care was elongated due to the number of Community Midwives within the Trust and Midwife-led care was not completely initiated until the start of 2010. Therefore, the Midwifery-led group will be the first 212 women who received this care and gave birth from the start of 2010.

I intend to employ a data retrieval assistant who is employed by the Trust and therefore has access to the case-notes to help me collect the data. The data collection tool has been designed to maintain anonymity and confidentiality as no personal details will be recorded.

The data will be analysed using SPSS for Windows. Bivariate analysis will be used to demonstrate the relationship between the type of care women receive and the primary research outcome, 'actual mode of birth'. The chi-squared test can be used to establish the degree to which a relationship exists between type of care received and mode of birth. The chance of a woman achieving a vaginal birth after Midwife-led antenatal care, compared to after Obstetrician-led antenatal care, will be displayed using 'Relative Risk', with confidence intervals. Having compared the various maternal and neonatal outcomes along with the 'actual mode of birth' rates for each group, it will be possible to state whether Midwife-led antenatal care for women with a previous Caesarean section is safe.

The results of this research will be disseminated widely, in order that it may influence practice and strategic decisions about the recommended type of antenatal care for women with one previous Caesarean section and no other risk factors.

Response from Head of Midwifery via email:

Helen
I would be delighted to support your research. In line with our normal processes here at [*Trust*] it would be [*Consultant Midwife*] who would critically look at the research proposal on my behalf and assess the impact on the service. I am sure [*Consultant Midwife*] is aware and I note that you have copied her in to the email. I will discuss with [*Consultant Midwife*] on Monday.
I wish you lots of luck and feel certain that we will be able to support you at [*Trust*] and will confirm that support following my discussions with [*Consultant Midwife*].

kind regards
[*Head of Midwifery*]

Confirmation from Consultant Midwife via email:

As mentioned this morning, I am familiar with Helen's plans and happy for her to go ahead.

[*Consultant Midwife*]

Appendix 4: Trust Research and Development department agreement

[redacted] NHS

[redacted]

Miss Helen Barnes

[redacted]

20 December 2011

Dear Miss Barnes

ID: RHM O&G0184 Comparing Obstetrician-led and Midwife-led antenatal care for women with one previous Caesarean section

EudraCT:

Thank you for submitting all the required documentation for Trust R&D approval. I write to inform you that your study has ful[redacted]&D approval. Please find attached the Conditions of Trust R&D approval which you are obliged to adhere to.

You are required to keep copies of all your essential documents relating to this study. Please download a copy of the relevant Investigator Site File template from the R&D website: http://tinyurl.com/3xtxv66.

Your project is subject to R&D monitoring and you will be contacted by our office to arrange this.

Please note: A condition of approval is that any changes need to be timeously notified to the R&D office. This includes providing copies of:

- All NRES substantial amendments and favourable opinions;
- All Serious Adverse Events (SAEs);
- NRES Annual Progress Reports;
- Annual MHRA Safety Reports;
- NRES End of Study Declaration;
- Notifications of significant breaches of GCP or protocol

Please quote the above RHM No. on any correspondence with our office.

Should you, or any of your team, require training in any of the policies and procedures required to ensure compliance with the conditions of approval, please refer to the R&D Training website http://tinyurl.com/prkd65 for an up-to-date calendar of training events.

Yours sincerely

[redacted]

Research Governance Officer

Appendix for R&D approval letter dated: 20/12/11

RHM O&G0184
Study Title: Comparing Obstetrician-led and Midwife-led antenatal care for women with one previous Caesarean section

The following documents have been reviewed as part of the R&D approval

Document	Version	Date
Protocol	3	01 October 2011

Appendix 5: Good Clinical Practice certificate

NHS
National Institute for Health Research
Clinical Research Network Coordinating Centre

Certificate of Attendance

Helen Barnes

attended

Introduction to Good Clinical Practice (GCP):
A practical guide to ethical and scientific
quality standards in clinical research

on 07/11/2011

Sessions include:
1. The Value of Clinical Research and the role of the NIHR CRN
2. GCP: the standards and why we have them
3. Study set up: responsibilities, approvals and essential documents
4. The process of informed consent
5. Case report form, source data and data entry completion

6. Safety reporting in clinical trials

Appendix 6: Data collection tool

Comparing Obstetrician-led and Midwife-led antenatal care for women with one previous Caesarean section
Data collection tool

Main Outcome

1 Type of antenatal care at Booking ☐
1 = Obstetrician-led Care
2 = Midwife-led Care

2 Intended type of Birth ☐
1 = VBAC
2 = Elective Caesarean section

3 Actual type of Birth ☐
1 = Spontaneous Vaginal Delivery
2 = Ventouse delivery
3 = Forceps delivery
4 = Emergency CS in 1st stage
5 = Emergency CS in 2nd stage
6 = Emergency CS no labour
7 = Elective CS

Maternal Demographics

4 Age at booking (in years) ☐☐

5 Parity ☐
1 = 1, 2 = 2, 3 = 3 etc

6 Gravida ☐
1 = 1, 2 = 2, 3 = 3 etc

7 Number of previous vaginal births ☐

8 Number of previous VBACs ☐

9 Time since previous CS (months) ☐☐

10 Single parent? ☐
1 = Yes
2 = No

11 Ethnic category ☐
1 = White British
2 = White other
3 = Asian
4 = Black
5 = Mixed
6 = Other: _____

12 Interpreter required? ☐
1 = Yes
2 = No

13 Employment status ☐
1 = Employed
2 = Unemployed
3 = Student

14 Partner's employment status ☐
1 = Employed
2 = Unemployed
3 = Student
0 = Not applicable

15 Smoking Status ☐
1 = Smoker
2 = Non-smoker

16 BMI at booking (nearest whole number) ☐☐

17 Reason for previous Caesarean section ☐☐
1 = Breech
2 = Multiple birth
3 = Placenta praevia
4 = Maternal psychological / social issue or maternal request
5 = Intrauterine growth restriction
6 = Pre-eclampsia
7 = Failed Induction of labour
8 = Slow progress in 1st stage
9 = Slow progress in 2nd stage
10 = Failed instrumental birth
11 = Suspected fetal compromise
12 = Other (please specify below)

