A Systematic Review of Clinical Outcomes in Midwifery Units (MUs) in Europe.

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Abstract

Introduction: Midwifery Units (MUs) offer a woman-centred approach that prioritises physiological birth with judicious and appropriate medical intervention when required. Global evidence suggests that MUs provide neonatal safety comparable to Obstetric Units (OUs) while enhancing maternal outcomes for low-risk pregnancies. However, their integration into European maternity systems remains inconsistent due to structural, policy, and awareness-related barriers. A comprehensive evaluation of their clinical outcomes is needed to support their expansion. This systematic review evaluates maternal and neonatal outcomes in MUs across Europe, providing evidence-based guidance for their integration into maternity care.

Methods: A literature review was conducted following PRISMA guidelines. Studies reporting maternal and neonatal outcomes for births planned in Alongside Midwifery Units (AMUs) and Freestanding Midwifery Units (FMUs) were included. Data synthesis was conducted on the prevalence data in MUs and comparative data with OUs. A meta-analysis evaluated primary outcomes prevalent in the literature to assess the feasibility of comparable expectations for midwifery units across Europe, similar to those that exist for obstetric units. The risk of bias was assessed using the Critical Appraisal Skills Programme (CASP) tools.

Results: Births in MUs were associated with significantly higher rates of normal vaginal delivery (prevalence: 64.9%-91.4% in AMUs; 85.3%,-97.5% in FMUs. AMUvs OU: OR 2.03 [95% CI: 1.79, 2.31] p=0.001. FMU vs OU: OR 2.44 [95% CI: 1.32, 4.54] p = 0.001),

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and lower rates of instrumental births (prevalence: 0.6%-10.4% for AMUs and 3%-13.7% for FMUs. AMU vs OU OR 0.48 [95% CI: 0.41, 0.56] p<0.00001. FMU vs OU: OR 0.41 [95% CI: 0.25, 0.67] p<0.00001), and caesarean sections (prevalence: 1.9%-10.3% for AMUs and 1.6%-12.3% for FMUs; AMU vs OU: OR 0.47 [0.36, 0.62] p<0.0001. FMU vs OU: OR 0.38 [0.22, 0.67] p=0.0008) post-transfer compared to OUs. Episiotomy and epidural analgesia rates were notably lower (episiotomy: prevalence in AMUs 6.8%-33.1%, in FMUs 8.8%-27.2%, AMU vs FMU OR 0.60 [0.56, 0.64] p<0.00001. Epidural: prevalence for AMU 4%-33.8% and for FMU 4.2%-46.6%; AMU vs OU: OR 0.22 [0.12, 0.42] p<0.00001; FMU vs OU: OR 0.18 [0.01, 2.33] p=0.004) reflecting a more physiological approach to childbirth. Although differences in postpartum haemorrhage and perineal trauma were less pronounced, trends favoured AMUs. No significant differences were observed in Apgar scores (Apgar score<7 at 5 minutes prevalence in AMUs 0%-1.7%; in FMUs 0.2%-1%. AMU vs OU.: OR 0.98 [0.75, 1.28] p=0.88)or small-for-gestational-age rates, reinforcing the safety of MUs for newborns.**Conclusions:** These findings provide valuable insights for clinicians, maternity service planners, and policymakers. Standardised data collection and further research are needed to enhance comparability across healthcare settings, strengthening the evidence base and improving maternal care outcomes.

Keywords: Midwifery Units, Maternal Outcomes, Neonatal Outcomes, Maternity Care Systems, Evidence

Chapter 1: Introduction

1.1 Background

It is established that every woman must be equipped with the necessary information to make informed decisions about her pregnancy care, including where she decides to give birth. [(1)].

A Midwifery Unit (MU) is a specialised healthcare setting that offers care provided by midwives who assume primary professional responsibility during the pregnancy, intrapartum, and postpartum periods. Ideally, continuity is maintained by the midwife (or team of midwives) that oversees patient care throughout these phases [(2)]. Although midwives are the primary professionals responsible for care in this setting, multidisciplinary collaboration must remain, with a linked obstetrician and neonatologist consulted for critical organisational and clinical decisions to support the MU [(3)]. In this type of setting, the care provided is patient-centred rather than service-centred to holistically treat childbirth as a physiological, psychological, cultural and social event in its entirety. These units offer an alternative to the obstetrician-led maternity care that has become prevalent over the last century by championing low-intervention births and advocating for the mother's autonomy and choice, thus preventing over-medicalisation of birth when not indicated.

Recent global-level studies have consistently reported no significant differences in adverse outcomes for the mother-infant dyad between deliveries planned in traditional labour wards and those planned in midwifery units (MUs). Additionally, a number of these studies have emphasised the higher likelihood of women experiencing spontaneous, uncomplicated births, as well as favourable perinatal outcomes in the context of midwifery unit care. Many studies have also highlighted the need to expand MUs, particularly for low-risk pregnancies[(4-6)]. Establishing midwifery units has encountered considerable challenges in Europe. Various models exist in different countries, such as alongside MUs (located within the hospital but separate from the obstetric unit, also known as AMUs and Freestanding MUs (located within the community, also known as FMUs). Governments across Europe show considerable variation in the level of support they offer for MUs, with this disparity evident in a wide range of policies, regulatory frameworks, and professional guidelines. These differences reflect the diverse healthcare priorities, cultural attitudes towards childbirth, and political ideologies in each country, leading to inconsistent implementation of midwifery units and differing standards of care across the continent. Consequently, the incorporation of

midwifery-led care into national maternity services and the guidelines governing its practice remains the exception rather than the rule, leading to significant variation in its accessibility and the quality of care available to women across different European nations [7].

1.2 Rationale for the Systematic Review

Conducting a review at the regional level in Europe is crucial, as the implementation of midwifery-led care may face common barriers, and health systems in European countries often share similarities. These shared features in obstetric care systems provide a relevant context to examine maternal and neonatal outcome trends within midwifery unit settings.

Although midwifery-led care is gaining traction across Europe, the widespread establishment of midwifery units (MUs) as the preferred and naturally associated birth setting has yet to be realised. One factor contributing to this delay is the lack of a comprehensive synthesis of maternal and neonatal clinical outcomes specific to MUs, as previous reviews have largely focused on global perspectives.

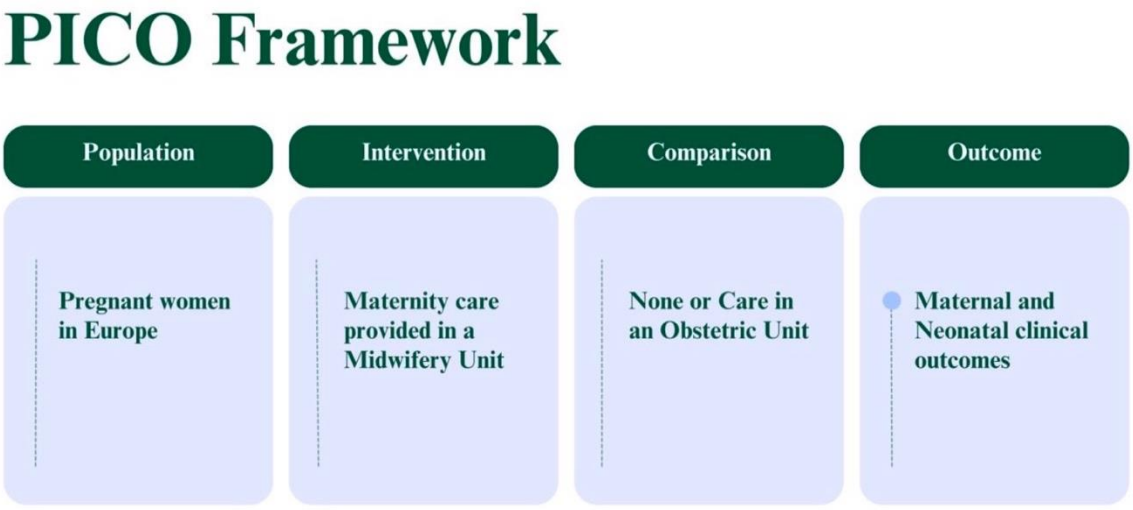
This systematic review seeks to fill the gap by synthesising evidence on maternal and neonatal clinical outcomes in midwifery units throughout Europe, with due consideration to the quality of included studies. By analysing research from various European countries, each with its healthcare system, this review aims to offer a clearer understanding of the effectiveness and safety of midwifery units in this region, which may help set realistic expectations for clinical outcomes. The results will enhance evidence-based recommendations that can influence policy decisions and clinical practices, thereby promoting the growth of midwifery units in the area.

1.3 Research Questions and Objectives

The primary objective of this systematic review is to evaluate and synthesise the available evidence on maternal and neonatal clinical outcomes in midwifery units across Europe. Specifically, the review will address the following research question:

"What is known about maternal and neonatal clinical outcomes when care is provided in European midwifery units?"

The research question was formulated using the PICO framework:



1.4 Significance of the Review

This systematic review will provide key insights into midwifery units' maternal and neonatal outcomes throughout Europe. The results will improve the understanding of clinical outcomes linked to midwifery-led care and will guide healthcare professionals, policymakers, and midwifery practitioners regarding the possible benefits and risks of these care models. The review will also highlight factors that influence outcomes in midwifery units, such as the type of care provided, the healthcare context, and the characteristics of the women receiving care. This information will be valuable for improving clinical practice, shaping future policies regarding midwifery-led care, and guiding the development of midwifery services in Europe. Furthermore, the review will identify areas where further research is needed, particularly regarding high-risk pregnancies, the integration of medical interventions in midwifery units, and the long-term outcomes for mothers and neonates. By providing a comprehensive synthesis of the available evidence, this review will support the development of evidence-based guidelines for midwifery care in Europe.

Chapter 2: Methods

2.1 Overview of the Systematic Review Approach

This systematic review was conducted to evaluate and synthesise the available evidence on maternal and neonatal clinical outcomes in midwifery units across Europe. The review adheres to a rigorous, transparent, and reproducible methodology to ensure its findings' reliability, transparency, and validity. This systematic approach guarantees that all relevant studies are identified, critically appraised, and synthesised in a manner that supports evidence-based decision-making in midwifery care policies throughout Europe.
No restrictions were imposed on the number or type of clinical outcomes to be considered, as the aim was to achieve a comprehensive picture of available data. All quantitatively measured outcomes were considered.

2.2 Inclusion and Exclusion Criteria

The studies included in this review were selected based on specific inclusion and exclusion criteria.
We included studies of all design types, such as randomised controlled trials (RCTs), cohort studies, and observational studies, that evaluated maternal and neonatal outcomes in midwifery units throughout Europe. Studies with purely qualitative designs were excluded.
This study's timeframe was from inception to the submission date of the Protocol to PROSPERO.
This review centres on pregnant women who plan to deliver and are eligible for childbirth in midwifery units and their newborns. It also includes women who were transferred due to complications arising from their pregnancy or labour or for the purpose of labour pain relief.
No restrictions were imposed regarding age or health status; however, studies concerning high-risk pregnancies were noted and discussed separately (i.e., studies that included a population of women with previous caesarean section).
The intervention of interest was midwifery-led care within midwifery units, including freestanding midwifery units (FMUs) and alongside midwifery units (AMUs). Where applicable, the comparison group consisted of women who gave birth in traditional hospital labour wards, which typically adhere to a more medicalised model of care, including the presence of obstetricians and a broader range of interventions.

Studies published in English and other European languages spoken and read fluently by the research team were considered, provided they were accessible and relevant to the review. Studies in languages outside of these were excluded.

A comprehensive overview of inclusion and exclusion criteria is presented below.

Table 1 Inclusion and exclusion criteria

	Inclusion	Exclusion
Phenomenon of interest	Clinical outcomes following care by a midwifery unit	Studies focusing exclusively on care provided in obstetric setting or homebirth without a comparison cohort of women planning care in an MU
1. Study design	RCT, quasi-experimental studies, prospective/retrospective cohort studies, case-control studies, cross-sectional studies, service audits, case reports, mixed-method studies	Exclusively qualitative research
2. Timeframe	All studies to be included, from inception to November 2024	none
3. Geography	WHO European countries: Albania, Andorra, Armenia, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Channel Islands, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Gibraltar, Greece, Hungary, Iceland, Ireland, Isle of Man, Israel, Italy, Kazakhstan, Kosovo, Kyrgyzstan, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Moldova, Republic of, Monaco, Montenegro, Netherlands, North Macedonia, Norway, Poland, Portugal, Romania, Russian Federation, San Marino, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Tajikistan, Turkey, Turkmenistan, Ukraine, United Kingdom, Uzbekistan, Greenland	Any other country not listed
4. Sample	Pregnant women who are eligible for a birth in a midwifery unit and plan for this type of care and birth. Women who planned to give birth in an MU but were transferred for pregnancy complications or medical or pain relief reasons during labour.	Pregnant people who are considered not eligible for a birth in a midwifery unit at any point prior to their birth or women who are eligible for MU care but opt for a birth in an obstetric setting as a result of maternal choice.
5. Comparator	A comparator won't be necessary and studies that meet all other inclusion criteria and don't have a comparator will be included. Studies that compare clinical outcomes for midwife-led care with obstetric care will be included as long as they meet all other eligibility criteria.	No exclusion
6. Outcome measures	Quantitative clinical maternal and neonatal outcomes and interventions.	Qualitative data

2.3 Information Sources and Literature Search Strategy

A comprehensive literature search was undertaken using electronic databases to identify relevant studies. The platforms employed to perform the searches included EBSCOhost

(CINAHL and MedLine) and OvidOnline (EBM – Cochrane Database of Systematic Reviews, the Cochrane Methodology Register Database, MIDIRS, Embase, Emcare, and Social Policy and Practice Database), selected for their extensive coverage of peer-reviewed obstetrics, midwifery, and healthcare literature.

The search was also initially intended to be extended to open-access repositories; however, this was not implemented, as sufficient results were retrieved from the principal databases. The reference lists from key studies and systematic reviews were reviewed to ensure all relevant studies were captured.

The search was conducted on the above platforms using specific terms (Table 2) to achieve sensitivity, specificity, and repeatability. These terms were produced by brainstorming relevant words and running each on the PubMed MESH (Medical Subject Headings) controlled vocabulary thesaurus database to ensure all synonyms, truncations, and spellings were included correctly. All applicable terms were selected and used to run the preliminary search using Boolean operators to refine the search strategy (Table 2). This search strategy was tailored to each database to maximise the identification of relevant articles.

