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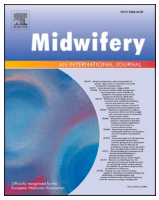

Review Article

Birth outcomes for women planning Vaginal Birth after Caesarean (VBAC) in midwifery led settings: A systematic review and meta-analysis

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ABSTRACT

Problem: There is a limited knowledge base available to midwives, obstetricians and women planning vaginal birth after caesarean (VBAC), impeding their ability to make informed choices regarding planned place of birth.
Background: A VBAC is associated with fewer complications for both mother and baby, but little is known on the safety and success of planning a VBAC in midwifery led settings such as birth centres and home birth, compared to obstetric led settings.
Aim: To synthesise the findings of published studies regarding maternal and neonatal outcomes with planned VBAC in midwifery setting compared to obstetric units.
Methods: PubMed, EMBASE, CINAHL complete, Maternity and Infant Care, PsycINFO, and Science Citation Index databases were systematically searched on 16/08/2022 for all quantitative research on the outcomes for women planning VBAC in midwifery led settings compared to obstetric led settings in high income countries. Included studies were quality assessed using the CASP Checklist. Binary outcomes are incorporated into pairwise meta-analyses, effect sizes reported as risk ratios with 95 % confidence intervals. A τ^2 estimate of between-study variance was performed for each binary outcome analysis. Other, more heterogeneous outcomes are narratively reported.
Findings: Two high-quality studies, out of 420 articles, were included. VBAC planned in a midwifery-led setting was associated with a statistically significant increase in unassisted vaginal birth (RR=1.42 95 % CI 1.37 to 1.48) and decrease in emergency caesarean section (RR= 0.46 95 % CI 0.39 to 0.56) and instrumental birth (RR= 0.33 95 % CI 0.23 to 0.47) compared with planned VBAC in an obstetric setting. There were no significant differences in uterine rupture (RR= 1.03 95 % CI 0.52 to 2.07), admission to special care nursery (RR= 0.71 95 % CI 0.47 to 1.23) or Apgar score of 7 or less at 5 min (RR= 1.16 95 % CI 0.66 to 2.03).
Conclusion: Planning VBAC in midwifery led settings is associated with increased vaginal birth and a reduction in interventions such as instrumental birth and caesarean section. Adverse perinatal outcomes are rare, and further research is required to draw conclusions on these risks.

Introduction

Across the globe caesarean section rates are rising with no associated reduction in maternal or infant morbidity or mortality (Betran et al., 2021). There is an increasing knowledge base of the short- and long-term risks associated with caesarean section (Sandall et al., 2018). Many of these risks increase with each caesarean section a woman has (J.M. Dodd et al., 2013). Therefore, one approach to improving maternal and infant outcomes is to offer women the choice of a vaginal birth after caesarean (VBAC), defined as a vaginal delivery following a previous caesarean section in a former pregnancy. Although the evidence base is limited (J.M. Dodd et al., 2013) there is a consensus that successful VBAC is both cost effective and associated with fewer complications for both mother and baby (J.M. Birth after Previous Caesarean Birth)

Midwifery led settings, such as home and birth centres, are associated with improved outcomes and experience for women with low-risk pregnancies (A. Reitsma et al., 2020; E.K. Hutton et al., 2019; P. Brocklehurst et al., 2011), however little is known of their safety for women with a previous caesarean section. A literature review in 2013 (Rimkoute and South, 2013) examined VBAC in birth centres and

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concluded that there was a higher rate of successful VBAC, and the risk of adverse outcomes was not increased. However, at the time of this review there were no studies comparing VBAC safety in obstetric units (OU) with midwifery led care, so the available results are descriptive. A year later a review by L. Beckmann et al. (2014) examined women planning VBAC in out of hospital environments. The review included five studies and concluded that women with one previous caesarean section, with no other risk factors may be suitable for birth centre care, providing there is an OU in close proximity for swift transfer. Again, the included studies lacked comparison to obstetric led units. The authors recommended further research with similar methodical measures and larger sample sizes to expand the data to enable clinical recommendations. Since then, a US based cohort study (E.L. Tilden et al., 2017) examined neonatal outcomes for women completing a VBAC in out of hospital settings compared to hospital settings. Neonates born in the out of hospital settings were over 8 times more likely to have neonatal seizures and almost twice as likely to have lower Apgar scores compared with those born in hospital settings. However, the study is limited in that data were collated from completed births, rather than planned place of birth. This could affect outcomes, as we are unable to differentiate between planned homebirths and babies born before arrival (BBAs). BBAs are associated with greater risk to both mother and baby (Unterscheider et al., 2011; Thornton and Dahlen, 2018). Another limitation that the authors recognise is that in some US states, midwives are unregulated and therefore may not practice within approved guidelines, have accredited education, or be well integrated with obstetric units, which may impact on adverse outcomes (E.K. Hutton et al., 2019). This is the case for several other US based studies exploring VBAC outcomes in out of hospital settings where the certification of the nurse midwife is not reported or reported as a small percentage (Cheyney et al., 2014; K.J. Cox et al., 2015; A. Grünebaum et al., 2017). As stipulated in the inclusion criteria for this review, studies would only be included if care was provided by regulated midwives. These findings may not be generalised to areas where midwives are regulated and certified. The inconsistency in findings between these US based studies, and the limitations identified warrants a comprehensive systematic review to provide robust evidence of the overall association for pregnant women, clinicians, and policy makers. Bridging this knowledge gap will enable women with a previous caesarean section to make an informed decision about where they plan to give birth.

Aim and objectives

To conduct a systematic review of quantitative studies to answer the following questions:

1. Does planning a VBAC in a midwifery led setting improve the chances of an unassisted (spontaneous) vaginal birth?
2. Are there differences in maternal and neonatal outcomes with planned VBAC in midwifery setting compared to obstetric units?

   Are there any known risks associated with planning VBAC in a midwifery led setting?

Methods

The protocol for this review was registered with the international prospective register of systematic reviews (PROSPERO) ID: CRD42022331285, 18th May 2022. The review is reported using the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines (PRISMA 2020).

Search strategy

Literature search strategies were developed using medical subject headings (MeSH) and text words related to vaginal birth after caesarean section and midwifery led care. To gain knowledge of free text terms and to ensure what MeSH were used in other databases initial scoping and screening searches were carried out. PubMed, EMBASE, CINAHL complete, Maternity and Infant Care, PsycINFO, and Science Citation Index databases were searched from their inception dates to 16th August 2022. The inclusion criteria stipulated studies published in peer reviews journals to be included in the review.

A hand search of the bibliographies and reference lists of the included studies was undertaken as well as JBI and other systematic reviews.

To ensure breadth of knowledge of the subject relevant websites, national and international reports, guidelines, dissertations, thesis and grey literature (e.g., Pubmed, Google Scholar, Scopus), the ISRCTN registry, PROSPERO, Cochrane and the Australian and New Zealand Clinical Trials Registry were searched.