_____

Antenatal details

18 Gestation at booking ☐☐

19 Number of antenatal appointments in community (community Midwife/GP) ☐☐

20 Number of antenatal clinic appointments (Obstetrician) ☐☐

21 Number of antenatal carers (total) ☐☐

22 Gestation of first discussion about mode of birth (completed weeks) ☐☐

23 Gestation of birth planning appointment ☐☐

24 Number of unscheduled antenatal care episodes in Day Unit ☐☐

25 Number of unscheduled antenatal care Episodes in Delivery Suite ☐☐

26 Number of antenatal inpatient Admissions (antenatal ward) ☐☐

27 Reason for unscheduled antenatal care (please state number of episodes for each reason)

A = PET (and associated symptoms) ☐
B = Reduced fetal movements ☐
C = PV Bleed ☐
D = Abdominal pain ☐
E = Threatened preterm labour ☐
F = Anaemia ☐
G = Urinary Tract Infection ☐
H = Obstetric cholestasis ☐
I = Presentation check ☐
J = 'Small for dates' ☐
K = 'Large for dates' ☐
L = Dopplers ☐
M = ? Ruptured membranes ☐
N = Other (please specify below) ☐

_____

28 Remained on original antenatal pathway (i.e. Obstetrician- or MW-led) ☐
1 = Yes
2 = No

Intrapartum details

29 Onset of labour ☐
1 = Spontaneous
2 = Induced
3 = No labour

30 Method of induction: 1 = Yes, 2 = No
A = Prostaglandin ☐
B = Artificial rupture of membranes ☐
C = Syntocinon ☐

31 Actual place of birth ☐
1 = Delivery Suite
2 = Midwife-led Unit (alongside)
3 = Midwife-led Unit (stand-alone)
4 = Home
5 = BBA

32 Gestation at birth (completed weeks) ☐☐

33 Analgesia used in labour: 1 = Yes, 2 = No
A = TENS ☐
B = Aromatherapy ☐
C = Water (birth pool/ bath/ shower) ☐
D = Entonox ☐
E = Opiates ☐
F = Epidural ☐
G = Spinal / Combined Spinal Epi ☐
H = None ☐
I = Other: ☐
_____
J = Not applicable (i.e. no labour) ☐

34 Length of 1st stage of labour (mins) ☐☐☐
(Not applicable = 0)

35 Length of 2nd stage of labour (mins) ☐☐☐
(Not applicable = 0)

36 Length of 3rd stage of labour (mins) ☐☐☐

37 Management of 3rd stage ☐
1 = Active
2 = Physiological
0 = Not applicable (i.e. CS)

38 Reason for elective / emergency CS / Instrumental birth: ☐☐
Please use options 1-12 as in question 17 and:
12 = Other:
_____
13 = Previous Caesarean section
0 = Not Applicable

39 Assessed in early labour? (i.e. <4cms) ☐
1 = Yes
2 = No
0 = Not applicable (i.e. el CS / IOL)

40 Admitted to hospital in early labour? ☐
1 = Yes
2 = No
0 = Not applicable (i.e. el CS / IOL)

41 Augmented in labour? ☐
1 = Artificial rupture of membranes
2 = Syntocinon
3 = Not augmented
0 = Not applicable (i.e. el CS / IOL)

42 IV access in labour? ☐
1 = Yes
2 = No
0 = Not applicable (i.e. elective CS) ☐

43 Type of fetal heart monitoring used in labour?
Record all used: 1 = Yes, 2 = No
A = Continuous CTG ☐
B = Intermittent CTG ☐
C = Intermittent auscultation ☐
D = None ☐
E = Not applicable (i.e. elective CS) ☐

44 Number of Midwives provided intrapartum care? ☐☐

Maternal postnatal complications

45 Estimated blood loss (mls) ☐☐☐☐

46 Perineal trauma: 1 = Yes, 2 = No
A = Intact perineum ☐
B = 1st degree tear ☐
C = 2nd degree tear ☐
D = 3rd degree tear ☐
E = 4th degree tear ☐
F = Labial lacerations ☐
G = Episiotomy ☐
H = Not applicable (i.e. CS) ☐