Table 2. Search strategy

Line	Saerch terms
1	"Birthing Centers"[Mesh] OR “Midwifery-led unit” OR “midwife-led unit” OR “midwife* unit” OR “birth* cent*”
2	"Treatment Outcome"[Mesh] OR “clinical outcom*” OR “maternal outcom*” OR “neonatal outcom*” OR “pregnancy outcome” OR "Maternal Health"[Mesh] OR "Infant Health"[Mesh] OR “pregnancy complications” OR "Obstetric Labor Complications"[Mesh] OR “patient outcome*” OR “adverse outcome*” OR “care outcome*” OR "Long Term Adverse Effects"[Mesh] OR “risk” OR “odds” OR “rate*” OR "Patient Reported Outcome Measures"[Mesh] OR "Patient Preference"[Mesh] OR "Patient Satisfaction"[Mesh]
3	"Delivery, Obstetric"[Mesh] OR “transfer*” OR “mode of birth” OR “"Analgesia, Epidural"[Mesh] OR “obstetric injury” OR “post-partum haemorrhage” OR "Postpartum Hemorrhage"[Mesh] OR "Depression, Postpartum"[Mesh] OR “perineal tear*” OR “perineal injury” OR “ transfer rate*” OR "Obstetrical Forceps"[Mesh] OR "Placenta, Retained"[Mesh] OR “intervention*” OR “augmentation of labo*”
4	"Apgar Score"[Mesh] OR “pH” OR "Intensive Care Units, Neonatal"[Mesh] OR "Birth Weight"[Mesh] OR "Premature Birth"[Mesh] OR "Birth Injuries"[Mesh]
5	1 AND (2 OR 3 OR 4)

Two independent reviewers screened the initial results and assessed titles and abstracts for relevance based on the predefined inclusion and exclusion criteria. Any disagreements were resolved through discussion or consultation with a third reviewer. The primary reviewer then reviewed full-text articles to confirm eligibility.

2.4 Data Extraction

Two independent reviewers undertook data extraction using a standardised online data extraction form [8] to guarantee consistency and accuracy. The data extracted included essential study characteristics, such as author, year of publication, study design, and relevant details about the population (i.e., sample size, maternal and neonatal characteristics) (Appendix I). Moreover, we collected information regarding the intervention (FMU or AMU) and the outcomes reported in each study.
The reviewers discussed and resolved any discrepancies in the data extraction process. Where necessary, missing data were clarified by contacting the corresponding authors of the studies, ensuring that the data included in the review was complete and accurate.

2.5 Quality Assessment and Risk of Bias

The methodological quality of the included studies was evaluated using established tools suited to the specific study designs. For randomised controlled trials (RCTs), we employed the "CASP Randomised Controlled Trials Checklist" [9], which gauges study quality based on factors such as randomisation, allocation concealment, blinding, and completion of outcome data. For cohort and observational studies, we utilised the "CASP Cohort Study Checklist" to assess selection bias, comparability, and the accuracy of outcome assessment.
The matching and confounding control quality was thoroughly examined in stratified sampling studies. In research employing matched designs, the matching criteria were meticulously reviewed to guarantee comparability between the exposed and unexposed groups, thus minimising biases in participant selection. Any potential biases arising from unmeasured confounders, such as socioeconomic status and prior caesarean sections, were noted during the risk of bias assessment. Furthermore, in instances where a study's methodological quality could significantly influence the results, sensitivity analyses were conducted to evaluate the robustness of the findings.

2.6 Data Synthesis and Analysis

This systematic review aggregated and statistically evaluated maternal and neonatal outcomes from twenty studies across nine European countries. Outcomes were categorised into maternal and neonatal subcategories. A meta-analysis was conducted where possible, using odds ratios (or adjusted OR where available) to compare outcomes among FMUs, AMUs and OUs. Odds ratios summarise the relative risk across care settings for both dichotomous and categorical data. Statistical heterogeneity was assessed with the I^2 statistic, where values over 50% indicated substantial heterogeneity. In the event that heterogeneity was determined to exceed 50%, sensitivity analyses were performed to assess the robustness of the findings through the evaluation of the impact of excluding individual studies and a review of the respective studies' quality. Random-effect models were employed to control for confounding variables, addressing variability between studies and bias from unmeasured confounders [31].

2.7 Ethical Considerations

As this systematic review used previously published data, no new ethical approval was necessary. However, all included studies were expected to adhere to ethical guidelines for protecting participants, such as obtaining informed consent and ensuring confidentiality according to established ethical standards.

Chapter 3: Results

3.1 Study Characteristics

This systematic review encompasses twenty studies from nine European countries: Norway, Germany, Sweden, France, Spain, Ireland, the Netherlands, Belgium, and England. The studies exhibited a range of designs, including one cross-sectional observational study, seven prospective cohort studies, two randomised controlled trials, and ten retrospective cohort studies. Each study was conducted in settings that included an FMU (5 studies), an AMU (14 studies), or both (1 study). Some studies also made comparisons between outcomes from midwifery units and those from comparable populations classified as low-risk, sampled from OU settings. Three studies [10-12] stratified the population sample by parity. For the purposes of this systematic review, the outcomes of these studies have been aggregated to ensure comparability. The populations examined within these studies were classified as low-risk; however, the definition of low-risk status exhibited slight variations among the studies. For instance, in 2005, Gottvall [13] included women who were transferred to specialist care during pregnancy, while other studies, such as Eide (2009) [14], focused exclusively on nulliparous women. Waldenström (1997) [15] accepted women with a history of caesarean section, provided they subsequently experienced a vaginal birth. These discrepancies in population definitions underscore the diverse criteria various countries to establish low-risk status. A comprehensive table of study characteristics is in Appendix I.

A PRISMA flowchart (Appendix II) delineates the study selection process, providing a comprehensive overview of the number of records identified, screened, assessed for eligibility, and ultimately included in the systematic review.

3.2 Key Results of the Studies

3.2.1 Outcome Measures

The protocol for this review did not specify outcomes, as the team aimed for a comprehensive representation of the available data studies. All eligible outcomes reported were considered and thoroughly analysed. The results of the studies were categorised into Maternal Outcomes and Neonatal Outcomes, each further divided into subcategories according to the nature of the results: Intrapartum, Delivery, Postpartum, Perineal, Pain relief, Transfer, Morbidity and

Other for Maternal Outcomes and Scoring, Breastfeeding, Hospital Stay, Morbidity, and Other for Neonatal Outcomes. A comprehensive list of Maternal and Neonatal Outcomes can be found in Appendixes III and IV.

A meta-analysis was performed on all primary outcomes identified as prevalent in the studied literature to evaluate the feasibility of establishing comparable expectations for outcomes in midwifery units across European countries, similar to those currently in place for obstetric units.

3.2.2 Summary of Results and Quantitative Synthesis

3.2.2.1 Maternal Outcomes – Normal Vaginal Delivery

The mode of delivery outcome was analysed and reported among most studies included in the review.

Fifteen studies [10,14,16-27] reported on the rates of normal vaginal deliveries (NVDs). In the AMU setting, NVD rates varied from 64.9% to 91.4%, while in the FMU setting, the lowest outcome reported was 85.3%, and the highest was 97.5%. Eight of these studies provided a comparative measure with an OU, where NVD rates ranged from 41.4% to 89.6%, as shown in Table 1 (P values, ORs and RRs provided in reference to comparative studies).

Normal vaginal delivery

STUDY ID	AMU			FMU			OU			p value	adjusted OR [CI 95%]	adjusted OR [CI 99%]		RR (95% CI)
	Events	% Events	Total	Events	% Events	Total	Events	% Events	Total			AMU	FMU	
Gaudineau 2012	280	88.6	316				737	82.8	890	0.034				
Prelec 2014	100	64.9	154				142	41.4	343	<0.001				
Eide 2009	205	81.3	252											
vanderKooy 2016	1403	83.9	1671				1368	86.4	1583	<0.05				
Alcaraz-Vidal 2024	145	83.3	174											
Bernitz 2011	345	83.7	412											
Merz 2020	517	84.5	612											
Rollet 2024	1156	89.3	1294				4853	81	5985	<0.001	3.19 [2.20–4.61]			
Palau-Costafreda 2023	233	91.4	255				522	83.8	623	0.003				
BirthplaceinEnglandCollaborativeGroup 2011	14413	86.4	16690	10150	90	11280	14645	74.4	19688			2.22 (1.76 to 2.81)	3.38 (2.70 to 4.25)	
Overgaard 2012				796	94.9	839	751	89.6	839					1.06 (1.03 to 1.09)
David 1999				732	91.4	801	2757	84.3%	3271	0.001				
David 2009				6285	97.5	6448								
Huitfeldt 2016				422	85.3	495								

Table 3 Normal Vaginal Delivery

A meta-analysis was conducted on the comparison of NVDs in AMUs versus OUs, employing Odds Ratios (OR) as the effect measure..

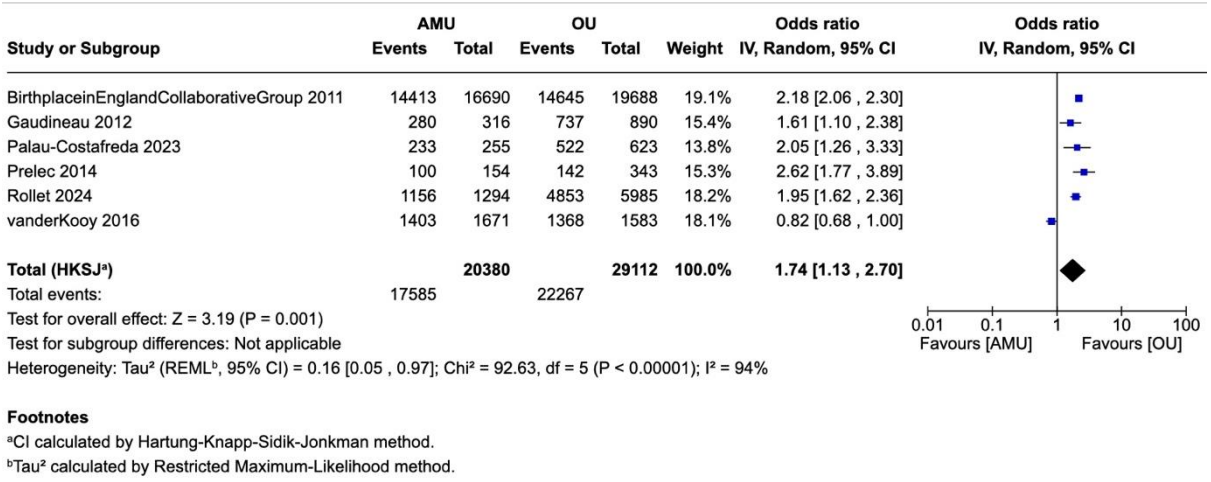


Figure 1. Meta-analysis of Normal Vaginal Deliveries AMU vs OU

The pooled OR was 1.74 [95% CI: 1.13, 2.70], indicating that the odds of a normal vaginal birth in AMUs are 1.74 times greater than in OUs (P = 0.001). However, considerable heterogeneity (I^2 = 94%) suggested additional influences on outcomes, possibly due to differences in populations or methodologies.

The VanderKooy 2016 study was an outlier, finding no significant difference between AMU and OU.

A sensitivity analysis revealed that excluding the VanderKooy study increased the pooled OR to 2.03 [95% CI: 1.79, 2.31] and reduced heterogeneity (I^2 = 8%).

A comparable analysis was performed to examine the comparative effectiveness of FMUs and OUs regarding the same outcome.

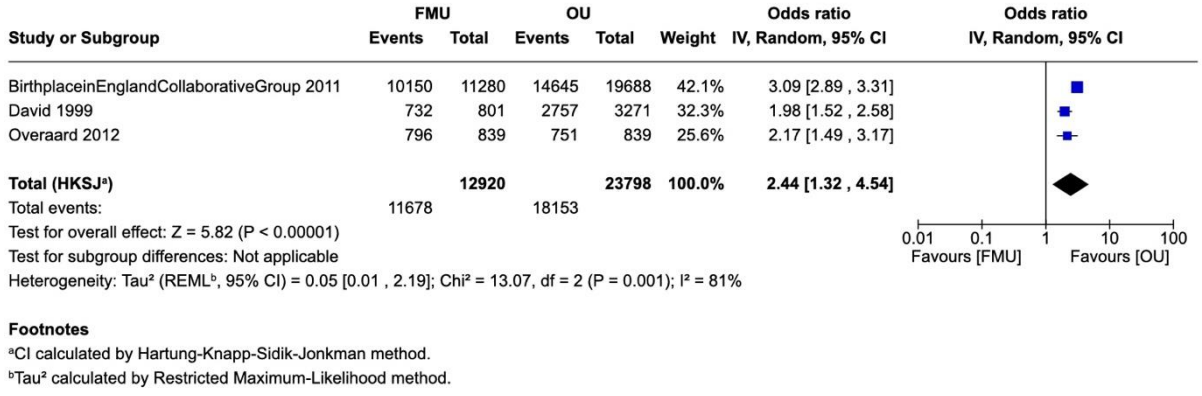


Figure 2. Meta-analysis of Normal Vaginal Deliveries FMU vs OU

The overall pooled OR was 2.44 [95% CI: 1.32, 4.54], indicating that the odds of an NVD occurring in FMUs are 2.44 times higher than in OUs, and this result is statistically

significant (P = 0.001). The I^2 value is 81%, indicating moderate to high heterogeneity between studies. The Tau^2 value is 0.05, which indicates moderate variability in the effect size between the studies.
The sensitivity analysis indicated that excluding the Birthplace in England Collaborative Group (2011) study results in a marginally decreased pooled OR, changing from 2.44 to 2.04. Nonetheless, it continues to exhibit a statistically significant effect favouring FMUs over OUs.

3.2.2.2. Maternal Outcomes – Instrumental Delivery

Instrumental deliveries among women necessitating transfer to an OU were documented by the majority of studies included in the analysis (Table 2).

Instrumental Delivery	AMU			FMU			OU			p value	adjusted OR [CI 95%]	adjusted OR [CI 99%]		RR (95% CI)
STUDY ID	Events	% Events	Total	Events	% Events	Total	Events	% Events	Total			AMU	FMU	
Gaudineau 2012	28	8.9	316				106	12	890	0.034	0,55 (0,34–0,89)			
Prelec 2014	1	0.6	154				16	4.7	343	<0.001				
Gottvall 2005	131	4	3238				14491	8	179502	<0.001				
vanderKooy 2016	173	10.4	1671				134	8.5	1583	<0.05				
Alcaraz-Vidal 2024	13	7.5	174											
Bernitz 2011	43	10.4	412											
Merz 2020	38	6.2	612											
Gottvall 2004		4.1%	3256					8.1%	180380	< 0.001				
Rollet 2024	85	6.6	1294				791	13.2	5985	< 0.001	0.34 [0.23–0.52]			
Palau-Costafreda 2023	10	3.9	255				70	11.2	623	0.003				
Welffens 2019	48	8.1	590											
Overgaard 2012				25	3	839	61	7.3	839					0.4 (0.3 to 0.6)
Huitfeldt 2016				19	3.9	495								
David 1999					5	801		11%	3271	<0.001				
Hermus 2017				229	13.7	1668								

Table 4. Instrumental Deliveries

The rates of instrumental births exhibited moderate variability across various studies, with rates ranging from a minimum of 0.6% to a maximum of 10.4% for AMUs and from 3% to 13.7% for FMUs. This discrepancy may be attributed to data aggregation concerning nulliparous and multiparous women in certain studies, while others concentrated exclusively on nulliparous populations. For example, Gottvall et al. (2004) stratified their results by parity, identifying that nulliparous women who planned their births in AMUs experienced instrumental births in 8% of cases and 14.4% for women who planned to deliver in the OU, while multiparous women exhibited rates of 0.8% and 2.2% respectively. Huitfeldt et al. (2016) report comparable outcomes for FMUs, noting that 13.9% of primiparas underwent an instrumental birth. In contrast, only 0.9% of multiparas experienced a similar outcome.
The meta-analysis included seven studies [11,13,16-18,22,23].