The included studies for the review met the inclusion criteria as stated below. Supplementary file 1 details the search strategy including the PICO table and facet analysis.

Non-English language studies were excluded as both reviewers are only fluent in English and resources did not permit to source translation. Studies were only included from high income (HIC) counties as infrastructure and population needs differ so widely between HIC and LMIC that it is useful to separate them to ensure homogeneity of the findings, and thus ensure the results are transferable to other similar populations (Greenhalgh, 2019). See Table 1 for inclusion criteria.

Study selection

Retrieved citations were imported from reference manager Mendeley to review manager software Covidence (Covidence - Better systematic review management). Two review authors independently screened the title and abstracts of all imported citations, forwarding potentially eligible papers for full text review. They independently assessed full text articles against the review's inclusion criteria specified in the Prospero protocol. Any discrepancies were resolved following discussion.

Outcomes

A core outcome set for studies on VBAC is currently inconsistent (Leow et al., 2021). For the purposes of this review, the research team pre-specified important outcomes based on clinical knowledge, outcomes commonly reported in recent studies, and outcomes that were identified as meaningful to women and health care professionals (HCP) through service user and stakeholder engagement.

The primary outcome of the review was unassisted vaginal birth (defined as vaginal birth that did not require instruments).

Secondary outcomes included:

Maternal:

- Intrapartum transfer to OU (during or immediately after birth)
- Emergency caesarean section (unplanned caesarean section)
- Uterine rupture
- Instrumental birth
- Significant postpartum haemorrhage (defined as requiring a blood transfusion)
- Obstetric anal sphincter injury

Neonatal:

- Admission to neonatal unit or special care nursery
- Apgars of 7 or less at 5 min
- Hypoxic ischemic encephalopathy
- Perinatal loss at term (37–42 weeks) stillbirth and neonatal death (up to 28 days)

Table 1
Inclusion and exclusion criteria.

Inclusion Criteria
• Quantitative studies comparing planned VBAC outcomes in midwifery led settings to obstetric led settings • English language • Human participants • Full text articles • Published in peer reviewed journals • High income counties (HIC) • Settings where midwives can practice legally and are regulated

Quality assessment

Included studies were quality assessed by two reviewers using the Critical Appraisal Skills Programme Quality assessment tool for cohort studies (Creative Commons Licence - CASP - Critical Appraisal Skills Programme). Studies were assessed against ten questions in which validity, relevance and results were evaluated as either low, moderate or high risk of bias.

Data extraction and analysis

The two reviewers independently extracted data from each included study and checked for accuracy using a pre-specified data extraction tool in the Covidence software. On review of the final included studies, a

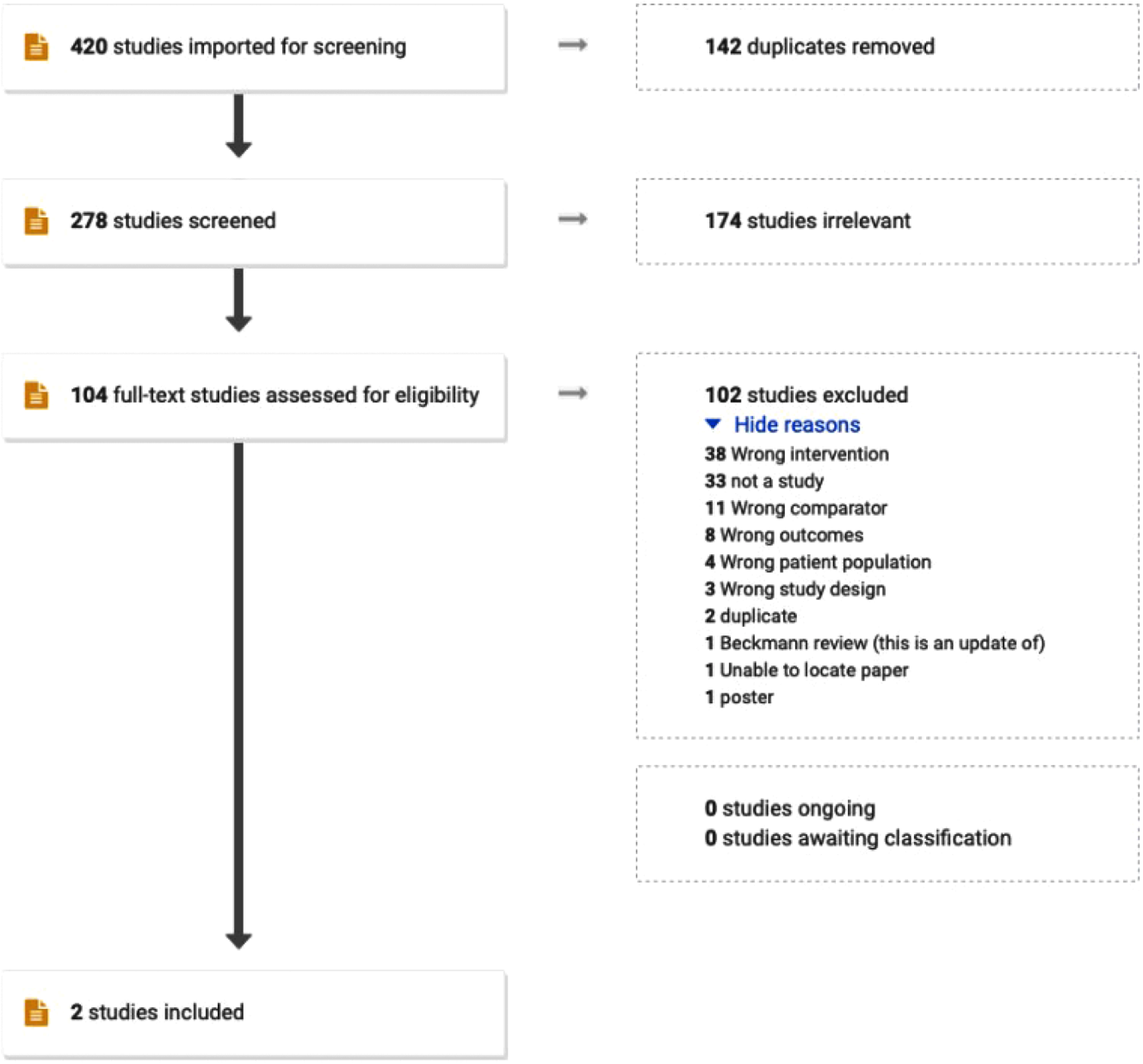

Fig. 1. PRIMSA Diagram.

decision was made as to whether meta-analysis was possible. As studies were similar in participant demographics and estimated similar quantities, a fixed-effect meta-analysis was performed (Chapter 10). This was completed using the Review manager 5.4 (Revman) software and forest plots were generated. Dichotomous data were summarized using risk ratios (RR) and 95 % confidence intervals (CI). Outcomes measures from individual studies were combined using a random effect model to improve statistical properties when the event is uncommon (Higgins and Thomas, 2022). Statistical heterogeneity was assessed using I^2.