47 Uterine rupture? ☐
1 = Yes
2 = No

48 Hysterectomy? ☐
1 = Yes
2 = No

49 Placental complication? ☐
1 = Yes
2 = No

50 Infection (uterine, genital tract, wound)? ☐
1 = Yes
2 = No

51 Venous thrombo-embolism? ☐
1 = Yes
2 = No

52 Eclampsia? ☐
1 = Yes
2 = No

53 Bowel complications? ☐
1 = Yes
2 = No

54 Bladder complications? ☐
1 = Yes
2 = No

55 Maternal ITU admission? ☐
1 = Yes
2 = No

56 Maternal death? ☐
1 = Yes
2 = No

57 Length of postnatal hospital stay? (days) ☐☐☐

58 Hospital readmission for maternal complication? ☐
1 = Yes
2 = No

Neonatal outcomes and complications

59 Sex of baby: ☐
1 = Male
2 = Female
3 = Indeterminate

60 Weight of baby (grams): ☐☐☐☐

61 5 minute Apgar score: ☐☐

62 Birth trauma? ☐
1 = Yes
2 = No
Please specify: _____

63 Intrauterine death? ☐
1 = Yes
2 = No

64 NNU admission? ☐
1 = Yes
2 = No

65 If admitted to NNU, which PN day? ☐☐

66 Jaundice requiring treatment? ☐
1 = Yes
2 = No

67 Respiratory distress (grunting/ 'singing') ☐
1 = Yes
2 = No

68 Hypothermia requiring treatment? ☐
1 = Yes
2 = No

69 Breast feeding initiated? ☐
1 = Yes
2 = No

70 Breastfeeding exclusively at discharge from Midwifery care (community)? ☐
1 = Yes
2 = No

71 Neonatal death? ☐
1 = Yes
2 = No

Appendix 7: Methodological critique of three studies with relevance to this research

Knight et al (2014) aimed to investigate the demographic and obstetric factors associated with the uptake and success of vaginal birth following a previous CS. This is a clinically significant aim, as evidenced by the current research. The study population included all women aged 15-45 whose first birth resulted in a live, singleton born by CS and who had a second live birth within a specified time period. The main outcome under investigation, mode of birth, was clear, as was the method of data collection, the Hospital Episode Statistics (HES) database. Conducting a retrospective, cohort study to achieve this research aim is reasonable, as the data for the cohort of women to be included are already routinely collected, enabling the researchers to collect a large amount of data in a short amount of time (n=143,970).

The cohort included every woman from every NHS Trust in England that fit the inclusion criteria, within a specified period of time. Hence, there was limited potential for bias in the sample selection. However, there was the potential for bias in the sampling strategy, due to its reliance on a pre-existing database. Systemic or random errors can be inherent in such databases, especially those not designed for the research purpose (Cox et al, 2009). The inclusion and exclusion criteria appear reasonable, as the researchers planned to exclude all women who were clinically precluded from attempting VBAC during their second birth. Yet, due to use of the HES database to determine study eligibility, the inclusion and exclusion were based on presumptions about the clinical characteristics of the women within the database. Inclusion criteria included women between the ages of 15-45 years, and who have previously birthed by CS. Hence, women outside of this age range who may have birthed by CS were excluded. It is acknowledged that this may be a small group of women, however, as already discussed (section 2.1) the rate of women giving birth in later years is increasing (Office for National Statistics, 2000; 2013) and therefore a *clinically* significant proportion of women who may have given birth by CS before will be excluded from this research. Additionally, the accuracy of the sampling technique is reliant on the sensitivity of the HES database for correctly identifying women who

birthed by CS. The researchers acknowledge this and report high levels of internal consistency for mode of birth (Kappa=0.93, $p<0.001$). However, individual rates of sensitivity were not reported for each of the exclusion criteria, including diagnoses such as multiple birth and non-cephalic presentation. Therefore, women may have been erroneously included in the study and the reader has no information with which to judge the potential invalidity of the findings as a result of these errors. Individual characteristics that cannot be identified using a database such as this were not accounted for, such as clinician recommendation for mode of birth following the previous CS, obstructing fibroids and fetal anomaly. The researchers do point out the limitation that their study could not control for other important confounding factors, such as BMI and smoking status, and others that they do not mention, such as reason for previous CS, previous complications and birth weight. This detail was not available from the database and hence could not be accounted for.

The researchers found that white women of lower socioeconomic status had the highest rates of attempted VBAC. Younger women and women of white ethnicity had the highest success rates. They also found that women who previously had an emergency CS, especially those with a failed induction of labour, had lower VBAC success rates than those who did not (OR 0.59; 95% CI 0.53-0.67). Due to the limitations and inherent bias of this study, some of which are acknowledged by the researchers, the clinical application and use of these findings is limited. These limitations provide examples of the research design weaknesses that this current study was designed to avoid. Reliance on the Trust hospital database was rejected as a data collection strategy, despite the potential to be quicker, because of the fact that systemic errors may be frequent and uncontrollable and because not all of the relevant information required for this research is collected. Data errors may also exist with the case-notes; however, these were less likely as the surrounding narrative within clinical records often identifies such errors. This research aimed to compare OLAC and MLAC and also to generate theories about why any differences may exist. Therefore collection of important data regarding the operational differences between the two groups was part of the data collection plan, which could not be captured using the Trust database.

De Jonge et al (2013) conducted a retrospective cohort study to test the hypothesis that low-risk women at the onset of labour with a planned homebirth have higher rates of severe morbidity than women who plan hospital birth, and to compare rates of manual removal of placenta (MROP) and PPH in the Netherlands. The research aims are valid, as this is a clinically significant issue that could influence national policy and place of birth recommendations. The researchers utilised datasets from a previous study (the LEMMoN study; Zwart et al, 2008) and the national perinatal register. Again, this design enabled the collection of a lot of data from a large sample size (n=146,752). This was of particular importance in this study, as severe complications among low-risk women are rare, hence a large sample was required to elicit statistically significant results.