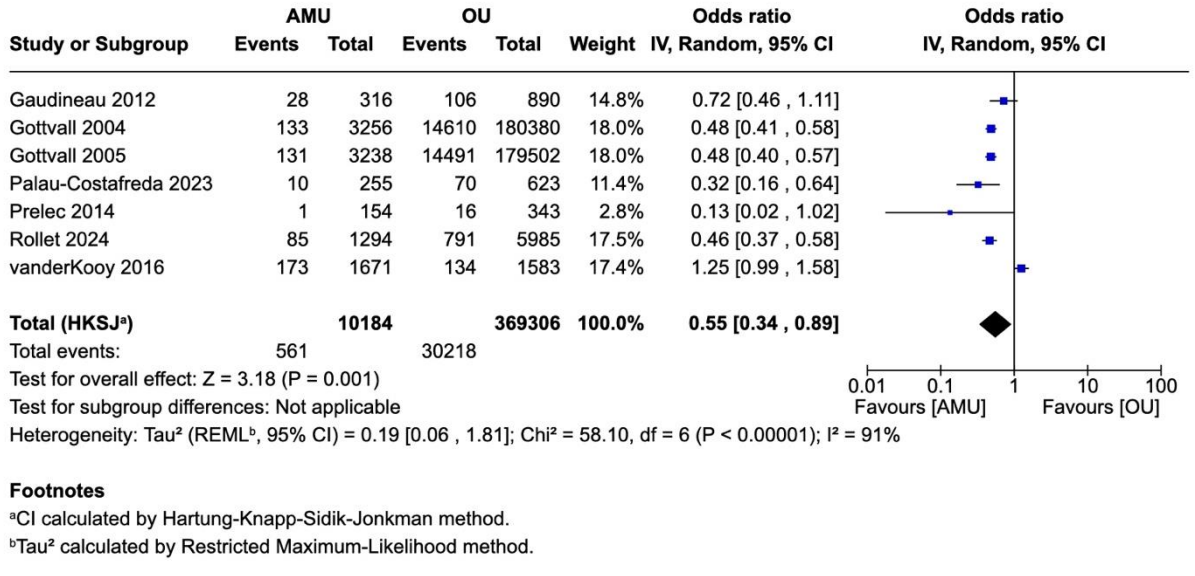


Figure 3. .Meta-analysis of Instrumental Deliveries AMU vs OU

The pooled OR was 0.55 [95% CI: 0.34, 0.89], indicating that the odds of an instrumental delivery occurring for AMUs are 45% lower than for OUs. This result is statistically significant (P = 0.001). An I^2 of 91% indicates high heterogeneity, and the Tau^2 value is 0.19, [0.06, 1.81], demonstrating some variance between studies.

Gottvall 2004 and 2005 show stronger effects with narrower confidence intervals, while VanderKooy 2016 has wider intervals and less conclusive results.

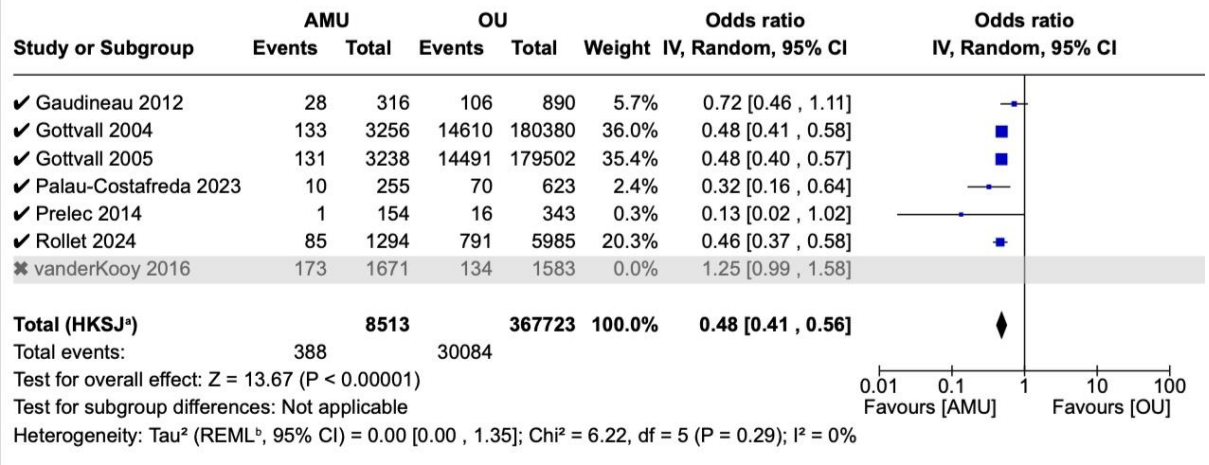


Figure 4. Meta-analysis of Instrumental Deliveries AMU vs OU, sensitivity results

The updated forest plot excluded VanderKooy's 2016 study, significantly altering results. The pooled OR improved to 0.48, statistically significant, and the I^2 value is now 0%.

Similar analyses were conducted to investigate FMU's performance.

The pooled OR was 0.41 [95% CI: 0.25, 0.67], which means the odds of the outcome occurring in FMUs are 59% lower than in OUs (P< 0.0001, $I^2 = 0$).

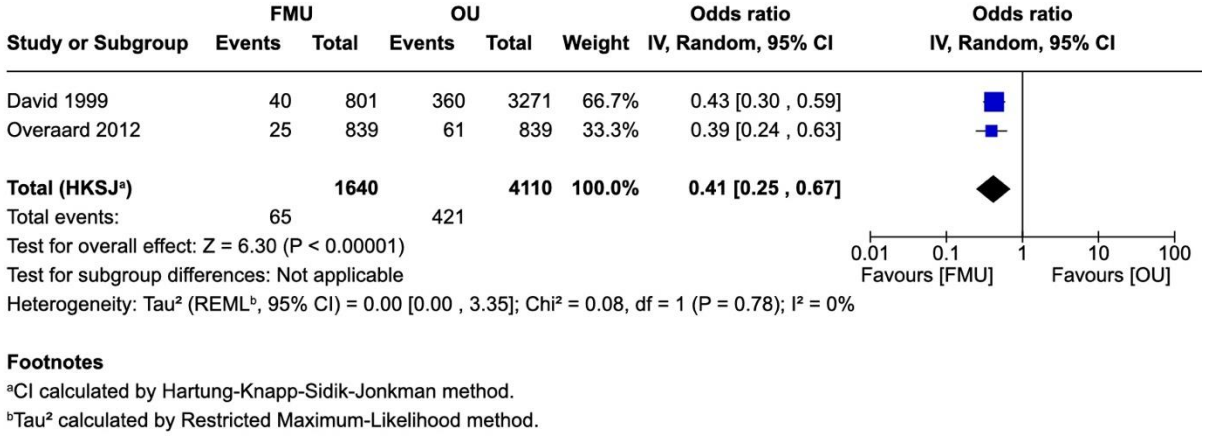


Figure 5. Meta-analysis of Instrumental Deliveries FMU vs OU

3.2.2.3. Maternal Outcomes – Caesarean Section

The incidence of caesarean sections for originally planned AMU births ranged from 1.9% to 10.3%. For FMUs, these varied from 1.6% to 12.3% of total cases. Studies of planned OU deliveries showed that caesarean sections ranged from 4% to 16% of cases (see Table 3)[10-22,24-28].

Cesarean section	AMU			FMU			OU			p value	adjusted OR [CI 95%]	adjusted OR [CI 99%]		RR (95% CI)
STUDY ID	Events	% Events	Total	Events	% Events	Total	Events	% Events	Total			AMU	FMU	
Gaudineau 2012	8	2.5	316				47	5.3	890	0.034	0,42 (0,19–0,94)			
Prelec 2014	3	1.9	154				46	13.4	343	0.001				
Gottvall 2005	189	5.8	3238				18284	10.2	179502	<0.001				
Eide 2009	16	6.3	252											
vanderKooy 2016	95	5.7	1671				81	5.1	1583	<0.05				
Alcaraz-Vidal 2024	16	9.1	174											
Bernitz 2011	24	5.8	412											
Merz 2020	57	9.3	612											
Gottvall 2004		5.9%	3256					10.2%	180380	<0.001				
Rollet 2024	33	2.6	1294				340	5.7	5985	<0.001	0.41 [0.27–0.62]			
Palau-Costafreda 2023	12	4.7	255				31	5	623	0.03				
Waldenström 1997	65	7.1	912											
Welffens 2019	61	10.3	590				63	16	394	<0.001	0.42 (0.25-0.69)			
BirthplaceinEnglandCollaborativeGroup 2011	727	4.4	16690	405	3.6	11280	2158	11	19688			0.39 (0.29 to 0.53)	0.32 (0.24 to 0.42)	
Overgaard 2012				19	2.3	839	34	4	839	0.04	0.6 (0.3 to 0.9)			
Huitfeldt 2016				9	12.3	73								
David 1999				24	3	801								
David 2009				106	1.6	6448								
Hermus 2017				82	4.9	1668								

Table 3. Caesarean Section

The forest plot shows meta-analysis results comparing AMUs to OU.

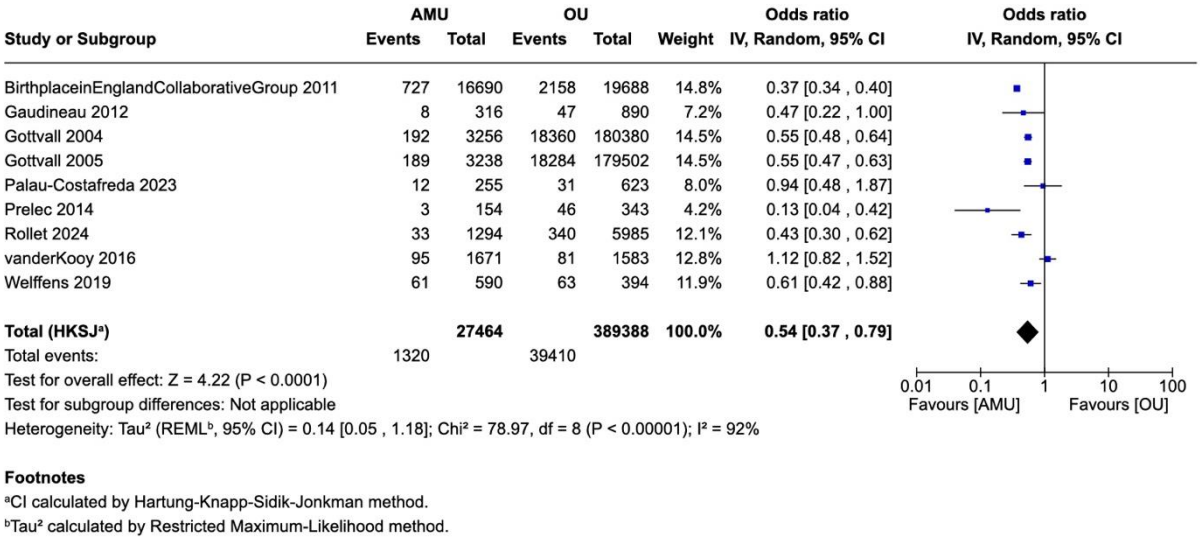


Figure 6. Meta-analysis of Caesarean Sections AMU vs OU

The pooled OR of 0.54 indicates that AMUs significantly reduce the odds of caesarean sections compared to OUs by 46%. Notably, the heterogeneity ($I^2 = 92\%$) suggests variability in results, yet the overall findings remain statistically significant. A sensitivity analysis reveals a pooled OR of 0.47, showing a 53% lower likelihood of the event occurring in AMUs. Although heterogeneity remains ($I^2 = 78\%$), it slightly decreased after excluding weaker studies (Palau Costafreda 2023 and Vanderkooy 2016).

The same outcome was studied in its effect for FMUs compared to OUs.

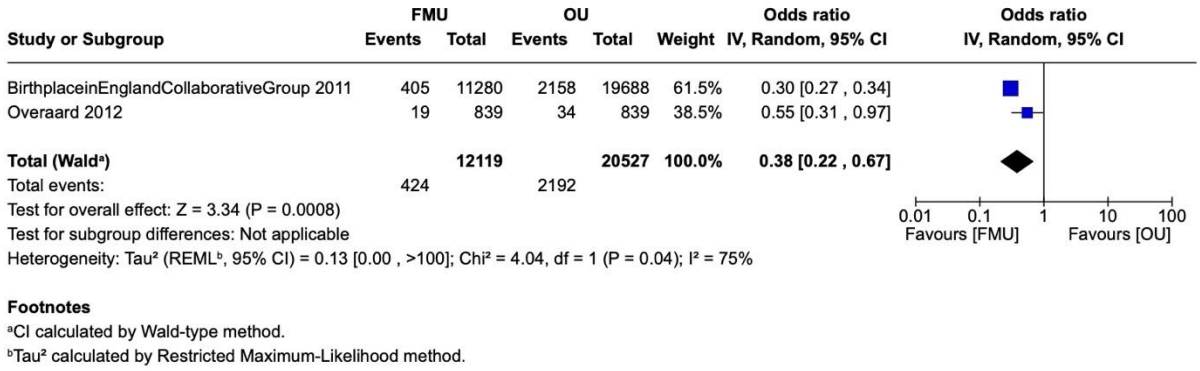


Figure 7. Meta-analysis of Caesarean Sections FMU vs OU

The pooled OR of 0.38 indicates that, across the two studies, the likelihood of the specified outcome occurring in FMUs is significantly lower than in OUs by 62%. The results are statistically significant. The $I^2 = 75\%$ indicates a moderate to high degree of heterogeneity.

3.2.2.4. Postpartum Haemorrhage

An extensively documented maternal outcome was the incidence of postpartum haemorrhage (PPH). In most cases, this was characterised by blood loss exceeding 500 ml, with some studies indicating more severe occurrences exceeding 1000 ml or 1500 ml. One study documented instances of PPH > 600 ml. Three studies did not specify the definition of PPH; therefore, those outcomes were excluded from this analysis. The proportion of women who gave birth in FMUs and experienced PPH > 500 ml ranged from 3.5% to 3.6%, whereas in AMUs, this range was broader, from 1.3% to 8%.