Results

The search generated 420 references imported for screening. Removing 142 duplicates left278 studies to be screened against title and abstract, following which, 174 studies excluded. The remaining 103 studies were assessed for full-text eligibility, 101 studies were excluded as they did not meet the PICO criteria described in Supplementary file 1. See Fig. 1 for the search Prisma diagram and reasons for exclusion.

Quality of the studies

The two included studies (H. Bayrampour et al., 2021; R. Rowe et al., 2016) were judged as high quality using the CASP assessment toolsee Table 2.

Characteristics of the included studies

For the two included studies (H. Bayrampour et al., 2021; R. Rowe et al., 2016), the midwifery led setting was planned homebirth. The comparator was obstetric led setting. Both studies were cohort studies. Rowe et al's (R. Rowe et al., 2016) a prospective cohort study of women planning home VBAC in the United Kingdom, and Bayrampour et al's (H. Bayrampour et al., 2021) a retrospective cohort of women planning home VBAC in British Colombia, Canada. Participants of both studies were similar in characteristics, bar the exceptions described below. The studies both have confounding factors that may be significant. Bayrampour does not include ethnicity, which can have an impact on outcomes (Knight et al.), and neither study has information on indication for previous caesarean section that could influence chance of VBAC success (Knight et al., 2014). See Table 3 for characteristics of the included studies and their participants.

Outcomes

Of the two included studies, meta-analysis was appropriate for five outcomes: unassisted vaginal birth (primary outcome), emergency caesarean section, uterine rupture, instrumental birth, and admission to a neonatal unit (special care nursery). Because these studies had relatively small sample sizes and number of events, a fixed effect meta-analysis was performed (Higgins and Thomas, 2022). Due to a lack of consistency in measuring, transfer to obstetric unit, significant postpartum haemorrhage, obstetric anal sphincter injury, hypoxic ischaemic encephalopathy and perinatal deaths are reported narratively.

Primary outcome

Unassisted vaginal birth

R. Rowe et al. (2016) reported vaginal birth to also include instrumental birth, therefore the authors of this review removed the instrumental birth from the total to calculate this outcome. The analysis adjusted for maternal age, ethnic group, understanding of English, marital/partner status, BMI in pregnancy, index of multiple deprivation score quintile, gestation at delivery, and parity. R. Rowe et al. (2016) separated all women planning VBAC and women planning VBAC with no additional risk factors. Subgroups of these included P1 and P2+ women. All groups had increased vaginal birth rates, this includes

Table 2
CASP quality assessment.

Quality Assessment	Rowe, R., Li, Y., Knight, M., Brocklehurst, P. and Hollowell, J., 2016. Maternal and perinatal outcomes in women planning vaginal birth after caesarean (VBAC) at home in England: secondary analysis of the Birthplace national prospective cohort study. *BJOG: An International Journal of Obstetrics & Gynaecology, 123*(7), pp.1123–1132. (H. Bayrampour et al., 2021)	Bayrampour, H., Lisonkova, S., Tamana, S., Wines, J., Vedam, S. and Janssen, P., 2021. Perinatal outcomes of planned home birth after cesarean and planned hospital vaginal birth after cesarean at term gestation in British Columbia, Canada: a retrospective population-based cohort study. *Birth, 48*(3), pp.301–308.
Addresses a clearly focused issue		
Cohort recruited in acceptable way		
Exposure accurately measured to minimise bias		
Outcome accurately measured to minimise bias		
Authors identifies all important confounding factors		
Have they taken account of confounding factors in design/analysis		
Follow up of subjects complete		
Follow up of subjects long enough		
Do you believe the results		
Can the results be applied to the population		
Do the results fit with other available evidence		
What are the bottom-line results (No judgement)	*Planned VBAC at home was associated with a statistically significant increase in the chances of having a vaginal birth compared with planned VBAC in an OU (adjusted relative risk1.15, 95 % confidence interval 1.06–1.24). The risk of an adverse maternal outcome was around 2–3 % in both settings, with a similar risk of an adverse neonatal outcome. Transfer rates were high (37 %) and varied markedly by parity (para 1, 56.7 %* versus *para 2+, 24.6 %)*	*Home births for those eligible for VBACs and attended by registered midwives within an integrated health system were associated with higher vaginal birth rates compared with planned hospital VBACs. Severe adverse outcomes were relatively rare in both settings. Can aid pregnant people when deciding on place of birth*
Reported rate or proportion between exposed/unexposed and risk ratio (No judgement)	*yes, relative risks reported*	*Yes, ODs ratio's and adjusted odds ratios for each group reported*
How strong is the association between exposure and outcome (No judgement)	*Adjusted RR 1.15*	*OR=0.61*
Absolute risk reduction (No judgement)	*For primary outcome Vaginal birth: Int (Home VBAC): 182/209= 0.87 Control (Hospital VBAC): 853/*	*For primary outcome C/S: Int (Home VBAC): 79/ 561= 0.14 Control (Hospital VBAC): 1275/*

(continued on next page)

Table 2 (*continued*)

Quality Assessment	Rowe, R., Li, Y., Knight, M., Brocklehurst, P. and Hollowell, J., 2016. Maternal and perinatal outcomes in women planning vaginal birth after caesarean (VBAC) at home in England: secondary analysis of the Birthplace national prospective cohort study. *BJOG: An International Journal of Obstetrics & Gynaecology, 123*(7), pp.1123–1132. (H. Bayrampour et al., 2021)	Bayrampour, H., Lisonkova, S., Tamana, S., Wines, J., Vedam, S. and Janssen, P., 2021. Perinatal outcomes of planned home birth after cesarean and planned hospital vaginal birth after cesarean at term gestation in British Columbia, Canada: a retrospective population-based cohort study. *Birth, 48*(3), pp.301–308.
	1227= 0.69 (baseline risk) −0.87 (absolute risk)= 0.16 Women in control group were 18 % more likely to have a vaginal birth compared to those in the control group	*4180= 0.30 0.30 (baseline risk) −0.14 (absolute risk)= 0.16 Women in control group were 16 % less likely to have a cs compared to those in the control group*
How precise are the results (No judgement)	*Adjusted 95 % CI 1.06–1.24*	*95 % CI for aOR 0.47–0.79*
What are the implications of the study (No judgement)	*Women in the cohort who planned VBAC at home had an increased chance of a vaginal birth compared with those planning VBAC in an OU, but transfer rates were high, particularly for women with only one previous birth, and the risk of an adverse maternal or perinatal outcome was around 2–3 %. No change in guidance can be recommended.*	*Can aid pregnant people when deciding on place of birth*

Key: YES, CAN'T TELL, NO.

instrumental birth and unassisted birth (RR 1.27 CI 1.18 to 1.36). H. Bayrampour et al. (2021) reported unplanned caesarean section and instrumental birth, therefore unassisted vaginal birth was calculated by the authors of this review. Analysis of the unadjusted outcomes found increased unassisted vaginal birth in the midwifery led setting (RR = 1.42 95 % CI 1.37 to 1.48; $P < 0.00001$ I^2=68 %). The I^2 may indicate statistical heterogeneity, however as there are only two studies this has uncertain value (Higgins and Thomas, 2022) (Fig. 2).