The study population was clear, including all women who were under 'primary care' at the onset of labour. In this healthcare context, to receive 'primary care' meant that the women must be of 'low-risk', all women with risk factors are referred to 'secondary care'. Exclusion criteria included women with prolonged rupture of membranes and those who had a 'medium risk status' recorded. The main outcome was a composite of severe maternal morbidity, including admission to ITU, HELLP syndrome, eclampsia, massive obstetric haemorrhage and uterine rupture. Secondary outcomes included PPH, MROP and other maternal safety outcomes. Confounders were identified and were appropriate to the research aims. These endpoints were identified using the national perinatal register and the dataset from the LEMMoN study. Again the data were collected from datasets that were not designed for record-keeping purposes or for the direct purposes of this study. Therefore, it is possible that information that would have strengthened the findings of this study were missed due to the scope of the database. Accuracy and errors may also have caused bias, indeed the researchers acknowledge the amount of missing data (4.2% of the main outcome) and the potential for inaccuracies in the datasets. The main limitation is that, although only women under 'primary care' were included, it is possible that there was an inherent difference in risk between the two groups. In addition to the subtleties of risk that may exist within the group of women that received 'primary care', there are also

psychological and emotional factors that may influence a woman's planned place of birth that cannot be accounted for by this research design.

The researchers also point out the fact that the information was based on women who gave birth in 2004-2006, which by the time this study was published was seven years old. Such a delay means that results may not be generalisable to contemporary clinical practice. However, based on their professional experience and knowledge, the researchers reassure us that maternity care has not substantially changed in this time and therefore the results still have validity.

This research demonstrated that women who plan homebirth have significantly less severe maternal morbidity, PPH and MROP than those who plan to birth in hospital. Despite the limitations of this research, these results have clinical significance as they relate directly to actual clinical practice. In this case, the retrospective design is a strength, as the main outcomes were not influenced by the research process itself. This consideration is also valid in this current research, as the fact that the groups being compared and the main outcomes in this research are not influenced by the research process means the findings depict the true clinical practice.

The Birthplace cohort study is a large, national, multicentre, prospective cohort study, designed to compare perinatal and maternal outcomes and interventions based on planned place of birth in England (Birthplace in England Collaborative Group, 2011). The study aimed to address a clearly focussed issue; whether the planned place of birth at the onset of labour affects perinatal and maternal outcomes. The population included women at low risk of complications at the onset of labour, giving birth in England. Women were classed as low-risk if they did not have any of the medical or obstetric risk factors listed in the NICE (NCCWCH, 2007) intrapartum care guidelines at the onset of labour. The outcomes under investigation were predefined; the main outcome was a composite of severe perinatal morbidity and secondary outcomes included maternal morbidity and obstetric intervention. The primary endpoints were identified to capture outcomes that may be related to the quality of intrapartum care received in each planned place of birth. As in this current research, a randomised

controlled trial may have been considered the gold standard. However, the policy of maternal choice for place of birth (DH, 2007; NCT, RCM, RCOG, 2007; NCCWCH, 2007; 2008) is well-established in England and to remove this choice for research purposes would be considered unethical. Therefore, a prospective cohort study was the most appropriate way to answer the aims of the research.

The Birthplace Study differs from this research, in that it was conducted prospectively. Every NHS Trust across England was invited to collect data for women whose planned place of birth was in a midwife-led environment (homebirth or midwife-led unit) and a random sample of Trusts were recruited to collect data on planned obstetric-led unit births using a pre-defined data-collection tool. The prospective design strengthens the findings of the study. This design was possible as women in England continue to have a choice of place of birth and the resources were available to recruit Trusts across England to complete the data collection tool for all women who fit the inclusion criteria, enabling a large sample size (n=64,538). As previously discussed (section 3.2), this was not possible within the constraints of this research, as the choice to receive OLAC for women who fit the inclusion criteria was no longer part of routine care. Therefore, inclusion into the OLAC group would have relied on women specifically requesting this type of care over MLAC meaning it would have taken a prohibitively long time to achieve the pre-specified sample size (section 3.4) and the research would have been significantly biased by self-selection. Additionally, as in this research, the data collection strategy meant that no patient identifying data needed to be collected, hence the Local Research Ethics Committee deemed that consent did not need to be gained from each woman involved in the study. In both the Birthplace study and this current research, this meant that a large sample could be used and the research was not biased by only including those who provided consent.

Unlike the two previous studies that have been discussed, the Birthplace study did not rely on a pre-existing database for data collection. It may have been possible to conduct the research using data from individual Trust obstetric databases, as the main inclusion and exclusion criteria and primary and secondary endpoints would generally have been recorded. However, important data that strengthened the findings of this research may have been missed. The data collection strategy included collection of

information about confounders that were then robustly analysed. For the same reason, this current study did not rely on data collection from a pre-existing database.

A limitation of the study is the composite primary endpoint. The composite outcome was required due to the thankful rarity of adverse perinatal outcome for this group of women. However, the researchers acknowledge that they cannot rule out the potential that this hides a difference in the severity of adverse perinatal outcome in each birth setting. They also acknowledge that the clinical implications of their findings may be affected due to the fact that the long-term prognoses of the elements of the composite outcome are uncertain. It is also a limitation that the design of the study meant that inherent differences in the groups of women cannot be controlled for, such as psychological and emotional reasons for selecting a particular birth environment. The potential for self-selection bias is clear. This criticism cannot be levelled at this research, as inclusion in the OLAC or MLAC group was dependant on the time in which the woman received her antenatal care, rather than her preferences.