Five of these studies were conducted with a comparison to obstetric units, documenting PPH>500 ml, ranging from 2.9% to 13%. More severe cases of PPH, characterised by blood loss greater than 1000 ml, were recorded in five studies, four of which included a comparative measure with an obstetric unit. Instances of PPH exceeding 1500 ml were reported in only three studies and indicated lower rates of occurrence, as evidenced by the table below (4).

	PPH>500 (%)			PPH>600 (%)			PPH>1000 (%)			PPH>1500 (%)		
StudyID	AMU	FMU	OU	AMU	FMU	OU	AMU	FMU	OU	AMU	FMU	OU
Gaudineau 2012	2.8											
Prelec 2014	1.3		5.5									
Alcaraz-Vidal 2024	2.3											
Bernitz 2011	8		13				2.7		3.2	0.7		2
Merz 2020	7											
Palau-Costafreda 2023	2.4		2.9									
Welffens 2019	4.4		3.1									
Overaard 2012		3.5	8.1					1.3	1.7		3.5	
Huitfeldt 2016		3.6									1.2	
Waldenström 1997				12.5		12.7						
vanderKooy 2016							5		5			
Rollet 2024							2.4		1.1			
Hermus 2017								5.1				

Table 4. Postpartum haemorrhage

A meta-analysis was performed to investigate the distribution of postpartum haemorrhage (>500 ml) in AMUs compared to OUs.

The analysis included four studies that reported relevant data for this outcome [17,20,23,28]. The pooled OR was 0.73 [95% CI: 0.25, 2.13], suggesting a potential favouring of AMUs over OUs. However, this finding does not reach statistical significance (P value = 0.32). A sensitivity analysis was conducted; however, this did not produce significant outcomes. The same analysis was not performed for FMUs as insufficient data was available for a significant study.

3.2.2.5. Maternal Outcomes – Intact Perineum

The included studies extensively reported on perineal outcomes, revealing heterogeneous results across different settings and within individual contexts.
An intact perineum was observed in 13% to 61.3% of FMUs and 15.8% to 55% of cases in AMUs. In OUs, results that ranged from 22% to 65% of intact perineums (Table 5).

Intact perineum

Study ID	AMU Events	AMU % Events	AMU Total	FMU Events	FMU % Events	FMU Total	OU Events	OU % Events	OU Total	p value	adjusted OR [CI 95%]	adjusted OR [CI 99%] AMU	adjusted OR [CI 99%] FMU	RR (95% CI)
Gaudineau 2012	101	32	316				220	24.7	890	0.013				
Prelec 2014	84	55	154				142	41.4	343	0.063				
Merz 2020	202	33	612											
Palau-Costafreda 2023	63	24.7	255				181	29	623	0.012				
Chapman 1986	12	15.8	76											
Overaard 2012				514	61.3	839	466	55.5	839	0.0142				1.1 (1.02 to 1.2)
David 1999					30%	801		22	3271					
Hermus 2017				217	13	1668				<0.001				

Table 5. Postpartum Haemorrhage

Three studies reported a comparison regarding rates of intact perineum, as shown in the forest plot below. The pooled OR was 1.24 [95% CI: 0.47, 3.29], meaning that the odds of the outcome occurring in AMUs are 1.24 times higher than in OUs. The P-value, however, was 0.33, indicating that this result is not statistically significant. The I^2 = 81%, indicating high heterogeneity; sensitivity studies did not yield significant differences.

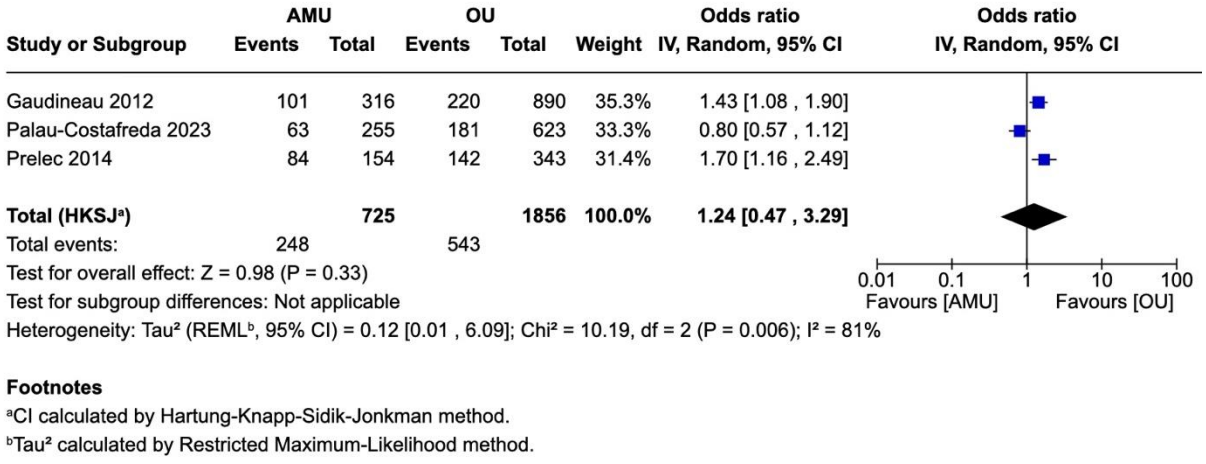


Figure 8. Meta-analysis of Intact perineum

A limited number of studies examined the perineal outcomes of FMUs compared to OUs for each result; therefore, only AMUs were studied.

3.2.2.6. First- and second-degree tears

First- and second-degree lacerations in FMUs represented 34.6%-77.3% of perineal injuries while accounting for 11.7%-62.4% in AMUs. Compared to OUs in four studies, the incidence ranged from 19.4% to 58.7% of cases.

First and second degree tears	AMU			FMU			OU			p value	adjusted OR [CI 95%]	adjusted OR [CI 99%]		RR (95% CI)
Study ID	Events	% Events	Total	Events	% Events	Total	Events	% Events	Total			AMU	FMU	
Gaudineau 2012	185	58.5	316				522	61.9	890	0.013	0,63 (0,49–0,82)			
Prelec 2014	18	11.7	154				61	17.8	343	0.063				
Palau-Costafreda 2023	159	62.4	255											
Welffens 2019	249	42.2	590				315	50.6	623		1.11 (0.78-1.60)			
Overaard 2012				290	839	34.6	337	40.2	839	0.0154				0.9 (0.8 to 0.97
Huitfeldt 2016				187	422	44.3								
Hermus 2017				1289	1668	77.3								

Table 6.. First and second degree perineal tears

Three studies examined the outcomes of first- and second-degree perineal tears in AMUs compared to OUs.

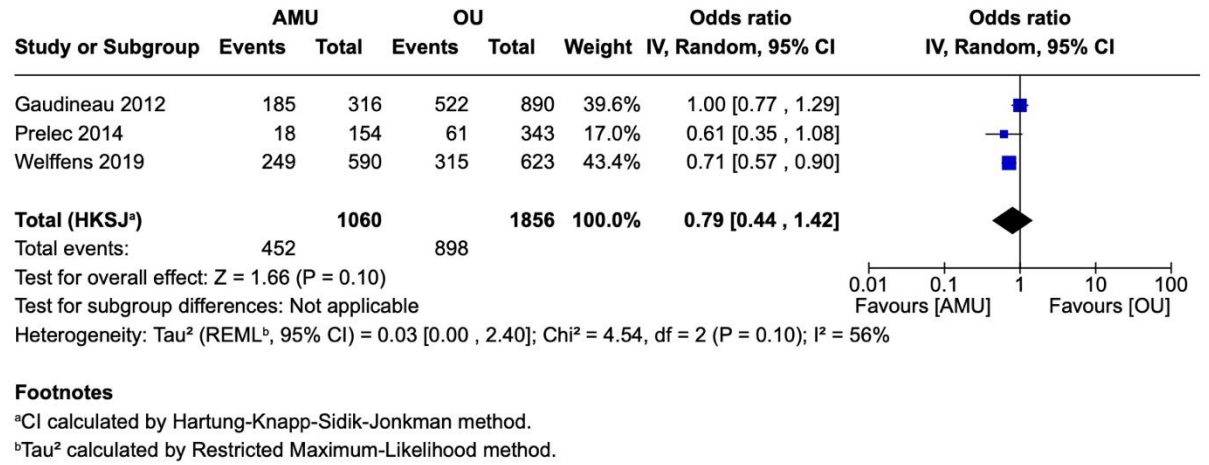


Figure 9. First and Second degree perineal tears

The pooled OR of 0.79 suggests a possible favouring of AMUs over OUs, but the result is not statistically significant (P= 0.10. The I^2 value of 56% indicates moderate heterogeneity. While sensitivity analyses lead to more consistent results from a heterogeneity point of view, these were not statistically significant.

3.2.2.7. Third- and fourth-degree tears

Third- and fourth-degree lacerations exhibited a more concentrated distribution across settings, recording outcomes between 0.6% and 3.2%.

Third and fourth degree tears	AMU			FMU			OU			p value	adjusted OR [CI 95%]	adjusted OR [CI 99%]		RR (95% CI)
Study ID	Events	% Events	Total	Events	% Events	Total	Events	% Events	Total			AMU	FMU	
Gaudineau 2012	0	0	316				5	0.6	890	0.013				
Prelec 2014	1	0.6	154				5	1.5	343					
vanderKooy 2016	43	2.6	1671											
Alcaraz-Vidal 2024	1	0.6	174											
Bernitz 2011	5	1.2	412											
Merz 2020	13	2.1	612											
Palau-Costafreda 2023	2	0.8	255				4	0.6	623	0.012				
Welffens 2019	10	1.7	590											
BirthplaceinEnglandCollaborativeGroup 2011	535	3.2	16654	259	2.3	11262	625	3.2	19638					1.04 (0.79 to 1.38) 0.78 (0.58 to 1.05)
Overaard 2012				19	2.3	839								
Huitfeldt 2016				2	1.1	187								
Hermus 2017				51	3.1	1668	8	2.3	348	<0.01				

Table 7. Third and fourth degree perineal tears

In this meta-analysis, the pooled OR of 0.67 suggests that AMUs may have a lower likelihood of the outcome than OUs; however, this result is not statistically significant (P=0.52). The I^2 value of 0% denotes no heterogeneity between the studies. The evidence from this meta-analysis does not support a definitive difference between AMUs and OUs regarding this outcome.

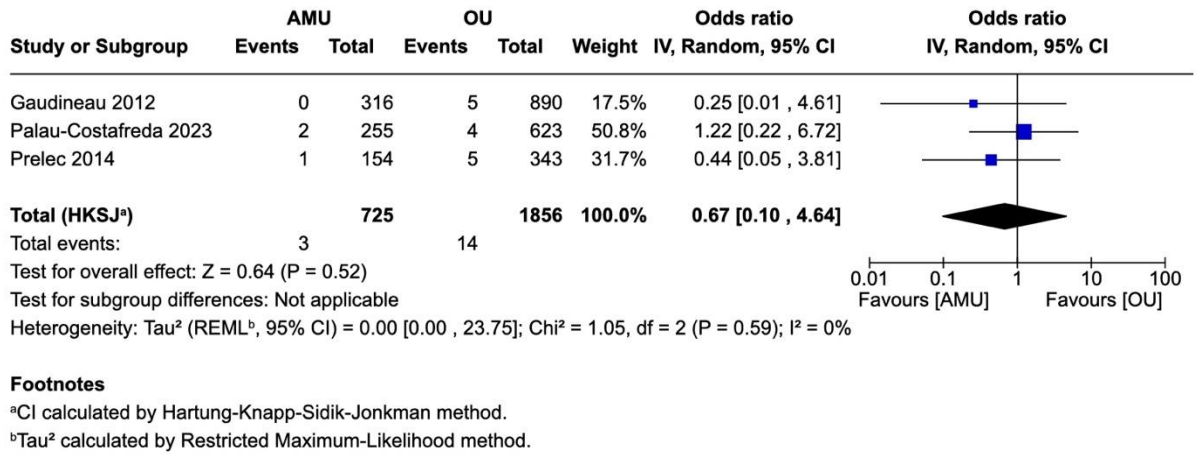


Figure 10. Meta-analysis of third and fourth degree tears

3.2.2.8. Episiotomy

Episiotomy rates exhibited significant variation across different settings, with FMUs documenting incidences from 8.8% to 27.2%, AMUs reporting rates between 6.8% and 33.1%, and OUs indicating occurrences from 10.8% to 52.2% (Table 8).

Episiotomy	AMU			FMU			OU			p value	adjusted OR [CI 95%]	adjusted OR [CI 99%]		RR (95% CI)
Study ID	Events	% Events	Total	Events	% Events	Total	Events	% Events	Total			AMU	FMU	
Gaudineau 2012	22	7	316				96	10.8	890	0.013	0,33 (0,30–0,36			
Prelec 2014	51	33.1	154				155	52.2	343	0.001				
Eide 2009	72	28.6	252				73	36.3	201	<0.05	1.6 (1.05–2.4)			
Alcaraz-Vidal 2024	12	6.9	174											
Bernitz 2011	88	22.7	388											
Merz 2020	26	4.2	612											
Palau-Costafreda 2023	18	7	255				91	15.4	623	0.012				
Waldenström 1997	66	7.8	847											
Welffens 2019	40	6.8	590				57	14.5	394	<0.01	0.31 (0.17-0.56)			
BirthplaceinEnglandCollaborativeGroup 2011	2098	12.6	16689	995	8.8	11275	3780	19.2	19678					0.62 (0.50 to 0.77) 0.40 (0.32 to 0.51)
Chapman 1986	10	13.2	76											
Hermus 2017				454	27.2	1668								

Table 8. Episiotomy

This meta-analysis included five studies, and the pooled OR of 0.60 suggests a significant favouring of AMUs over OUs for this outcome (P< 0.00001). The I^2 value of 0% indicates no heterogeneity.