Secondary outcomes.

Emergency caesarean section

Both studies (H. Bayrampour et al., 2021; R. Rowe et al., 2016) reported unplanned or emergency caesarean sections (having both excluded caesaraean section prior to the start of labour). The analysis found a statistically significant decreased caesarean section rate for women planning VBAC in the midwifery led setting (RR= 0.46 95 % CI 0.39 to 0.56; $P < 0.00001$ I^2= 0 %) (Fig. 3).

Uterine rupture

There were no significant differences in this relatively rare event. Rowe et al. 's (R. Rowe et al., 2016) study had one uterine rupture in the midwifery led setting of 209 women and 3 in the obstetric led setting of 1227 women. Bayrampour et al's (H. Bayrampour et al., 2021) study reported 8 uterine rupture events in the midwifery led setting of 561 women and 61 in the obstetric setting of 4180 women. Both resulted in wide confidence intervals. The meta-analysis was statistically insignificant (RR= 1.03 95 % CI 0.52 to 2.07.; $P = 0.93$ I^2= 0 %) (Fig. 4).

Table 3
Included studies.

	Rowe et 2015 (R. Rowe et al., 2016)	H. Bayrampour et al. (2021)
Authors	R Rowe, Y Li, P Brocklehusrt, J Hollowell	H Bayrampour, S Lisonkova, S Tamana J Wines, S Vedam, P Janssen
Article title	Maternal and perinatal outcomes in women planning vaginal birth after caesarean (VBAC) at home in England: a secondary analysis of the Birthplace national prospective cohort study.	Perinatal outcomes of planned home birth after caesarean and planned hospital vaginal birth after caesarean at term gestation in British Columbia, Canada: A retrospective population-based cohort study.
Date of publication	23 July 2015	24 January 2021
Study period	April 2008- April 2010	April 2000-March 2017
County of Origin	England	Canada
Source of funding	Policy Research Programme. Department of Health	Stollery Midwifery Research Initiative, UBC Midwifery
Aim/objectives	To compare vaginal birth rates in women planning vaginal birth after caesarean (VBAC) at home versus in an obstetric unit (OU) and explore transfer rates in women planning home VBAC.	To determine whether the mode of delivery and maternal and neonatal outcomes differ between planned home VBAC (HBAC) and planned hospital VBAC
Study design	Prospective cohort study	Retrospective cohort study
Inclusion criteria	Planned a vaginal birth and received care by an NHS midwife during established labour	Midwifery clients with at least one prior caesarean section. Eligible for VBAC
Exclusion criteria	Caesarean section before labour	Elective caesarean birth
	Preterm < 37 weeks gestation	Caesarean birth before labour
	Multiple pregnancy	Preterm labour <37 weeks gestation
	Unplanned homebirth	Gestation > 43 weeks
	Induction of labour	Unplanned homebirths
	Stillbirth before labour	Stillbirth before labour
Recruitment procedures	Study specific data collection form completed by midwives. 85 % response rate	Data collected from British Colombia Perinatal Data Registry (BCPDR)
Intervention	Homebirth	Homebirth
Control	Obstetric unit	Hospital
Number of participants included	1436	4741
	1227 planned OU	4180 planned hospital
	209 planned homebirth	561 planned homebirth
Summary of data outcome	Dichotomous	Dichotomous
Study analysis	Risk ratio	Odds Ratio

(*continued on next page*)

Table 3 (*continued*)

Maternal Characteristics	Rowe 2016 (R. Rowe et al., 2016)		Bayrampour 2021 (H. Bayrampour et al., 2021)	
	Midwifery led *n* = 209 (%)	Obstetric led *n* = 1227 (%)	Midwifery led *n* = 561 (%)	Obstetric led *n* = 4180 (%)
Maternal Characteristics	Rowe 2016 (R. Rowe et al., 2016)		Bayrampour 2021 (H. Bayrampour et al., 2021)	
	Midwifery led *n* = 209 (%)	Obstetric led *n* = 1227 (%)	Midwifery led *n* = 561 (%)	Obstetric led *n* = 4180 (%)
One previous caesarean section	NR	NR	544 (97)	4065 (97.1)
Previous vaginal birth	NR	NR	252 (45)	871 (21)
Parity ≥ 2	122 (58)	440 (35)	NR	NR
Pre-existing medical conditions	8 (4)	104 (8)	11 (2)	238 (5.7)
Pregnancy complications	13 (6)	134 (11)	138 (25)	1349(31.3)
Adverse reproductive history	16 (8)	77 (6)	201 (36)	1325 (32)
BMI ≥ 30	23 (11)	252 (20)	47 (8.4)	462 (11.1)
Ethnicity (non-white)	18 (7.6)	347 (31.4)	NR	NR
IMD quintiles 1 (least deprived)	43 (21.4)	206 (15.6)	NR	NR
2	45 (20.8)	206(15.6)	NR	NR
3	39 (19.0)	216 (17.0)	NR	NR
4	38 (18.5)	222 (18.5)	NR	NR
5 (most deprived)	44 (20.30	365 (33.0)	NR	NR
Substance use	1 (0.5)	6 (0.4)	20 (3.6)	170 (4.1)
Mental health	NR	NR	139 (25)	941 (22.5)
Maternal age ≥ 35	98 (47)	354 (29)	196 (35)	1400 (33.5)

Instrumental birth

Both included studies (H. Bayrampour et al., 2021; R. Rowe et al., 2016) found a statistically significant reduction in instrumental birth. The analysis of this event found a statistically significant reduction for instrumental birth in the midwifery led settings compared to OU setting (RR= 0.33 95 % CI 0.23 to 0.47; $P = 0.90$ I^2= 0 %) (Fig. 5).

Admission to special care nursery

Meta-analysis of this outcome demonstrated no statistically significant difference (RR= 0.71 95 % CI 0.47 to 1.23; $P = 0.26$ I^2= 50 %) (Fig. 6).

Apgar Score of 7 or less

Meta analysis of this outcome demonstrated no statistically significant difference ((RR= 1.16 95 % CI 0.66 to 2.03; $P = 0.61$ I^2= 0 %) (Fig. 7).

Narratively reported outcomes

Intrapartum transfer

The overall intrapartum transfer rate in Rowe et al's (R. Rowe et al., 2016) study was 39.2 %, though it was higher for women planning VBAC in their second pregnancy (58 %) than for those planning VBAC in their third or subsequent pregnancies (24.6 %). This outcome was not reported in Bayrampour et al's (H. Bayrampour et al., 2021) study.