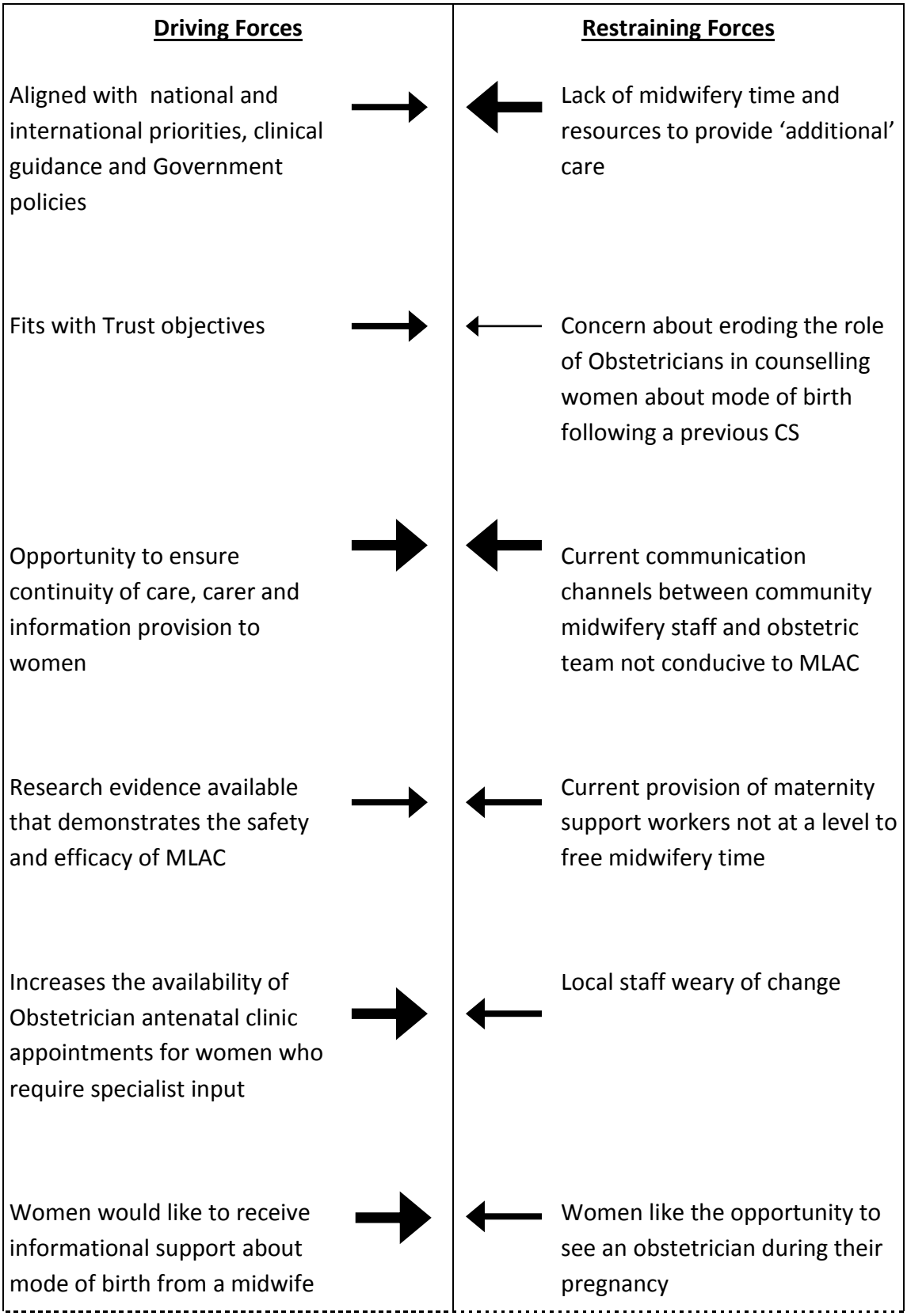
The Birthplace study found that adverse perinatal outcomes were uncommon in all birth environments and that obstetric intervention is more likely during planned birth in an obstetric unit. There was evidence to suggest that for primiparous women planning birth at home is associated with an increased risk of adverse perinatal outcome. These findings were important to strengthen the provision of choice of place of birth for all women at low-risk of complications at the onset of labour and to provide additional information to help women and health professionals in making that choice. The Birthplace study is similar to this current research in that it has used a cohort design to compare different modes of birth, based on the lead professional midwife or obstetrician.

Appendix 8: Change management theory

A 8.1 Force-field analysis

The discipline of identifying the driving and restraining forces within a project early on can assist the change process. Lewin (1951) first described the method of assessing the forces that maintain the current equilibrium of, for example, clinical practice (an example of a force-field analysis that could be applied to this project is shown in figure A8.1). The review process (section 6.4.4) advocated by the RCM (2011) constitutes a maternity specific force-field analysis. Wider thinking, using the experience and expertise of colleagues will enable change facilitators to add meaningful context to the review process. Working closely with local colleagues will ensure that the voices of those who will implement the change are heard in addition to developing a thorough understanding of the local practice context. Just as importantly, best practice can be shared and support elicited by engaging with regional and national multidisciplinary networks. Force-field analysis theory recognises that the current driving and restraining forces for change are dynamic, are in a state of imbalance, and assumes that the forces on each side can be influenced (Lorent et al, 2006). In order to make any positive, sustainable change, the current driving and restraining forces first need to be addressed and then rebalanced.