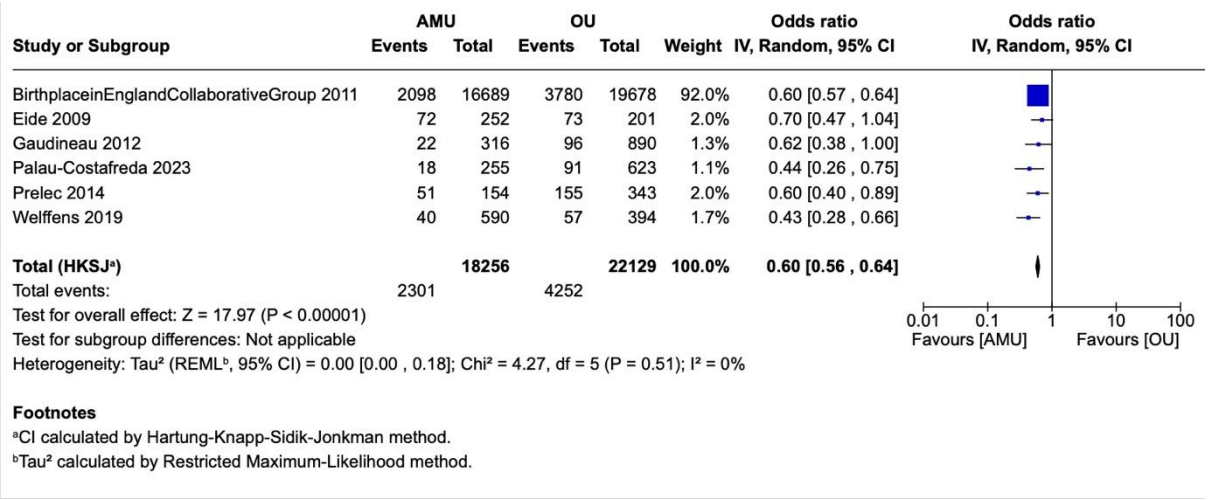


Figure 11. Meta-analysis of Episiotomy AMU vs OU

Only one study compared this outcome between FMUs and OUs; therefore, meta-analysis was not performed.

3.2.2.9 Maternal Outcomes – Epidural

The use of epidural among transferred women was highly reported (Table 9).

Epidural	Transferred from AMU (%)	Transferred from FMU (%)	Planned OU (%)
Gaudineau 2012	20.6		60.6
Eide 2009	24.2		62.7
Alcaraz-Vidal 2024	27.6		87
Overaard 2012		4.2	10.3
Bernitz 2011	15.8		24.9
Merz 2020	19.1		41.2
Huitfeldt 2016		46.6	
Palau-Costafreda 2023	19.6		77.5
Waldenström 1997	12.1		15.1
Hermus 2017		18.8	80.7
Welffens 2019	24.9		59
BirthplaceinEnglandCollaborativeGroup 2011	14.8		31.3
BirthplaceinEnglandCollaborativeGroup 2011		11.1	
Chapman 1986	0		8.3

Table 9. Epidural

In a meta-analysis of this outcome for AMU vs OU settings, the pooled OR=0.22 indicates that AMUs are associated with significantly lower epidural rates than OUs across the included studies (P< 0.0001). However, the presence of substantial heterogeneity (I^2 = 98%) and a significant Chi^2 statistic signals variability among the studies (Figure 12). Sensitivity

analyses were performed; however, they did not reveal any difference in the results and failed to reduce heterogeneity.

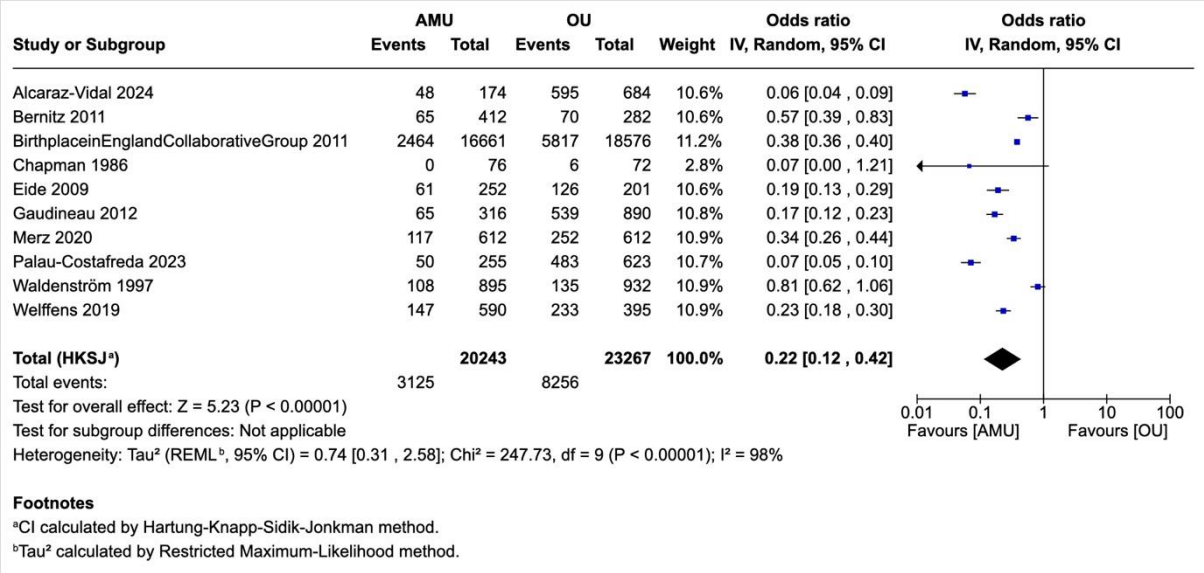


Figure 12. Meta-analysis of epidural AMU vs OU

The same analysis was conducted for FMUs as shown in the forest plot in Figure 13.

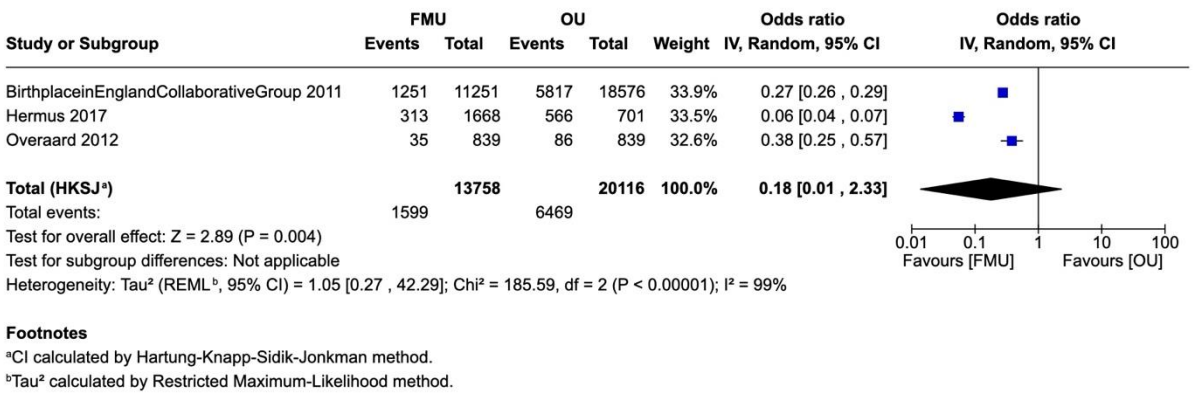


Figure 13. Meta-analysis of epidural FMU vs OU

The pooled OR of 0.18 suggests that FMUs are associated with lower rates of epidural than OUs, though the wide confidence interval indicates uncertainty. The P-value=0.004 indicates a statistically significant result. The high heterogeneity ($I^2 = 99\%$) and significant Chi^2 statistic suggest variability across the included studies.

3.2.2.10 Maternal Outcomes – other

The rates of intrapartum transfer were consistent across the studies, ranging from 14.7% to 28.4% (AMU 21.2%-28.4%; FMU 14.7%-18.2). David et al. (2009) reported a 5.7%, which could be attributed to including only multiparous individuals cohort. Postpartum transfer rates exhibited consistency across the seven studies that reported this outcome, ranging from 2.4% to 4.8% (AMU 2.4%-4.3%; FMU 2.5%-4.8%).

Only four studies documented outcomes related to maternal mortality; however, none of these studies reported any instances of such cases.

3.2.2.11 Neonatal outcomes – Apgar Scores

The Apgar score was consistently documented across various studies. However, it was recorded in multiple formats across different studies.
A study conducted by Prelec et al. (2014) reported Apgar scores < 6 at both one and five minutes of life. Only one case was documented in the first category within their AMU cohort (0.6%). The reported cases in the OU setting constituted 2% and 1.2%, respectively. Palau and Costafreda (2023) indicated that Apgar scores < 7 at one minute of life occurred in 0.4% of cases in AMUs and 1.9% in OUs. Three additional studies addressed this outcome, revealing rates ranging from 0.4% to 5% for FMUs and from 1.9% to 8.1% for OUs. Most studies concentrated on Apgar scores <7 at five minutes of life. The rates for AMUs were 0%-1.7%, for FMUs 0.2%-1%, and from 0.3% to 2.8% for OUs, as evidenced in the table below.

	Apgar <7 at 1 min (%)			Apgar <7 at 5 min (%)		
Study ID	AMU	FMU	OU	AMU	FMU	OU
Palau-Costafreda 2023	0.4		1.9	0.8		0.3
Overaard 2012		3.6	3		0.6	0.6
David 1999		5	1.9			
David 2009		0.4	8.1		1	
Gottvall 2005				0.8		0.9
vanderKooy 2016				1.7		1.3
Alcaraz-Vidal 2024				0		0.4
Bernitz 2011				1%		0.5
Merz 2020				0.5		0.3
Rollet 2024				0.4		0.6
Waldenström 1997				1.3		1.1
Welffens 2019				1.7		2.8
Huitfeldt 2016					0.2	

Table 10. Neonatal Apgar Scores

Only one study investigated the incidence of Apgar < 7 at five minutes of life in FMUs compared to OUs, so this meta-analysis focused on AMUs.

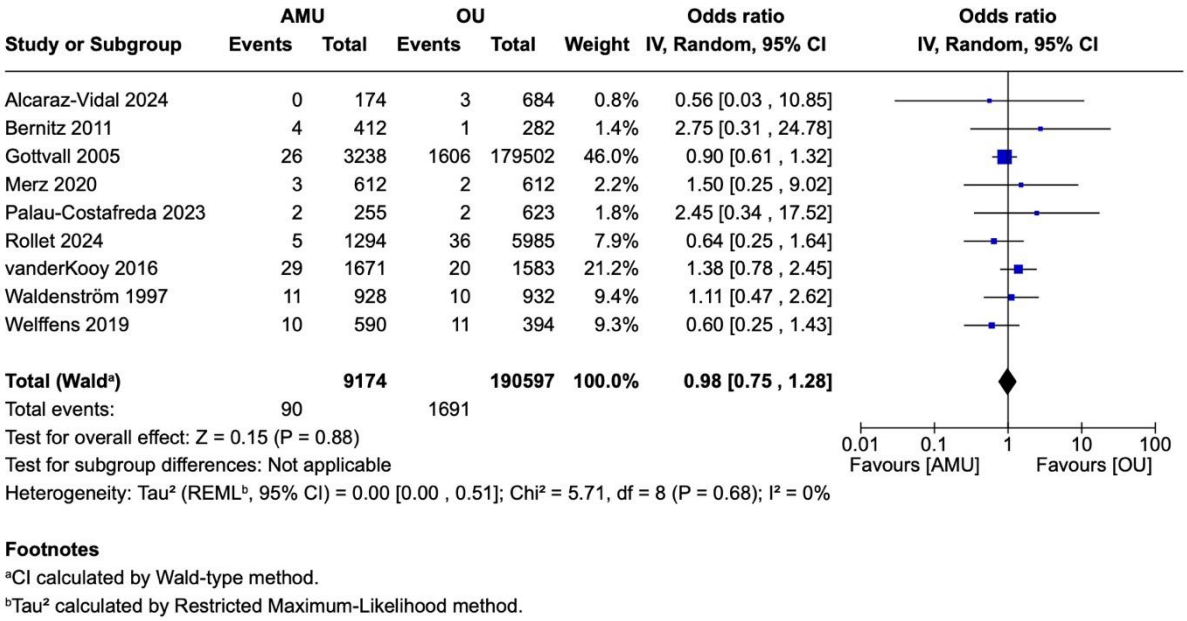


Figure 14. Meta-analysis of Apgar scores AMU vs OU

The pooled OR of 0.98 suggests no significant difference between AMUs and OUs (P= 0.88). The I^2 value of 0% denotes a high level of consistency across the studies. In summary, this meta-analysis suggests no clear evidence that AMUs either outperform or underperform compared to OUs concerning Apgar scores.

Overgaard (2012) and Hermus (2017) analysed Apgar <9 at five minutes of age. The incidence was reported at 1.8% and 1% in the FMU settings studied. Conversely, the OUs showed 2.4% and 1.1% rates in each study.

3.2.2.12. Neonatal Outcomes - Small for Gestational Age

Three of the studies included in this analysis reported the rates of Small for Gestational Age (SGA) infants in AMUs and presented results ranging from 0.9% to 7.2%.
None of the studies included in the analysis conducted within FMUs examined the rates of SGA. Consequently, a meta-analysis was performed exclusively for AMUs.

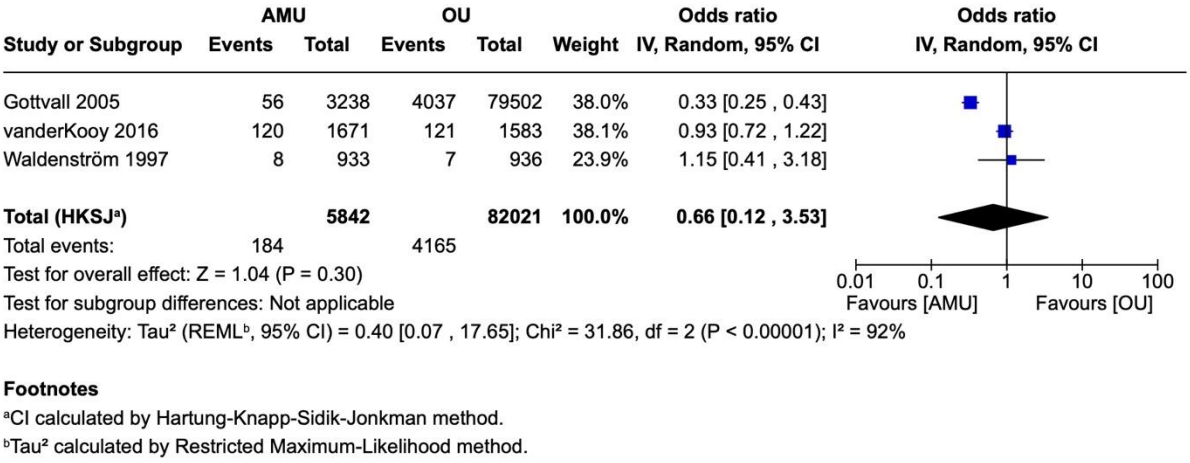


Figure 15. Meta-analysis of SGA infants AMU vs OU

The pooled OR of 0.66 suggests that AMUs may be favoured for lower rates of SGA. The wide confidence interval indicates high uncertainty, and it includes 1, which suggests that there may be no real difference between AMUs and OUs (P=0.30. The high heterogeneity (I^2=92%) and significant Chi^2 test suggest that the studies included in the meta-analysis have substantial variability in their findings. Sensitivity studies provided low heterogeneity but did not change the results or their statistical significance.