Significant PPH

The authors of this review defined significant postpartum haemorrhage as a blood loss requiring transfusion. Rowe et al. (R. Rowe et al., 2016) report a composite outcome of 'maternal blood transfusion or maternal admission to higher level care' compared to OUs that was not statistically significant (RR= 1.05 95 % CI 0.49 to 2.26). Bayrampour et al. (H. Bayrampour et al., 2021) report 'third stage haemorrhage' (OR=0.66 95 % CI 0.26 to 1.66) and 'any postpartum haemorrhage' (OR=0.86 95 % CI 0.62 to 1.19) however, the authors do not define this. Neither of these reported outcomes were statistically significant.

Obstetric anal sphincter injury

Neither study report this as a separate outcome. Rowe et al. (2016) does not include any data on obstetric anal sphincter injury and Bayrampour et al. (2021) report the composite outcome of 'obstetric trauma' including: third or fourth-degree tears, cervical tears, high vaginal tears, uterine rupture/dehiscence or inversion, pelvic haematoma, organ damage or joint and ligament damage at delivery. The authors report this as 6.6 % and 11.8% for midwifery led settings and obstetric settings respectively.

Hypoxic Ischaemic encephalopathy

Rowe et al. (2016) report 1 such event in the obstetric led setting. Bayrampour et al. (2021) do not include this in their adverse neonatal

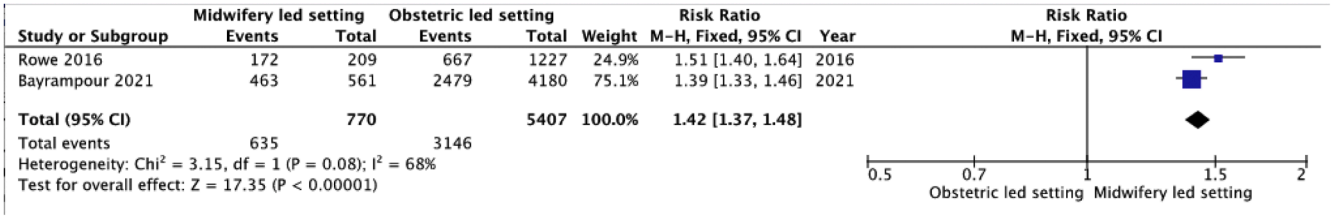

Fig. 2. Unassisted vaginal birth forest plot.

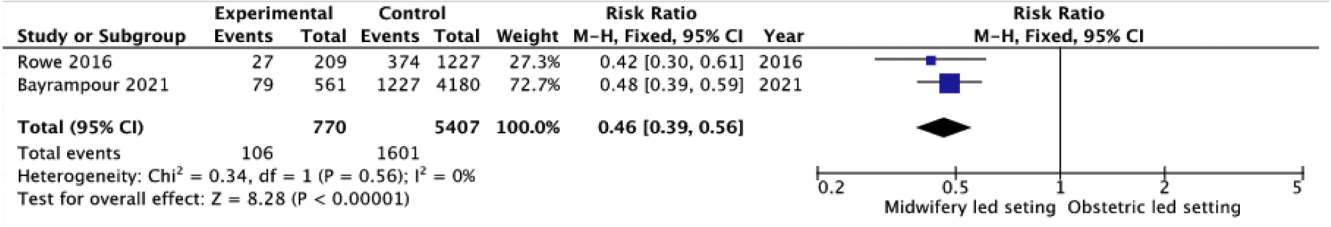

Fig. 3. Emergency caesarean section forest plot.

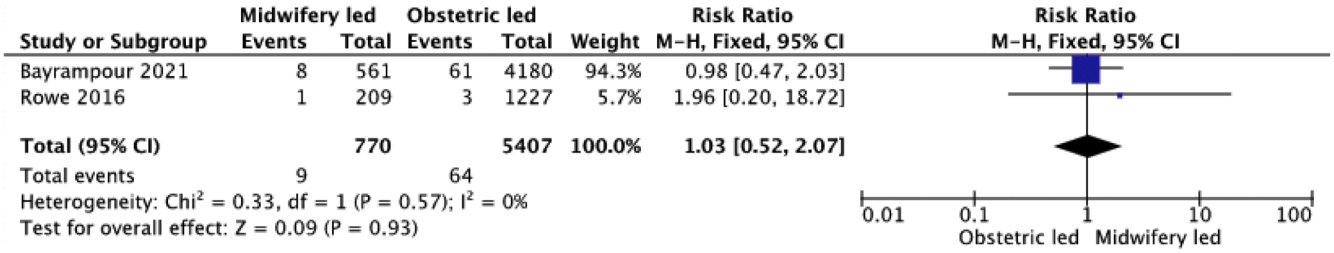

Fig. 4. Uterine rupture forest plot.

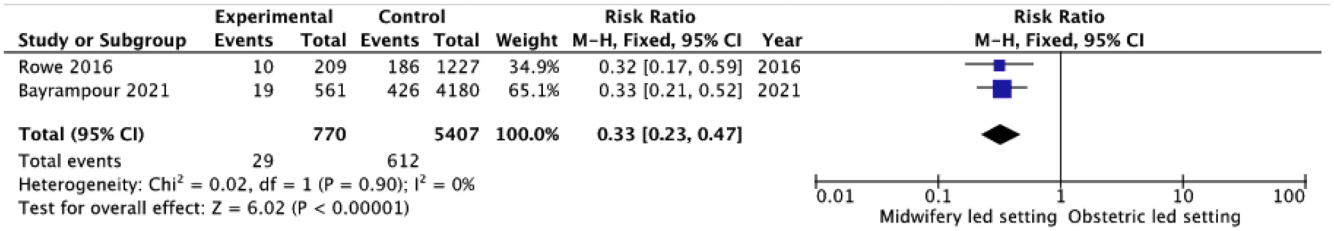

Fig. 5. Instrumental birth forest plot.

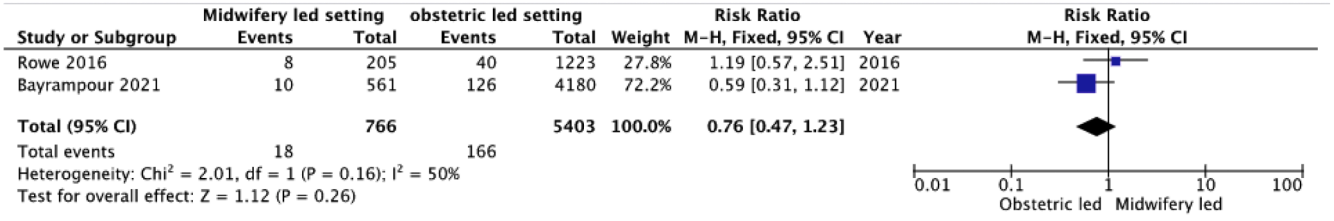

Fig. 6. Admission to special care nursey forest plot.