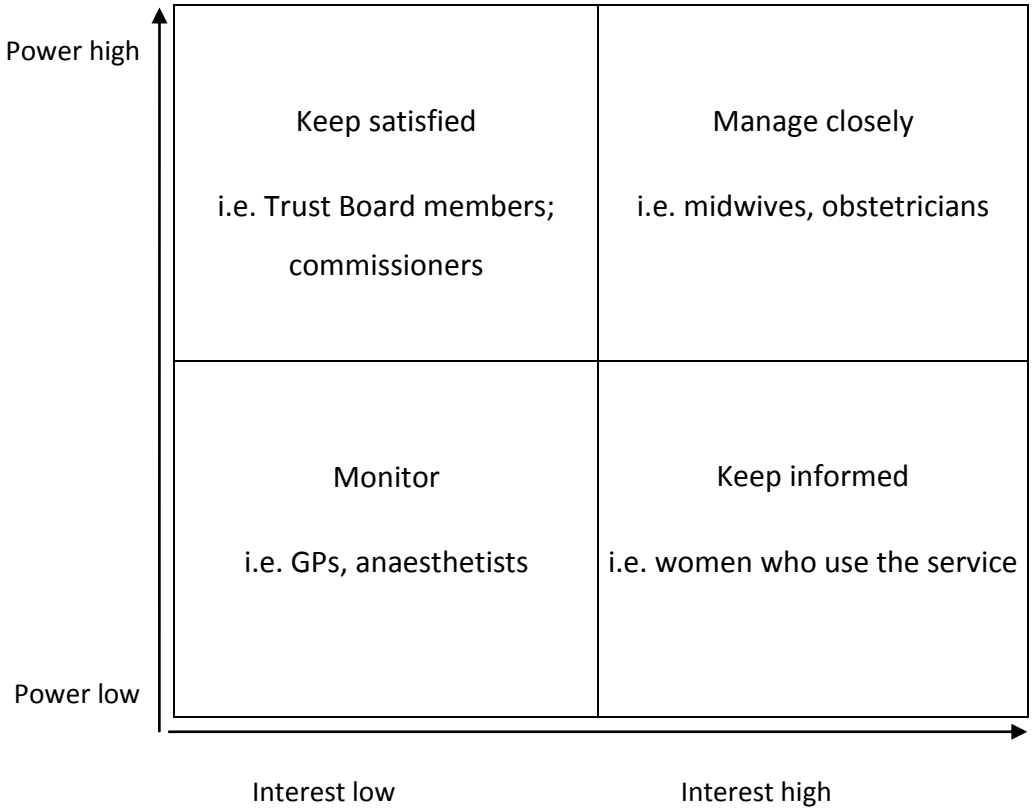
Figure A 8.1: An example of a force-field analysis for MLAC – the arrows demonstrate the direction of the force and can also denote the strength of force based on understanding of the local context.



A 8.2 Stakeholder analysis

Change is affected by people; therefore having a clear understanding of the people that will be impacted upon by the change is another essential element of the development process. A stake-holder analysis utilises a similar theory to that of the force-field analysis. Schmeer (1999) provides practical guidance for conducting a stakeholder analysis, defining the process as systematically gathering evidence to determine whose interests should be taken into account when developing or implementing a policy or programme. Again, this is detail that must be determined locally, as models of care and organisational structures vary; however, for the implementation of MLAC key stakeholders must at least include midwifery staff, managers, students, local educators and support staff; obstetricians and trainees; anaesthetists; local GPs, health visitors and commissioners; Trust Board members; and, most importantly, women who use the service. Once key members have been identified it is also important to establish the level of interest in and power over the development they will have (see example in figure A8.2). Those with significant influence over the development of maternity services and a high level of interest in the project should be closely involved; those with limited power and interest, but who remain key stakeholders, should be kept informed about what is happening. This will ensure that communication and involvement of important groups is appropriate. This background research will provide an essential framework around which change facilitators can base their development plan. The analysis should be revisited throughout the development process as groups and individuals may change their level of interest or influence as the project progresses.

Figure A 8.2: Adapted from NHS Institute for Innovation and Improvement (2008), including the stakeholders who may be in each category; however, this is something that should be determined locally.



Local knowledge of these groups and individuals will help the change facilitators answer important questions, including; what motivates this group, what information do they need, how much influence (financial / physical / emotional) will they have over this project, who influences their opinions?

A 8.3 Local opinion leader

Having carried out these essential first steps, anyone planning a change in practice such as implementation of MLAC will have a considerable amount of knowledge on which to base their development process. One important element is knowledge of who the opinion leaders are within the wider team. The status of 'opinion leader' is

not assigned due to an individual's role or job description; rather the position is earned and maintained by clinical competence, professional credibility, social acceptance and conformity with system norms (Flodgren et al, 2011). The influence of opinion leaders on the promotion of best practice, which in some cases involves a significant change in practice, is acknowledged in the literature (Flodgren et al, 2011). Research has focussed on the impact of opinion leaders within healthcare, with or without additional interventions, to initiate changes in practice. A recent Cochrane systematic review included 18 trials and demonstrated that the words and actions of opinion leaders from different professions within healthcare, with or without additional interventions (such as audit and feedback, formal meetings and local reminders) resulted in an overall performance improvement of 12% (Flodgren et al, 2011). An essential step for the implementation of a new initiative such as MLAC, following stakeholder analysis to identify opinion leaders is to enlist them as early as possible. This process helped to ensure the successful implementation of MLAC in the Trust where this research took place. Early in the development of the project, key members of midwifery staff, educationalists and obstetricians were involved and remained so throughout. As bastions of evidence-based care, consultant midwives and obstetricians should use the evidence from this research and future research into MLAC to appropriately champion such innovations.

A 8.4 Clinical guidelines

Clinical guidelines are considered to be a useful means of communicating best practice procedures to clinicians to ensure that healthcare users receive evidence-based care. Over two decades ago, the Institute of Medicine (1991) defined clinical guidelines as systematically identified recommendations to assist the professional in making clinical decisions in specific circumstances. This definition holds true today, as clinicians are expected to practice within the best available evidence or best practice (NMC, 2008), as should be defined within national and local guidance. MLAC was integrated into the VBAC clinical guideline within the Trust, during a multidisciplinary, evidence- and best practice-based guideline review and update. The guideline was then peer reviewed,

using the formal multidisciplinary review process. This ensured that any concerns within the multidisciplinary team were addressed at an early point within the development process. Once ratified, the guideline provided clarity about specific elements of MLAC; including which women were suitable for MLAC, the schedule of care, referral and request for consultation guidance, and clear information about procedures including arranging induction of labour and discussion with an obstetrician if this were required.