3.2.2.13 Neonatal Outcomes – Other

Gottvall et al. (2005) and Vanderkooy (2016) reported congenital abnormalities in AMUs at rates of 2.6% and 1.4%, respectively. Hermus et al. (2017) found 0.7% congenital abnormalities in an FMU context cases.

Four studies reported exclusive breastfeeding rates at discharge in AMUs, ranging from 80.5% to 91.8%. Three compared these rates with an OU, and the meta-analysis showed no statistically significant difference between AMUs and OUs (OR 1.35 [0.56, 3.25] p=0.19).

Transfer to an NNU was recorded by ten of the included studies. Six of these analysed transfers from AMUs [17,19-22,28], and the reported rates ranged between 0.3% to 7.7%. Transfers from FMUs [10,12,26,27] accounted for rates between 0.5% and 2.6%.

The documentation of fatal outcomes for infants was identified as the most complex, as it was characterised by varying terminologies and definitions across nearly all studies.

Four studies [11,18,22,25] reported on perinatal mortality (deaths between 28 weeks and 7 days postpartum) in FMUs and AMUs. Overgaard (2012) found a rate of 0.1% in the FMU, while AMU rates ranged from 0.1% to 0.6%.
Gottvall (2004) reported intrapartum deaths accounting for 0.09% of cases. David (1999) also reported on intrapartum deaths but found no cases.
Three studies [12,26,27] documented neonatal mortality in FMUs. David (2009) reported a rate of 0.2% of cases, whereas the other two studies did not indicate any incidence.

3.3 Study Quality and Risk of Bias

The bias risk assessment of the twenty studies used the Critical Appraisal Skills Programme (CASP) tools [9] for cohort studies and randomised controlled trials. This evaluation assessed study validity, confounding variables, participant selection, and outcome reliability. Most studies showed low bias risk in areas such as research question clarity and measurements mitigation. Some studies exhibited bias risks in findings, intervention delivery, and follow-up data completeness. Some studies had high bias risks, particularly in blinding, allocation concealment, and randomisation. This outcome arises naturally because a woman's delivery environment cannot be blinded. These quality discrepancies highlight the need for careful result interpretation, considering methodological limitations. A bias risk assessment for each study is in Appendix V.

Chapter 4: Discussion

4.1 Statement of Principal Findings

This review synthesised evidence regarding maternal and neonatal outcomes in FMUs and AMUs, offering a comprehensive understanding of outcomes in the European context by providing prevalence data and meta-analyses to quantify differences between MUs and OUs. Findings show that planned childbirth in MUs is associated with significantly higher NVD rates and lower instrumental births and caesarean sections compared to planned births in OUs for similar low-risk cases populations. Episiotomy rates were lower in MUs, and epidural analgesia was less frequent. An essential finding of this review is that MUs are safe and, at the very least, as safe as OUs [4].

For additional maternal outcomes, such as PPH and perineal trauma, discrepancies between MUs and OUs were less pronounced. The trends suggest a positive link with MUs, indicating that while differences may not be as significant as those for NVDs and post-transfer instrumental deliveries, MUs continue to offer advantages over OUs. Concerning neonatal outcomes, including Apgar scores and rates of SGA infants, no significant differences were noted across birth settings, implying that births conducted in MUs do not confer additional risks to neonatal well-being.

4.2 Strengths and Weaknesses of the Study

The strength of this review lies in its synthesis of evidence from multiple European countries, demonstrating that consistent findings across different nations provide a comprehensive picture of maternal and neonatal outcomes within MUs. This convergence of results enhances the generalisability of the outcomes across various healthcare settings. Furthermore, the meta-analysis quantitatively assesses disparities between MUs and OUs, providing a statistical measure of these differences. Sensitivity analyses are employed to evaluate study heterogeneity, effectively identifying sources of variability and assessing the robustness of results.

However, limitations exist: the literature search focused on English and major European languages, potentially excluding relevant studies. The variability in defining “low-risk population” and outcomes may complicate direct comparisons; publication bias could

underrepresent studies with null findings. Most included studies were observational, with few experimental ones, which may result in residual confounding. Additionally, heterogeneity across studies, stemming from differences in study design, population characteristics, and outcome definitions, may affect the comparability and generalisability of findings. While moderate heterogeneity was observed, methodological literature suggests that when heterogeneity is high (e.g., $I^2 > 75\%$), pooled estimates may become less meaningful, limiting their applicability [32]. For example, discrepancies exist among included studies regarding differences in instrumental birth rates between MUs and OUs. Some studies found no significant difference, while others highlight a protective effect of MUs. This heterogeneity may stem from different countries' operational practices, such as staffing models and referral pathways [5,25]. Moreover, incorporating various types of MUs (such as FMUs and AMUs) and the differing treatment of parity across studies presents additional challenges. Certain studies encompassed women of diverse parity, while others concentrated exclusively on nulliparous women or women with prior caesarean sections (typically followed by a normal vaginal delivery), thereby complicating the interpretation and comparability of results. We addressed these issues by acknowledging the varied definitions of low-risk populations and parity in the studies, which we considered when synthesising the evidence. These challenges highlight the importance of standardising these definitions in future research to improve the consistency and generalisability of findings. These issues also point to the need for further research using standardised measures for maternal and neonatal outcomes in MUs to reduce bias and improve future meta-analyses.

4.3 Strengths and Weaknesses in Relation to Other Studies

The findings of this review align with previous research evaluating birth outcomes in MUs, further substantiating the proposition that these environments provide safe and effective care for low-risk pregnancies. A systematic review conducted by Q. Long in 2016 [33] demonstrated that AMUs are correlated with significantly reduced rates of medical interventions, including caesarean sections and instrumental deliveries for transferred patients while achieving comparable neonatal outcomes to OUs. This evidence supports the endorsement of AMUs' role within maternity care systems. Furthermore, the same study reported positive outcomes regarding the satisfaction levels of both midwives and women. Similarly, research by Hodnett et al. (2012) examining the effects of MU care found that women in these settings reported significantly higher levels of satisfaction with their birth

experiences and lower levels of intervention, further supporting the positive outcomes seen in AMUs and FMUs [6]. The results of our review are in line with a systematic review conducted by Scarf et al. in 2018 [5], which examined planned births across various settings in high-income countries and discovered that births in MUs typically displayed lower rates of caesarean sections and instrumental deliveries, with no associated increase in adverse neonatal outcomes. This corroborates the conclusions of this review, reinforcing the expectation that MUs foster an environment conducive to optimal physiological birth while minimising unnecessary medical interventions. The consistency of these results across multiple studies indicates that MUs can function as a dependable alternative to OUs for women with low-risk pregnancies, striking a balance between safety and diminished intervention rates.

Conversely, it is crucial to acknowledge that although MUs have persistently demonstrated favourable outcomes regarding reduced interventions and comparable neonatal safety, certain challenges persist concerning the generalisability of these findings. Notably, studies such as those conducted by Sandall et al. (2016) emphasise the significance of specialised training and the integration of midwifery unit care within national healthcare strategies to attain optimal outcomes. Their review indicates that while MUs can provide effective care for low-risk pregnancies, the expertise and proficiency of midwifery staff, as well as the incorporation of these units into broader healthcare systems, are vital for ensuring favourable results [2]. This implies that the success of MUs does not solely rely on the physical setting but also reflects the quality of care rendered by trained midwives and their capacity to collaborate effectively with other healthcare professionals as required.

The findings of this review align with and reinforce the conclusions of several key studies, demonstrating that MUs are associated with lower intervention rates and comparable neonatal outcomes to OUs. However, further research is needed to explore the factors that contribute to the successful implementation of MUs across different national contexts and how they can be optimally integrated into existing healthcare systems. Such investigations will be key to enhancing the accessibility and effectiveness of midwifery-led care for women with low-risk pregnancies.

4.4 Meaning of the Study: Possible Explanations and Implications for Clinicians and Policymakers

The findings of this review provide a clearer understanding of the maternal and neonatal outcomes expected in MUs, which may serve as reference points for clinicians and policymakers. The high rates of normal vaginal delivery and low intervention rates confirm that MUs facilitate physiological birth processes in appropriately selected populations. These findings align with research on women's childbirth preferences, which underscores the tendency of many women to seek to avoid unnecessary medical interventions and favour birth settings that promote autonomy and facilitate physiological labour [34,35]. By demonstrating that MUs provide a safe environment with reduced intervention rates, this review substantiates their function as a viable option for women who prioritise minimal medical intervention while simultaneously ensuring favourable maternal and neonatal outcomes.

The anticipated outcomes outlined in this context serve as a valuable resource for maternity care providers. By understanding these outcomes, they can effectively counsel women regarding the options available for birth settings: home births, midwifery units, or hospitals. National guidelines, such as those from the National Institute for Health and Care Excellence (NICE), emphasise the importance of providing evidence-based information to women to support informed decision-making regarding their choice of birth setting [36]. Additionally, this knowledge allows providers to manage and align the expectations of women concerning the potential outcomes of their childbirth experiences in MUs. In doing so, care providers can foster a more informed decision-making process, ultimately enhancing the overall maternity care experience for mothers-to-be. Existing literature highlights that women's preferences for place of birth are influenced by factors such as perceived safety, desire for minimal intervention, and trust in midwifery-led care [37,38]. By ensuring access to clear, research-backed information on birth outcomes in different settings, maternity care providers can empower women to make choices that align with their values and preferences, ultimately improving satisfaction and overall birth experiences.

The findings presented in this report underscore a critical dimension of maternal healthcare for policymakers: the imperative to ensure that Midwifery Units are sufficiently resourced and seamlessly integrated within existing healthcare frameworks. The Midwifery Unit Standards, developed by the Midwifery Unit Network and City, University of London, provide comprehensive guidelines on the philosophy and organisation of care in MUs, aiming to improve the quality of maternity care and facilitate the integration of midwifery-led

models within health systems [3]. Similarly, the International Confederation of Midwives (ICM) emphasises that Midwife-Led Birth Centres (MLBCs) must be integrated into local healthcare services, enabling midwives to consult and refer women to secondary and tertiary-level services as needed, thereby ensuring a continuum of care [39]. Furthermore, the ICM highlights the necessity of an enabling environment that supports the infrastructure, professional development, and system-level integration required for midwives to practice effectively within their full scope, essential for scaling midwife-led care [40].

The analogous neonatal outcomes observed across diverse settings further substantiate the established safety profile of MUs for low-risk pregnancies, emphasising their pivotal role in the strategic planning of maternity services and the allocation of resources. Nonetheless, it is essential to acknowledge substantial variability in the reporting of specific neonatal outcomes. For instance, Apgar scores exhibit a considerable range of values recorded at different minutes of an infant's life. Furthermore, the reporting of fatal adverse events is frequently grouped into wider time frames or diverse subgroups, such as “perinatal mortality”, “intrapartum death," or even “neonatal death," reported at different points in time. This highlights the critical necessity to establish standardised measures and protocols. Such protocols and enhanced data collection methodologies are crucial in refining our expectations regarding the efficacy of MUs and augmenting the comparability of outcomes across distinct healthcare systems. This standardisation will facilitate the identification of best practices and ensure that all MUs function at an optimal level of care.

Additionally, further research into the factors influencing outcome variations will be imperative. Specifically, studies should investigate the influence of staffing ratios, clinical guideline discrepancies, and transfer policy variations on maternal and neonatal outcomes. Longitudinal research that compares midwifery unit models across diverse healthcare systems could yield valuable insights regarding the structural factors that impact outcomes. Additionally, mixed-methods research that includes qualitative interviews with midwives and service users may assist in identifying barriers and facilitators to achieving optimal care within MUs.

A comprehensive understanding of these factors is crucial for fortifying the evidence base that supports MUs and can broadly contribute to advancements in care delivery and improved maternal and neonatal health outcomes. This research will also enable the development of

targeted strategies designed to mitigate discrepancies in maternity care, thereby promoting equity in healthcare across diverse populations.

4.5 Unanswered Questions and Future Research

This review provides valuable insights into expected clinical outcomes in midwifery units. Nonetheless, several areas need further exploration. More research is essential to explore the factors contributing to variability in maternal and neonatal outcomes across different MU environments. Differences in admission criteria, transfer protocols, and clinical management practices could influence birth outcomes and require a more thorough investigation.

Secondly, the long-term health outcomes for mothers and neonates after childbirth in MUs remain insufficiently examined. Future research should explore the degree to which the benefits linked to deliveries in midwifery units persist beyond the immediate postpartum period, including potential influences on maternal recovery, breastfeeding establishment, and neonatal development.

In conclusion, it is essential to standardise data collection and reporting practices across various studies to enhance the comparability of findings significantly. Establishing uniform outcome measures cannot be overstated, as they serve as a foundation for consistency in research and facilitate the interpretation of results. By creating clear and comprehensive guidelines for reporting maternal and neonatal outcomes within MUs, researchers will be better equipped to evaluate anticipated birth outcomes accurately. This standardisation will lead to more reliable data and enhance the quality and trustworthiness of systematic reviews conducted in this field. Establishing these standardised practices will ultimately improve health outcomes for mothers and newborns alike, making them a crucial aspect of ongoing research efforts and health policy development.

Chapter 5: Conclusion

This systematic review presents comprehensive evidence regarding the anticipated maternal and neonatal outcomes in MUs, reporting notably higher rates of normal vaginal delivery compared to other types of delivery settings. Additionally, the review highlights lower intervention rates in MUs, while the neonatal outcomes are comparable to those observed in OUs.

These findings offer critical insights for healthcare providers, including clinicians, maternity service planners, and policymakers. They provide a benchmark for understanding expected outcomes in FMUs and AMUs, thus enhancing their planning and decision-making processes.

Despite these promising results, the variations in study outcomes underline the necessity for more extensive research. Addressing the unanswered questions will help refine expectations and improve the comparability of outcomes across various healthcare settings. By establishing standardised data collection and reporting protocols, the healthcare community can significantly strengthen the evidence base. Such improvements will ultimately contribute to better decision-making in maternity care and may lead to enhanced outcomes for mothers and their newborns.

Declaration of Interest

The authors declare no conflicts of interest related to this systematic review. No financial, personal, or professional relationships influenced the design, execution, or reporting of this research.

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Authors' Contributions

M. Valerio was the primary researcher responsible for conducting the systematic review, data extraction, and analysis. L.H. Jackson acted as the second reviewer, contributing to study selection, data validation, and quality assessment. M. Daniele supervised the development of the review, providing critical oversight and mentorship throughout the process. L. Rocca-Ihenacho offered valuable guidance and insight, supporting the conceptual development of the review and strengthening its overall framework.