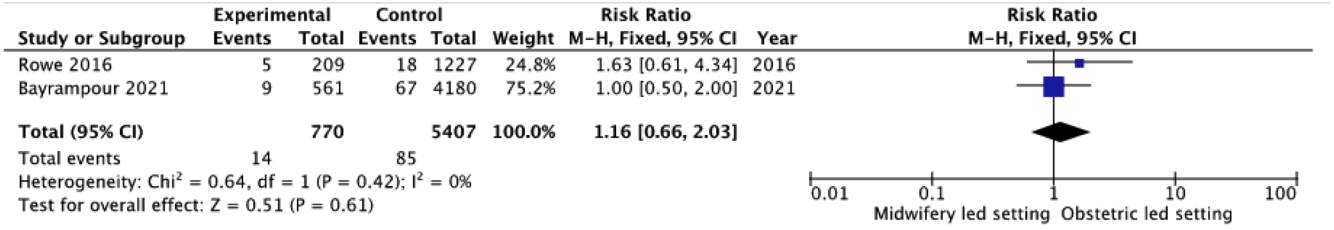

Fig. 7. Apgar of 7 or less forest plot.

outcomes.

Perinatal loss at term

Rowe et al. (2016) report four stillbirths, 2 from each group (0.9 % in midwifery led setting and 0.16 % in obstetric led setting). There were no neonatal deaths. Bayrampour et al. (2021) report a composite outcome that includes: stillbirth, early neonatal death, serious morbidity, birth trauma, 5 min Apgar < 4, admission to the NICU, transfer of the newborn to a higher level care, serious neonatal morbidity (i.e. respiratory distress syndrome in the newborn, chronic respiratory disease, septicaemia of the newborn, other infections, fetal and neonatal haemorrhage, birth trauma, necrotizing enterocolitis, intestinal perforation, other perinatal disorders, and convulsions). The midwifery led setting-compared to the OU control were 2.5 % and 4.6 % for this outcome (OR = 0.54 95 % CI 0.31 to 0.93), which demonstrates a statistically significant reduction in midwifery led settings. Bayrampour et al. (2021) do not report the perinatal deaths separately.

Discussion

There are no systematic reviews analysing the outcomes of vaginal birth after caesarean in midwifery led settings compared to obstetric led settings. Previous reviews of VBAC outcomes (Rimkoute and South, 2013; L. Beckmann et al., 2014) did not compare different birth settings, and included studies measuring the outcomes of completed home births, as opposed to planned home birth. The studies also included birth attended by midwives who were not certified. Similarly, several studies (E.L. Tilden et al., 2017; Cheyney et al., 2014; K.J. Cox et al., 2015; A. Grünebaum et al., 2017) were excluded from this review as they did not meet the inclusion criteria stipulating midwifery led care as legally recognised and regulated. This previous literature base has informed current maternity practice across the globe, restricting women's choice of place of birth based on poor quality evidence that is not generalisable to settings in which certified midwifery practice is available.

This systematic review and meta-analysis included two high-quality studies (H. Bayrampour et al., 2021; R. Rowe et al., 2016) comparing VBAC outcomes in HIC between midwifery led settings, attended by

certified midwives and OUs. The results demonstrate that VBAC in midwifery led settings is associated with increased vaginal birth and a reduction in interventions such as instrumental birth and caesarean section. Adverse perinatal outcomes were rare, therefore further research is required to draw conclusions on these risks.

R. Rowe et al. (2016) secondary analysis of the UK's national prospective cohort study 'Birthplace' includes a nationally representative sample, using high quality data, with a low risk of bias due to low non-response and controlled for potential confounders. The authors addressed the risk of bias that could arise from the differing risk status in the two groups and adjusted for complicating factors that were present at the start of labour. The authors comment that there may be differences in the groups in other unmeasured ways, and comment that the homebirth VBAC group are 'self-selecting' and could be different in ways that can't be measured. The sample was large enough to detect a difference in this review's primary outcome, however the small numbers of adverse outcomes meant that statistical analysis had limited power on these important findings. The sample was limited as there was no information on the number of previous caesarean sections or whether the woman had previously given birth vaginally, both of which can affect safety and chance of success for VBAC (Wu et al., 2019; Tahseen and Griffiths, 2010). An important factor to consider with this study is that more women planning homebirth were white, living in less deprived areas, in a relationship, had a healthy body mass index (BMI) and spoke fluent English. This is also seen in the wider evidence base, not only for women planning VBAC in midwifery led settings (E.L. Tilden et al., 2017; A. Grünebaum et al., 2017) but also for low-risk women planning birth in midwifery-led settings (Stewart et al., 2004).

Bayrampour's 2021 retrospective population-based cohort study (H. Bayrampour et al., 2021) included all women planning VBAC between 2000 and 2017 in British Columbia. Again, authors adjust for demographic and pregnancy characteristics, and note the study is limited as the women that chose homebirth may constitute a more low-risk group compared to the overall population. Another limitation of the study is that ethnicity, deprivation and fluency of English are not reported, yet are known to have a significant effect on outcomes (Rayment-Jones et al., 2021). It is recognised that Black and minority ethnic women and those with low income, poor housing and limited education or fluency in English may have less choice regarding their care and midwives may restrict information to certain groups of women (Kapadia et al., 2022; Black maternal experiences report — FIVEXMORE; Goode and Katz-Rothman, 2014; Schinkel et al., 2019).

Clinical guidelines should be used as tool to aid discussion and decision between the clinician and the woman (Frohlich and Schram, 2015). The guideline should document the best available evidence to inform practice and decisions. Though guidelines are not always consistent nationally and locally (Feeley, 2018), VBAC at home is universally considered 'outside of guidance' (J.M. Birth after Previous Caesarean Birth). The women in both included studies planning VBAC in midwifery led settings are opting for care that is 'outside of guidance'. Women's choices and decisions around labour and birth are "a dynamic and temporal process, in that it is made within a defined period and invokes both the past, whether this is personal, familial, social or historical, and the future" (Yuill et al., 2020). Qualitative studies have explored the reasons why women may opt for 'care outside of guidance' and want a physiological birth. Themes around this choice have been identified as birth always having an element of risk, hospitals not being safe, and interference is a risk (Jackson et al., 2012). Women report a lack of control and choice in previous births, they may have had a previous traumatic experience or conflict with HCP (Hollander et al., 2017), have a profound belief in the physiological process of birth and want autonomy over their bodies (Hollander et al., 2017) In the case of VBAC 'never wanting a repeat of a previous experience (caesarean section) (Keedle et al., 2015) Whatever the motivation for the choice, these women may be different in an unmeasurable way to women accepting the recommended care, and this unmeasured difference may affect the results.