The efficacy of guidelines as an intervention to improve clinical practice was assessed in a systematic Cochrane review (Thomas et al, 1999). The 18 studies included in the review mainly concerned the practice of nurses. The review concluded that guideline-driven care can be effective in changing the process and outcome of care for professionals allied to medicine, such as midwives. Of note, the review included six studies where nurse-led management of specific conditions was compared with traditional physician-led care (Greenfield et al, 1975a; 1975b; 1976; Jewell and Hope 1988; Klassen et al, 1993; Zeler et al, 1992). This sub-set of studies has close links to this research, as in this case midwives have taken on a role that was previously delivered by obstetricians. In general there was found to be no significant difference in the performance of nurses compared with the performance of physicians, suggesting that the intervention (the guideline) was efficacious. This also adds weight to the previously discussed precedent of midwives extending their role and strengthens the argument for the inter-changeability of clinical roles, where appropriate and beneficial. The practice implication is that the use of guidelines to standardise and clarify new practice is an effective tool for changing practice, if implemented alongside other change management procedures.

Glossary

95% confidence interval	The confidence interval is used to indicate the reliability of an estimate (in this case the relative risk or odds ratio). 95% indicates that there is a 95% level of certainty that the true result lies within the quoted range.
Antenatal Care	The care of women by a health professional during the antenatal period. The National Institute of Health and Clinical Excellent (NICE) have guidelines outlining the evidence based recommended practice (National Collaborating Centre for Women's and Child Health, 2008).
Apgar score	A scoring system to assess the condition of the newborn, taking account of the newborn's colour, breathing rate, heart rate, response to stimuli and muscle tone.
Augmentation	Interventions such as artificial rupture of membranes or oxytocin intravenous infusion to enhance ineffective uterine contractions and speed up labour.
Bag and mask ventilation	Artificial inflation of newborn lungs, using a neonatal sized (500 ml) bag and facial mask. Used as part of neonatal resuscitation where intubation is not possible or is inappropriate.
Birth asphyxia	The fetus is deprived of adequate oxygenation whilst in utero; during labour, immediately prior to or just after delivery.
Breech presentation	Where the fetus enters the maternal pelvis with it's buttocks or feet first.
Caesarean section	A surgical procedure to deliver the baby through an incision made in the mother's abdomen and uterus.
Caesarean section rate	The percentage of babies born by Caesarean section, with the total number of babies born as the denominator. This includes elective and emergency Caesarean sections.
Caseloading midwife	A midwife who cares for a woman throughout her entire pregnancy, during labour and in the postnatal period. The midwife is on-call for unscheduled care. In this case, such care may be organised in 'teams', so that the woman receives her care from a small group of midwives.
Catecholamine	Catecholamines are hormones released by the body, such as adrenaline and noradrenaline, that prepare the body for physical activity.

Glossary

Cephalic	The baby's head presenting first in the maternal pelvis.
Chi-squared (χ^2) test	Statistical test comparing the counts of categorical data between independent groups.
Classical Caesarean section	Longitudinal uterine incision.
Dystocia	In this case, referring to a difficult labour where progress is less than optimal or there is no progress. 'Dystocia' may be the indication for an operative birth.
Eclampsia	Serious complication of pregnancy characterised by maternal fitting, hypertension, proteinurea and oedema. Eclampsia can be life-threatening for the mother and her unborn baby.
Elective repeat Caesarean section (ERCS)	A Caesarean section is chosen as the mode of delivery, where the previous Caesarean section is the only clinical indication.
External cephalic version	Manual manoeuvre to convert a breech (or other malpresentation) to cephalic.
Failure to progress	The reason given for operative birth where progress was considered too slow; now termed delay in the first or second stage of labour.
Haemorrhage	Excessive bleeding (see antepartum or postpartum haemorrhage).
HELLP syndrome	A severe complication of pre-eclampsia characterised by three elements: Haemolysis, elevated liver enzymes and low platelets.
Hypoglycaemia	Low blood sugar. Babies at risk of hypoglycaemia immediately after birth include those born to diabetic mothers, born prematurely and those of low birthweight.
Hypothermia	Low body temperature.
Index pregnancy	The pregnancy being studied.
Induction of labour	The process of starting labour artificially, either by medical (usually vaginal prostaglandin administration or synthetic oxytocin) or mechanical (usually artificially rupturing the membranes) means.
Intubation	Introduction of a tube, in this case an endotracheal tube to the trachea to enable artificial inflation of the lungs as part of neonatal resuscitation or for on-going airway management of the sick newborn.
Logistic regression	Logistic regression measures the relationship between a categorical dependent variable and one or more