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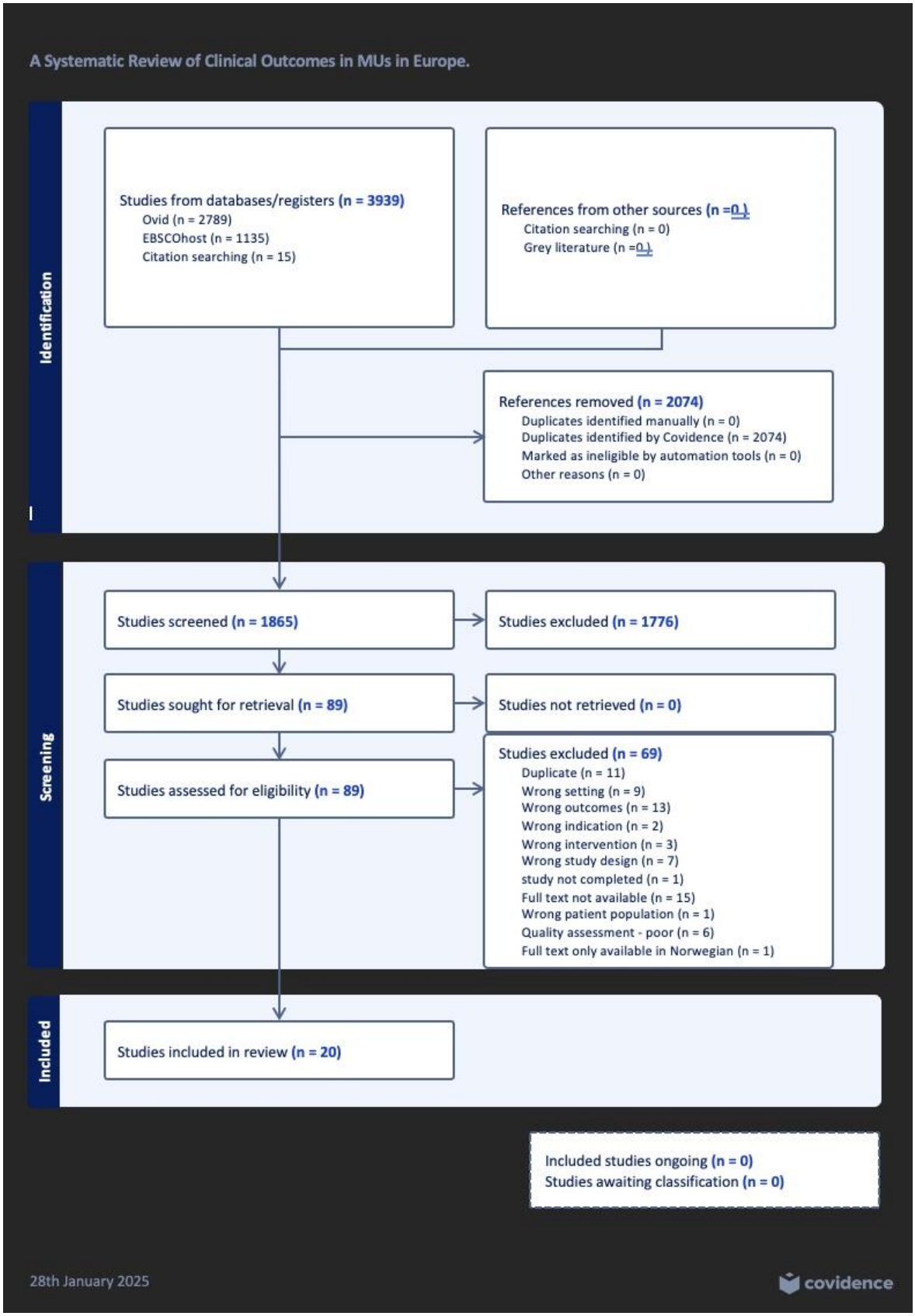
Appendix I

Study ID	Title	Study Identification	Country	Setting	Start Date:	End Date:	Methods	Design	Population	Inclusion criteria	Exclusion criteria	Group differences	Total sample size	Number of withdrawals	Reason for withdrawals	Interventions		Number of participants allocated
Prelec 2014	A comparison of frequency of medical interventions and birth outcomes between the midwife led unit and the obstetric unit in low-risk primiparous women.		Slovenia	AMU and OU	May 2013	August 2013		Prospective cohort study		low risk primiparous women; singleton pregnancies at 37 - 41 weeks of gestation; normal foetal heart beat according to NICE , cephalic presentation; spontaneous onset of labour; active phase of labour	gestational diabetes, fetal growth restriction, mental and other health disorders.	AMU care vs OU care	497		preterm, breech, eferral to tertiary centre, gestational diabetes, fetal growth restriction, mental and other health disorders		AMU	154
Gaudineau 2012	Obstetric and neonatal outcomes in a home-like birth centre: a case-control study.		France	AMU	Jan 2005	Jun 2008		Retrospective cohort study		The only criterion for inclusion in the HLBC was the mother's desire to give birth there.	medical, surgical or obstetrical history at risk of obstetric complications, multiple pregnancy, toxemia, gestational diabetes, intrauterine growth restriction, non-cephalic presentation, placenta praevia, pPROM> 24 h, preterm labor, post-term >42weeks, IOL, abnormal CTG at admission. To obtain two comparable groups, we applied the exclusion criteria used for the HLBC to retrospectively select a low-risk population among all women admitted to our level 3 maternity.	AMU care or OU care	1206		Did not fit inclusion/exclusion criteria		AMU	316
Alcaraz-Vidal 2024	First alongside midwifery led unit in a high complexity public hospital in Spain: Maternal and neonatal outcomes.		Spain	AMU and OU	July 2021	June 2022		Cross-sectional observational study		women at low risk of complications, at term, with a single baby and cephalic; sponta-neous onset of labour.	women without antepartum or intrapartum contraindications to birth there during the same period and were facilitated to give birth at the standard Obstetric Unit (OU) of the HGT.	AMU care or OU care	858	11	not decided for natural birth, analgesia, PROM>24hrs		AMU	174
Gottvall 2005	Birth centre care over a 10-year period: infant morbidity during the first month after birth.		Sweden	AMU		1989 2000		Retrospective cohort study		Only women at low medical risk were included. Women who had previously undergone caesarean section were eligible if they had subsequently had a normal deliverv.	high blood pressure, diabetes, medication for epilepsy, alcohol abuse, drug abuse and smoking precluded birth centre care, history of multiple birth or perinatal death.	AMU or OU care	3423	185	miscarriages, missing from MBR, multiple pregnancies, perinatal deaths		AMU	3238
Merz 2020	Maternal and neonatal outcome of births planned in alongside midwifery units: a cohort study from a tertiary center in Germany.		Germany	AMU and OU	2010	2017		Retrospective cohort study		singleton term cephalic pregnancies were included	preexisting medical condition; body mass index (BMI)> 35 kg/m2, complications during previous deliveries; previous CS; Complications during the ongoing pregnancy: maternal complications; amniotic fluid abnormalities (oligo- or polyhydramnios)	AMU care vs standard obstetric care	1224				AMU	612
Rollet 2024	Severe adverse maternal and neonatal outcomes according to the planned birth setting being midwife-led birth centers or obstetric-led units.		France	AMU				Retrospective cohort study		singleton cephalic pregnancies who delivered after 37 weeks, had no pre-pregnancy medical conditions, no history of complications in previous pregnancies, and no complications in the current pregnancy,	We excluded from these datasets women who were not considered low-risk as per the National Institute for Health and Care Excellence (NICE)	AMU care or OU care	15618	653	refusal to provide medical records, stillbirth, minors		AMU	1294
Overaard 2012	Freestanding midwifery unit versus obstetric unit: a matched cohort study of outcomes in low-risk women.		Denmark	FMU and OU	2004	2008		Matched Cohort study		presented in spontaneous labour between 37+0 and 41+6 days of gestation and had an uncomplicated pregnancy and no medical/obstetric history or conditions increasing obstetric risk as outlined in the UK NICE	Excluded from the study were three women admitted to an FMU for emergency treatment without satisfying the criteria for FMU care;	FMU care or OU care	1678	0			FMU	839
Gottvall 2004	Safety of birth centre care: perinatal mortality over a 10-year period.		Sweden	AMU and OU	1989	2000		Retrospective cohort study		Singleton pregnancies who met the low risk medical criteria for birth centre care	Multiple pregnancies High blood pressure, diabetes or gestational diabetes, multiple pregnancy, medication for epilepsy, alcohol abuse, drug abuse and smoking. Women with a previous caesarean section were eligible if they had had a subsequent normal delivery. Labour before 37 þ 0 weeks or after 42 þ 6 weeks.	met same low risk criteria, difference is standard	3423	176	miscarriage, multiple pregnancy, missing from MBR		AMU	3456
Eide 2009	Births in two different delivery units in the same clinic--a prospective study of healthy primiparous women.		Norway	AMU and OU	Novemb er 3,	May 31, 2002		Prospective cohort study		low-risk primiparous women admitted to labour between 36 and 42 weeks of gestation.	Expressed desire of epidural analgesia at admission to the hospital before admission to the labour ward.	Level of care	453				AMU	252
Waldenström 1997	The Stockholm birth centre trial: maternal and infant outcome.		Sweden	AMU				Randomized controlled trial		residents of Greater Stockholm and at least one partner in each expectant couple had to be swedish-speaking. Women with a previous caesarean section were accepted if their last delivery was vaginal	Women with a complicating general condition, drug abusers, smokers. A history of low birthweight, preterm birth, perinatal death, or a difficult vaginal delivery did not preclude participation.	level of care	928	22	miscarriage; Breech ;High blood pressure, toxemia; > 42 weeks or< 37 weeks; Twins; Growth retardation;Haemorrhage; Rh isoimmunisation; fetal distress; IUD		AMU	928
Hermus 2017	Differences in optimality index between planned place of birth in a birth centre and alternative planned places of birth, a nationwide prospective cohort study in the Netherlands: Results of the Dutch Birth Centre Study		Netherlands; United Kingdom of Great Britain and Northern	FMU, OU and home births	1 July 2013	31 December 2013		Prospective cohort study		birth centre was in service for more than a year before the start of the study to be included	in service less than a year	Level of care	3455				FMU	1668
Huitfeldt 2016	Outcomes of care at 'Føderiket Midwifery Unit' 2007-2011, a freestanding midwifery-led unit in Oslo, Norway: A prospective cohort study.		Norway	FMU		2007 2011		Prospective cohort study		non-smokers, BMI < 30, no chronic medical diseases before pregnancy, no complications in pregnancy, a single cephalic foetus, with spontaneous onset of labour at term, <para6., and women with a previous caesarean delivery had to have had a subsequent uncomplicated vaginal delivery to	smokers, BMI >30, chronic medical conditions, pregnancy complications, multiple gestation, non-vertex position, labour pre or post term, more than 5 previous deliveries, prior c-section without subsequent NVD	no comparison	808	313	developed complications, moved or changed their mind.		FMU	495
Bernitz 2011	Is the operative delivery rate in low-risk women dependent on the level of birth care? A randomised controlled trial.		Norway	MU, NU and OU				Randomized controlled trial		low-risk women, one fetus in cephalic presentation, (BMI) <32, not smoking more than ten cigarettes per day, no prior operation on the uterus, no prior complicated deliveries, and spontaneous onset of labour between 36+1 and 41+6 weeks of gestation	Not low risk or risk level changed prior to onset of labour	level of care	2884	1773	no longer considered low risk;changed mind about participating; midwife-led unit closures		AMU	412
Palau-Costafreda 202	The first alongside midwifery unit in Spain: A retrospective cohort study of maternal and neonatal outcomes.		Spain	AMU and OU	January 2018	December 2020		Retrospective cohort study		Gestational age 37-42 weeks, singleton pregnancy, cephalic lay, BMI less than 30, parity 0-3, HB at labor greater than 10 g/dL, age<40,	gestational age < 37 weeks or > 42 weeks; multiples pregnancy; breech or transverse lay BMI > 40; parity > 5 ; Hb <9 or Hct less than 25% at labor ; not controlled medical condition ; previous uterine surgery; previous shoulder dystocia, postpartum hemorrhage, retained placenta; previous 4th degree tear; recurrent PVB during pregnancy, pre-eclampsia ; low-lying placenta; active infection: toxoplasmosis, rubella, syphilis, cytomegalovirus with fetal infc active genital herpes, HIV, hepatitis B or C; insulin controlled diabetes; EFW less than P5 or greater than 4500 g; major fetal abnormality; oligoamnios/polyhydramnios; ROM greater than 24 hrs with no established labor; meconium stained fluid before onset of labor; heavy vaginal bleeding	Care in AMU vs care in OU	878	rospective	n/a		AMU	255
David 2009	Prior cesarean section--an acceptable risk for vaginal delivery at free-standing midwife-led birth centers? Results of the analysis of vaginal birth after cesarean section (VBAC) in German birth centers.		Germany	FMU	2000	2004		Retrospective cohort study		The target group of the study included all second births to mothers with a previous cesarean, cephalic presentation >34/0 weeks of gestation	Women were not accepted for VBAC in the birth centers if they presented with other than a Pfannenstiel scar, a history of preterm birth, an unusual position of placenta, more than one previous c-section, or any other pregnancy complication	The control group included all second births to	6812	oactive selec	n/a		FMU	6448