The meta-analysis of the combined findings from these two included studies found that women planning VBAC in a midwifery led setting were 1.5 times more likely to have an unassisted vaginal birth. This is consistent with current literature reporting higher rates of vaginal birth in out of hospital setting. Beckmann's literature review (L. Beckmann et al., 2014) reported a rate 73–98.3 % for successful VBAC in out of hospital settings, noting that women who had previously given birth vaginally had a significantly increased chance of successful VBAC (Mercer et al., 2008). Of the two studies included in this review, Bayrampour et al. (2021) reports 45 % of women planning birth in midwifery led settings had previously given birth vaginally, compared to 21 % of those planning a VBAC in an obstetric led setting. Rowe et al. (2016) do not report previous vaginal birth, or number of previous caesarean sections, but does report parity. This is a limitation that the authors address, as previous mode of birth can affect success of VBAC and adverse outcomes (Smith et al., 2002).

This review found a significant reduction in the caesarean section rates for women planning VBAC in midwifery led settings compared to those planning VBAC in obstetric settings. Rowe et al. (2016) report an emergency caesarean section rate of 12.9 % versus 30.4 % for women planning midwifery led setting and obstetric setting respectively. Bayrampour et al. (2021) report similar finding of 14.1 % verses 30.5 %. Following adjustment for previous vaginal birth and parity there remains a 39 % reduction in chance of caesarean. This finding is not consistent with previous literature reporting chance of emergency caesarean section as 20.5 % for women planning home VBAC (K.J. Cox et al., 2015), though still lower than the 25.5- 36.7 % reported for women planning VBAC in obstetric led settings (J.M. Birth after Previous Caesarean Birth) (Mercer et al., 2008). For context, low-risk women with no history of caesarean section that plan to give birth on an obstetric unit have a chance of emergency caesarean section of 12 % compared to 8 % that plan homebirth (P. Brocklehurst et al., 2011).

Women report that their incentive for planning VBAC in midwifery led settings, is often to 'never have it (caesarean section) happen again' (Keedle et al., 2015), so this an important finding for women's decision making, as well as implications for maternal and infant health and addressing the global rising caesarean section rates and associated long-term health implications (Sandall et al., 2018).

Reflecting Beckmann et al's (L. Beckmann et al., 2014) review findings, this meta-analysis found no significant difference in uterine rupture for women planning VBAC in midwifery led settings compared to VBAC in an obstetric setting. The studies in Beckmann's review included a high proportion of women that had previously had a successful VBAC, which evidence demonstrates significantly lowers the chance of uterine rupture (Mercer et al., 2008). Due to the small numbers of this event, the confidence intervals are wide, and statistical power is limited for these uncommon but clinically serious events. Larger studies are required to be able to detect if there are differences.

Instrumental birth is associated with maternal morbidity, with increased risk of perineal trauma involving the anal sphincter and increased pain (Verma et al., 2021), Though rare, instrumental birth can lead to significant maternal and infant birth injuries in the infant (Towner and Ciotti, 2007; Doumouchtsis and Arulkumaran, 2008) and women have a higher chance of reporting negative feelings about their birth (Hildingsson and Karlström, 2013). This review found a significant reduction in instrumental births for women planning VBAC in midwifery led settings. Rowe report 4.8 % instrumental birth rate for VBAC planned in midwifery led settings versus 15.1 % for obstetric led setting, and Bayrampour et al. (2021) report this as 3.4 % versus 10.2 % respectively. This finding is consistent with the Birthplace study P. Brocklehurst et al. (2011) and a large systematic review of planned homebirth for low-risk women A. Reitsma et al. (2020) that clearly demonstrates a reduction in this intervention in midwifery led settings. Previous literature reports 39 % of women planning VBAC in obstetric settings have an instrumental birth compared to 19 % of low-risk primiparous women in OUs (Hehir

et al., 2014). An important factor to consider is that women are more likely to have regional analgesia in an obstetric setting (P. Brocklehurst et al., 2011) and this may increase the risk of an instrumental birth (Anim-Somuah et al., 2018). Neither study reported obstetric anal sphincter injury however H. Bayrampour et al. (2021) did report obstetric injury. This was reduced in the midwifery led setting compared to obstetric setting (6.6 % and 11.8%) and may be associated with the reduced rates of instrumental birth.

This review found no significant differences in neonatal admissions to a neonatal unit or special care nursery, or low Apgar scores. Studies from the USA report statistically significant higher rates of low Apgar scores and ventilatory support in home VBAC but interestingly, lower neonatal unit admissions and birth injuries (E.L. Tilden et al., 2017). The finding regarding neonatal unit admissions correlates with other studies finding no difference in admission rates between neonates of primiparous women planning homebirth compared to those of women planning VBAC homebirth in their second pregnancy (K.J. Cox et al., 2015). However, when comparing multiparous women without a uterine scar with women with a scar and a previous vaginal birth, an increase chance of neonatal admission has been reported (K.J. Cox et al., 2015).

Two studies based in the US report that there is twice the risk of low Apgar's at 5 min for neonates of women having VBAC in midwifery led settings (E.L. Tilden et al., 2017; A. Grünebaum et al., 2017). However, one US study found no such differences comparing women with and without a uterine scar (K.J. Cox et al., 2015). The limitations for these US based studies are twofold: we cannot be assured that the care provided in the midwifery led setting is by a certified midwife and we cannot be assured that the women planned birth in these settings. Due to small numbers the outcome for perinatal death was inconclusive in this review and further studies are required to observe a statistically significant effect.

Many of the secondary outcomes in this review could not be included in the meta-analysis and are therefore reported narratively; H. Bayrampour et al. (2021) did not report the rates of transfer to an obstetric unit during labour, birth and the immediate postnatal period. R. Rowe et al. (2016) report a high chance of transfer to an obstetric unit of 56.7 % for women in their second pregnancy, and 24.6 % in subsequent pregnancies. Compared to low-risk women planning their first birth at home, transfer rates are in the UK are 45 % and for low-risk women in subsequent pregnancies is 11.5 % (P. Brocklehurst et al., 2011). These higher rates for women planning VBAC in midwifery led settings correlate to other studies (David et al., 2009; K.J. Cox et al., 2015). David et al. (David et al., 2009) hypothesise that these higher rates of transfer could be due to the midwives having a 'lower threshold' for transfer due to the time it takes to get to the obstetric unit, and/or less experience in caring for woman planning VBAC in these settings.