	independent variables, which are usually (but not necessarily) continuous, by using probability scores as the predicted values of the dependent variable.
Lower segment Caesarean section (LSCS)	A Caesarean section where the incision is made in the lower segment of the uterus. This type of Caesarean section is routinely performed in developed countries when the gestation of that pregnancy has progressed past the time when the lower segment forms (about 24 weeks), unless there is a contraindication to this type of incision.
Manual removal of placenta	Where delivery of the placenta is not achieved following either 'physiological-' or 'active-management' so removal of the placenta using a sterile, gloved hand under local or general anaesthetic is required.
Mat B1 certificate	Certificate provided by a doctor or midwife to the woman, confirming the estimated due date. This certificate must be presented to claim maternity benefits.
Maternal mortality	Death of the mother during pregnancy or childbirth, or within 42 days of the end of pregnancy (WHO definition).
Maternal request Caesarean section	Where the Caesarean section is planned at the request of the mother, with no clinical indication. In this case, psychological indications, such as fear of childbirth, are included in the definition of 'maternal request'.
Neonatal encephalopathy	Damage to the brain, which may be caused by hypoxia during childbirth.
Neonate	Newborn child, up to four weeks old.
Peri-mortem Caesarean	Caesarean section performed at or around the time of maternal death. This is carried out to improve the chances of maternal resuscitation or to save the neonate.
Perinatal death	Death of the fetus (from 24 weeks gestation) or baby (from birth to 28 days old).
Perineal trauma	Trauma to the perineum caused during vaginal childbirth. Trauma may be spontaneous tearing or iatrogenic, caused by an episiotomy. The trauma is classified as: First degree – involving only the skin Second degree – involving skin and perineal muscles Third degree – 3a: involving skin, perineal muscle including the <50% of the thickness of the external anal sphincter 3b: as above including >50% of the thickness of the external anal sphincter 3c: as above including trauma to the internal anal sphincter Fourth degree – as above and including trauma to the anal

	mucosa.
Peripartum hysterectomy / Hysterectomy	Removal of the uterus as a life-saving procedure around the time of, or related to, giving birth. The rationale for performing a hysterectomy is to stop massive obstetric haemorrhage (blood loss) that is unresponsive to other measures.
Peripheral nerve damage	Nerve damage caused (in this case) by a traumatic delivery, such as shoulder dystocia. Types include Erb's palsy, caused by damage to the brachial plexus.
Placental abruption	Where the placenta separates from the wall of the uterus prior to the birth of the baby. This can lead to massive maternal blood loss and the death of the baby.
Placenta accreta	The placenta is adhered abnormally deeply through the endometrium and myometrium of the uterus. Further types of abnormal placentation include placenta increta (where the placenta penetrates further into the myometrium) and placenta percreta (where the placenta penetrates the entire myometrium, serosa and may also invade adjoining organs)
Placenta praevia	The placenta lies partly or wholly in the lower segment of the uterus. The classifications range from the placenta encroaching on the lower segment to the placenta totally covering the internal opening of the cervix.
Postpartum haemorrhage (PPH)	Excessive bleeding after the birth of the baby, up to 6 weeks. Defined as blood loss over 500 mls or any amount that is detrimental to the health of the mother.
Pre-eclampsia	Characterised by maternal hypertension, proteinurea and oedema. In severe cases can be a pre-curser to eclampsia.
Presumed (or suspected) fetal compromise	Where the fetal heart rate pattern or fetal blood sampling results indicates that there is fetal hypoxia and that immediate delivery is required.
Primary Caesarean	The first Caesarean birth for the woman.
Relative risk	The ratio of the probability of an event occurring in an exposed group to the probability of the event occurring in a comparison, non-exposed group.
Respiratory morbidity	In this report, this relates to neonatal respiratory morbidity. This definition includes a number of conditions affecting the neonate's ability to breathe soon after birth. Including, transient tachypnoea of the newborn (TTN) which presents as a fast breathing rate, in order for the neonatal to receive adequate oxygenation, in the absence

	of infection.
Shoulder dystocia	An obstetric emergency, when the baby's shoulder becomes impacted behind the maternal symphysis pubis, following delivery of the head. Without prompt action from a health professional to release the shoulder, the neonate will suffer hypoxia.
Stillbirth	A baby born dead, after the age of viability (after 24 weeks).
Subdural haemorrhage	Bleeding under the dura mater, a form of intracranial or intracerebral haemorrhage seen in the neonate as the result of a traumatic delivery
Synthetic oxytocin	Oxytocin is a hormone that is released by the pituitary gland and is at its peak during childbirth. In addition to eliciting certain emotional and behavioural changes, oxytocin also stimulates uterine contractions. Synthetic oxytocin (branded in the UK as Syntocinon) is administered via intravenous infusion to stimulate uterine contractions, when labour is induced or augmented.
Trainee	In this case, a healthcare professional training to become a consultant. In this thesis this refers to trainee obstetric consultants or trainee consultant midwives.
Transient tachypnoea of the newborn	Abnormally rapid breathing rate in the newborn, which resolves with treatment. This is a common form of respiratory morbidity.
Ureteric injury	Iatrogenic injury to the ureter(s), in this case caused during surgery.
Uterine rupture	Rupture of the uterine muscle. This can be complete, involving the full thickness of the uterine wall and pelvic peritoneum, or partial, involving some of the myometrium. It is usually associated with pain, blood loss, maternal shock and fetal compromise, but in some circumstances can occur with minimal signs and symptoms.
Vaginal birth	This definition includes operative vaginal birth (ventouse or forceps birth).
Vaginal birth after Caesarean section (VBAC) - Actual VBAC rate - Intended VBAC	Birthing vaginally following a previous Caesarean section. This used to be termed Trial of Labour. Rates explained: - Percentage of group of women with a previous CS who gave birth by VBAC - Percentage of group of women with a previous CS who planned birth by VBAC

Glossary

- Successful VBAC	- Percentage of those who planned birth by VBAC who actually gave birth by VBAC
Venous thromboembolism / Thromboembolism	A blood clot formed in the deep veins, often in the calf, femoral or iliac veins. Untreated, the clot may break away and be carried into the pulmonary artery (a pulmonary embolism), which is a medical emergency.

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