Both included studies (H. Bayrampour et al., 2021; R. Rowe et al., 2016) found insignificant differences in the rate of blood loss, transfusions and admissions to higher level care between the groups. This was not the case in Cox's study that compared women planning VBAC at home with women without a uterine scar. In this study blood loss was greater in all subgroups of women planning VBAC in midwifery led settings and maternal hospitalisation was higher in women planning VBAC (16.6 versus 6.6 %) though the authors do not elaborate on the reason for admission (K.J. Cox et al., 2015). By comparison, studies reporting maternal outcomes for low-risk women planning home birth consistently report less haemorrhage. (A. Reitsma et al., 2020; P. Brocklehurst et al., 2011)

R. Rowe et al. (2016) report one confirmed case of Hypoxic Ischaemic Encephalopathy (HIE), with a woman having a forceps birth in the planned obstetric group. No cases were reported from the midwifery led setting. Bayrampour et al's (H. Bayrampour et al., 2021) composite neonatal outcomes did not include this diagnosis but did include 'convulsions' which are associated with HIE (Glass and Shellhaas, 2019). They found significantly less severe neonatal morbidly in the midwifery led setting, compared to obstetric led (2.4 % versus 4.6). This is in direct opposition to the findings of the US studies previously discussed whereby neonatal seizures were found to be 'up to 10 times more prevalent' in the infants of women planning VBAC in out of hospital settings (E.L. Tilden et al., 2017; A. Grünebaum et al., 2017). Again, caution must be given when applying these findings to the UK, Europe and Australasia as care provided in the US may not be by certified midwives and the relationships between care providers may be less integrated, which greatly effects safety (E.K. Hutton et al., 2019). Another limitation of these studies is that data may be missing as uncertified midwives may not have access to medical history, and that the data did not indicate planned place of birth, which may affect results as unplanned homebirths (BBAs) carry significantly more risk. (Unterscheider et al., 2011)

The findings of this review suggest that planning VBAC in a midwifery led setting reduces the risk of maternal intervention and increases the chance of an unassisted vaginal birth. This correlates to many studies that demonstrates this for both women planning VBAC (L. Beckmann et al., 2014) and for low-risk women (P. Brocklehurst et al., 2011) (A. Reitsma et al., 2020). Of the included studies, H. Bayrampour et al. (2021) reported fewer adverse neonatal outcomes, and conclusions could not be drawn from Rowe et al's (R. Rowe et al., 2016) smaller sample size. This does not correlate to the wider USA literature that report greater risk to the infant, although significant limitations and biases in this evidence has been discussed (A. Grünebaum et al., 2017; K. J. Cox et al., 2015; Lieberman, 2004). The absolute perinatal risk remains low 0.5–0.9 % and this is comparable to low-risk primiparous women planning homebirth in the UK (Lieberman et al., 2004; R. Rowe et al., 2016; P. Brocklehurst et al., 2011)

Practice recommendations

It is imperative that women are provided with up-to-date evidence to be able to make an informed choice for their care (R. Royal College of Midwives 2022). The option for women to have a VBAC in a midwifery led settings such as a birth centre or home should be discussed, and the evidence (and lack of) explained. Women that have had a previous vaginal birth may be particularly suitable for VBAC in a midwifery led setting, as the evidence suggests they are highly likely to have an unassisted vaginal birth and adverse outcomes are rare (L. Beckmann et al., 2014; K.J. Cox et al., 2015; R. Rowe et al., 2016; H. Bayrampour et al., 2021). Midwives caring for women planning VBAC must be knowledgeable of and vigilant to the signs and symptoms of uterine rupture and be cautions of prolonged or arrested labour as this has been found to be an independent risk factor (Ronel et al., 2012) however, defining prolonged labour is an area of contention as partogram use is not well evidenced to improve outcomes (Lavender et al., 2018).

The centre of all shared decision making is to provide women with the available evidence and then support them in their choice (R. Royal College of Midwives 2022; R. Royal College of Midwives 2022). However, literature demonstrates that many women do not have genuine choice, and that often they perceive that they must accept standard care as there is much emphasis on the fetus, rather than the woman (Jomeen, 2012). This is fuelled by the growing culture of risk aversion in maternity services. HCP not only fear an adverse outcome for their patients, but also fear of litigation, risk investigations and their continued employment, which may affect how risks are framed, which can limit the choices perceived to be available (Coxon et al., 2016). Once the woman has made the decision for 'outside of guidance' midwives can and do support women that choose care 'outside of guidance', utilising their experience of physiology of birth and evidence informed care (Feeley, 2018) However, many midwives feel vulnerable and anxious providing this care and often need support form senior colleagues (Thompson, 2013)

An important point for HCPs to consider when discussing place of birth are the words by Dahlen (Dahlen, 2016):

'What traumatises women most is how they are treated during birth and

lack of control, communication and consent'.

Giving women genuine options, based on the best evidence available, so they are in control of their birth is not only considered gold standard care but can reduce trauma (Keedle et al., 2015; R. Royal College of Midwives 2022)

Research recommendations

This review indicates scope for further research examining place of birth for women planning VBAC. Planning VBAC in midwifery led settings, increased rates of vaginal birth and reduced emergency caesarean sections. The small numbers of adverse outcomes make statistical analysis problematic therefore larger studies are required to enable conclusions of these important outcomes

A gap in the research literature was identified in completing this review. There are no comparative studies examining VBAC in birth centres with OUs. Further research would in this area would aid decision making for women and HCPs.

Conclusion

This systematic review has found high quality evidence demonstrating that planning VBAC in midwifery led settings increases the chance of having an unassisted vaginal birth and reduces the chance of having an emergency caesarean. Due to the small numbers of adverse outcomes, more studies are required to draw meaningful conclusions about any associated perinatal risks. However, the current evidence on perinatal risk is comparable to primiparous women planning homebirth, and women planning VBAC that have previously given birth vaginally may be particularly suitable for this plan of care. Women need to be provided with the best available evidence to inform their choice around place of birth. Their decision should be respected and supported.

Strengths and limitations

Strengths of this review include a considered research question and a well-defined PICO that aided a thorough systematic search. The search resulted in appropriately designed, high quality studies with similar populations for analysis. Two researchers worked independently and reasons for exclusion clearly discussed. An appropriate model for meta-analysis was used and the results can be applied local populations to inform clinicians, women and birthing people. The limitations of the study are the sample size. The sample size of 770 women planning VBAC at home was sufficiently large to demonstrate a statistically significant difference in the primary outcome, however for the rare, adverse outcomes a larger population is needed to highlight differences.

Reflexivity

I am aware that in my current role of consultant midwife, counselling women, there is potential to skew the interpretation of the results. This further justifies the methodology of a systematic review and meta-analysis for an objective presentation of the findings. I have discussed the findings and discussion with the wider multi-disciplinary team, including obstetric colleagues and my academic supervisor. My significant clinical experience in both midwifery led and obstetric led settings, in addition to clinical governance and risk experience places me in an advantageous position to synthesize the evidence holistically and safely to interpret the results. Further research should address issues of reflexivity by including relevant stakeholders and experts by experience to ensure conclusions are transparent, and findings are balanced.

Declarations

Ethics approval not required.

Availability of data and material

Attached as additional file or contact the lead author EP.

CRediT authorship contribution statement

Elidh Parslow: Investigation, Project administration, Writing – review & editing. **Hannah Rayment-Jones:** Supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.midw.2024.104168.

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