Study ID	Title	Study Identification	Country	Setting	Start Date:	End Date:	Methods	Design	Population	Inclusion criteria	Exclusion criteria	Group differences	Total sample size	Number of withdrawals	Reason for withdrawals	Interventions		Number of participants allocated
David 2009	Prior cesarean section--an acceptable risk for vaginal delivery at free-standing midwife-led birth centers? Results of the analysis of vaginal birth after cesarean section (VBAC) in German birth centers.		Germany	FMU	2000	2004		Retrospective cohort study		The target group of the study included all second births to mothers with a previous cesarean, cephalic presentation >34/0 weeks of gestation	Women were not accepted for VBAC in the birth centers if they presented with other than a Pfannenstiel scar, a history of preterm birth, an unusual position of placenta, more than one previous c-section, or any other pregnancy complication	The control group included all second births to mothers	6812	0 active selec	n/a		FMU	6448
Chapman 1986	The use of a birthroom: a randomized controlled trial comparing delivery with that in the labour ward		UK	OU and AMU				Randomized controlled trial		multiparous who had had normal previous pregnancies and deliveries. All were under the care of the Queen Charlotte's Maternity Hospital community midwives; all had asked for early discharge and lived within 5 miles of the hospital	wanting epidural or continuous electronic fetal monitoring	level of care	148	35	epidural, intrauterine growth retardation, post-maturity, pre-eclampsia, transverse lie, and antepartum haemorrhage. Fever, meconium-stained amniotic fluid and preterm labour accounted for the remainder, breech, twins, moved out of area, APH, IOL, poor social circumstances preventing early discharge		AMU	76
David 1999	Perinatal outcome in hospital and birth center obstetric care.		Germany	FMU and OU	1992	1994		Retrospective cohort study		Both groups could be characterized as being low-risk. They were a modified version of the risk criteria from the New York Maternity Center	Antenatal risks; Significant past medical history of risks ; Intrapartum risks; more than 14 days postdates, meconium stained amniotic fluid, non-reassuring cardiotocogram CTG , and vaginal bleeding	level of care	4072				FMU	801
Welffens 2019	The 'Cocoon,' first alongside midwifery-led unit within a Belgian hospital: Comparison of the maternal and neonatal outcomes with the standard obstetric unit over 2 years		Belgium	AMU and OU	March 1, 2014	Feb 29, 2016		Retrospective cohort study		strong motivation for natural birth, Fluent French,, >18 and <40 years old, parity <4, BMI >18 and <30, no substance abuse, no pre-existing maternal medical condition, GA at booking of care with MU <14/40, Hb at 36/40 >10, 1 cephalic fetus, GA at labour onset >37 and <42, normal EFW, no fetal pathology, no placental abnormality, no amniotic fluid abnormality	poor motivation for natural birth; Beginner French; Maternal age >45; Parity>7; Pre-pregnancy BMI >35 or <18; Substance abuse; Pre-existing maternal medical conditions; Myomectomy or hysterectomy; severe pre-eclampsia; eclampsia, IUD of unknown cause; neonatal GBS septicemia; GA at booking of care with MU >14/40 and <32/40; Hb at 36/40 >9 and <10; minor fetal abnormality (eg cleft lip and palate)	Care in AMU vs care in OU	984	0			AMU	590
vanderKooy 2016	Different settings of place of midwife-led birth: evaluation of a midwife-led birth centre.		Netherlands	home, AMU and OU	2007	2012		Prospective cohort study		singleton pregnancies supervised by a community midwife at the onset of labour	history of PPH or BMI > 35.		1671				AMU	1671
BirthplaceinEnglandC	Perinatal and maternal outcomes by planned place of birth for healthy women with low risk pregnancies: the Birthplace in England national prospective cohort study		England	Home, /	Apr-08	Apr-10		Prospective cohort study		singleton, greater than 37 wks pg, planning to birth during study timeframe	elective C/S, C/S before onset of labor, preterm, multiples	location of	79774	1921	unsuccessful data collection by units, units not agreeing to participate		AMU	16710
BirthplaceinEnglandC	Perinatal and maternal outcomes by planned place of birth for healthy women with low risk pregnancies: the Birthplace in England national prospective cohort study		England	Home, /	Apr-08	Apr-10		Prospective cohort study		singleton, greater than 37 wks pg, planning to birth during study timeframe	elective C/S, C/S before onset of labor, preterm, multiples	location of	79774	1921	unsuccessful data collection by units, units not agreeing to participate		FMU	11282

Appendix II


A Systematic Review of Clinical Outcomes in MUs in Europe.
Identification
Studies from databases/registers (n = 3939)
Ovid (n = 2789)
EBSCOhost (n = 1135)
Citation searching (n = 15)
References from other sources (n = 0)
Citation searching (n = 0)
Grey literature (n = 0)
References removed (n = 2074)
Duplicates identified manually (n = 0)
Duplicates identified by Covidence (n = 2074)
Marked as ineligible by automation tools (n = 0)
Other reasons (n = 0)
Screening
Studies screened (n = 1865)
Studies excluded (n = 1776)
Studies sought for retrieval (n = 89)
Studies not retrieved (n = 0)
Studies assessed for eligibility (n = 89)
Studies excluded (n = 69)
Duplicate (n = 11)
Wrong setting (n = 9)
Wrong outcomes (n = 13)
Wrong indication (n = 2)
Wrong intervention (n = 3)
Wrong study design (n = 7)
study not completed (n = 1)
Full text not available (n = 15)
Wrong patient population (n = 1)
Quality assessment - poor (n = 6)
Full text only available in Norwegian (n = 1)
Included
Studies included in review (n = 20)
Included studies ongoing (n = 0)
Studies awaiting classification (n = 0)
28th January 2025
covidence

Maternal

Intrapartum Outcomes
Electronic fetal monitoring
Internal monitoring
Dystocia in labour
Admission to delivery interval
Length of labour
Duration of first stage <12 h
Prolonged second stage of labour (> 120 mins)
Length of the second stage of labour
Intrapartum fetal-pelvic complications
Induction of labour
Amniotomy
Syntocinon augmentation
Upright birthing position
Non recumbent position for birth
Waterbirth
Spontaneous rupture of membranes
Clear amniotic fluid
Time between rupture of membranes and delivery

Delivery Outcomes
Normal vaginal birth
Vaginal breech birth
Ventouse delivery
Forceps delivery
Instrumental delivery
Cesarean section

Postpartum Outcomes
Intrauterine palpation
Retained placenta
Manual removal of placenta
Postpartum haemorrhage >500ml
Postpartum haemorrhage >600 ml
Postpartum haemorrhage > 1000ml
Postpartum haemorrhage > 1500ml
No active management of 3rd stage
One or more uterotonics
Discharge <6 h postpartum
Early discharge (24h)
Postpartum stay of 2 days or less
Maternal readmission
Admission to a higher level of care
Blood transfusion

Perineal Outcomes
Intact perineum
First and second degree tears
First degree tear
Second degree tear
Third and fourth degree tears
OASI
Episiotomy
Perineal suturing

Pain relief Outcomes
No pain relief used
No injectable medication for pain relief during first or second stage of labour
None or local anaesthesia
Local analgesia postpartum
Non-medical pain relief
Water immersion for pain relief
Pain relief: Acupuncture
Pain relief: sterile water injections
Pain relief : pharmacological
Pain relief: Opiates
Pain relief: nitrous oxide
Pudendal nerve block
Epidural
General anaesthesia

Transfer Outcomes
Birth occurred in the place originally planned at onset of labour
Antenatal transfer
Intrapartum transfer
Emergency intrapartum transfer
Delivery within 1 h of arrival at hospital following transfer
Delivery mode: spontaneous delivery, women transferred to a hospital
Delivery mode: cesarean, women transferred to a hospital
Postpartum transfer
No referral during labour or two hours post partum
No urgent referral
Total no of transfers intrapartum or <2 h after birth

Morbidity
Severe maternal morbidity
Total intrapartum related maternal morbidities
ICU admission (mother)
Maternal death
Composite Severe adverse maternal and neonatal outcome

Other
Miscarriage <22 weeks
Positive effect of environment
Insufficient freedom of movement

Neonatal

Scoring Outcomes
Birthweight
Birthweight<2500g
Birthweight > 4000g
Birthweight>4500g
Birthweight betweeen 10th and 90th centiles
SGA
Apgar score <6 at 1 min
Apgar score <6 at 5 min
Apgar score <7 at 1 min
Apgar score <7 at 5 min
Apgar score <7 at 10 min
Apgar score <9 at 5 min
Neonatal arterial pH
Arterial pH <7.05 and BE (Base Excess) <)12 mmol/l.

Breastfeeding Outcomes
Breastfeeding at discharge
Partial breastfeeding at discharge
Feeding problems

Hospital stay Outcomes
Infant hospital stay 0-3 days
Infant hospital stay 4-6 days
Infant hospital stay 7-27 days
Infant hospital stay >27 days
Neonatal stay in NICU>48 h
Neonatal readmission
NNU admission in the first week

Morbidity Outcomes
No neonatal complications
Resusitation of infant
Transfer to Neonatal Unit
Shoulder dystocia
Treatment fo shoulder dystocia
Total intrapartum related neonatal morbidities
Perinatal mortality and intrapartum related neonatal morbidities (stillbirth after start of care in labour, early neonatal death, neonatal encephalopathy, meconium aspiration syndrome, brachial plexus injury, fractured humerus or clavicle)
Intrauterine death
Perinatal mortality
Intrapartum Death
Neonatal mortality
Neonatal death 0-6 days postpartum
Neonatal death 7-27 days postpartum
Fractures
Hypoglycaemia
Rh Immunization and hyperbilirubinaemia
Peripheral nerve lesion
Prematurity
Congenital abnormality
Minor malformations
Major malformations
Lethal malformations
Neonatal asphyxia
Intrauterine hypoxia and birth asphyxia
Massive meconium aspiration
Congenital pneumonia
Neonatal septicemia
Neonatal: other infections
Jaundice or haemolytic disease
Fetal and neonatal haemorrhage
Neonatal respiratory conditions
Convulsions
Neonatal Birth trauma

Other Outcomes
Abnormal fetal heart rate leading to action
Cephalic presentation at birth
Occipital posterior presentation at birth

Critical Appraisal Skills Programme

Appendix V

CASP Checklist:
For Randomised Controlled Trials (RCTs)

Reviewer Name:	
Paper Title:	
Author:	
Web Link:	
Appraisal Date:	

During critical appraisal, never make assumptions about what the researchers have done. If it is not possible to tell, use the "Can't tell" response box. If you can't tell, at best it means the researchers have not been explicit or transparent, but at worst it could mean the researchers have not

undertaken a particular task or process. Once you've finished the critical appraisal, if there are a large number of "Can't tell" responses, consider whether the findings of the study are trustworthy and interpret the results with caution.

Section A Is the basic study design valid for a randomised controlled trial?	
1. Did the study address a clearly formulated research question?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: *Was the study designed to assess the outcomes of an intervention?* *Is the research question 'formulated' in terms of:* • *Population studied* • *Intervention given* • *Comparator chosen* • *Outcomes measured?*	
2. Was the assignment of participants to interventions randomised?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: • *How was randomisation carried out? Was the method appropriate?* • *Was randomisation sufficient to eliminate systematic bias?* • *Was the allocation sequence concealed from investigators and participants?*	
3. Were all participants who entered the study accounted for at its conclusion?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: • *Were losses to follow-up and exclusions after randomisation accounted for?* • *Were participants analysed in the study groups to which they were randomised (intention-to-treat analysis)?* • *Was the study stopped early? If so, what was the reason?*	
Section B Was the study methodologically sound?	

4. (a) Were the participants 'blind' to intervention they were given?	☐ Yes ☐ No ☐ Can't Tell
(b) Were the investigators 'blind' to the intervention they were giving to participants?	☐ Yes ☐ No ☐ Can't Tell
(c) Were the people assessing/analysing outcome/s 'blinded'?	☐ Yes ☐ No ☐ Can't Tell
5. Were the study groups similar at the start of the randomised controlled trial?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: • *Were the baseline characteristics of each study group (e.g. age, sex, socio-economic group) clearly set out?* • *Were there any differences between the study groups that could affect the outcome/s?*	
6. Apart from the experimental intervention, did each study group receive the same level of care (that is, were they treated equally)?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: • *Was there a clearly defined study protocol?* • *If any additional interventions were given (e.g. tests or treatments), were they similar between the study groups?* • *Were the follow-up intervals the same for each study group?*	
Section C: What are the results?	
7. Were the effects of intervention reported comprehensively?	☐ Yes ☐ No ☐ Can't Tell

CONSIDER: • *Was a power calculation undertaken?* • *What outcomes were measured, and were they clearly specified?* • *How were the results expressed? For binary outcomes, were relative and absolute effects reported?* • *Were the results reported for each outcome in each study group at each follow-up interval?* • *Was there any missing or incomplete data?* • *Was there differential drop-out between the study groups that could affect the results?* • *Were potential sources of bias identified?* • *Which statistical tests were used?* • *Were p values reported?*	
8. Was the precision of the estimate of the intervention or treatment effect reported?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: • *Were confidence intervals (CIs) reported?*	
9. Do the benefits of the experimental intervention outweigh the harms and costs?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: • *What was the size of the intervention or treatment effect?* • *Were harms or unintended effects reported for each study group?* • *Was a cost-effectiveness analysis undertaken? (Cost-effectiveness analysis allows a comparison to be made between different interventions used in the care of the same condition or problem.)*	
Section D: Will the results help locally?	
10. Can the results be applied to your local population/in your context?	☐ Yes ☐ No ☐ Can't Tell

CONSIDER: • *Are the study participants similar to the people in your care?* • *Would any differences between your population and the study participants alter the outcomes reported in the study?* • *Are the outcomes important to your population?* • *Are there any outcomes you would have wanted information on that have not been studied or reported?* • *Are there any limitations of the study that would affect your decision?*	
11. Would the experimental intervention provide greater value to the people in your care than any of the existing interventions?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: • *What resources are needed to introduce this intervention taking into account time, finances, and skills development or training needs?* • *Are you able to disinvest resources in one or more existing interventions in order to be able to re-invest in the new intervention?*	

APPRAISAL SUMMARY: *List key points from your critical appraisal that need to be considered when assessing the validity of the results and their usefulness in decision-making.*		
Positive/Methodologically sound	Negative/Relatively poor methodology	Unknowns

Referencing recommendation:

CASP recommends using the Harvard style referencing, which is an author/date method. Sources are cited within the body of your assignment by giving the name of the author(s) followed by the date of publication. All other details about the publication are given in the list of references or bibliography at the end.

Example:

Critical Appraisal Skills Programme (2024). CASP (insert name of checklist i.e. randomised controlled trials (RCTs) Checklist.) [online] Available at: insert URL. Accessed: insert date accessed.

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CASP Checklist:
For Cohort Studies

Reviewer Name:	
Paper Title:	
Author:	
Web Link:	
Appraisal Date:	

During critical appraisal, never make assumptions about what the researchers have done. If it is not possible to tell, use the "Can't tell" response box. If you can't tell, at best it means the researchers

have not been explicit or transparent, but at worst it could mean the researchers have not undertaken a particular task or process. Once you've finished the critical appraisal, if there are a large number of "Can't tell" responses, consider whether the findings of the study are trustworthy and interpret the results with caution.

Section A: Are the results valid?	
12. Did the study address a clearly focused issue?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: *A question can be 'focused' in terms of* • *the population studied* • *the risk factors studied* • *is it clear whether the study tried to detect a beneficial or harmful effect* • *the outcomes considered*	
13. Was the cohort recruited in an acceptable way?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: • *Look for selection bias which might compromise the generalisability of the findings:* • *was the cohort representative of a defined population* • *was there something special about the cohort* • *was everybody included who should have been*	
14. Was the exposure accurately measured to minimise bias?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: *Look for measurement or classification bias:* • *did they use subjective or objective measurements* • *do the measurements truly reflect what you want them to (have they been validated)* • *were all the subjects classified into exposure groups using the same procedure*	
15. Was the outcome accurately measured to minimise bias?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: *Look for measurement or classification bias:* • *did they use subjective or objective measurements* • *do the measurements truly reflect what you want them to (have they been validated)* • *has a reliable system been established for detecting all the cases (for measuring disease occurrence)*	

• *were the measurement methods similar in the different groups* • *were the subjects and/or the outcome assessor blinded to exposure (does this matter)*	
16. (a) Have the authors identified all important confounding factors?	☐Yes ☐ No ☐ Can't Tell
CONSIDER: • *list the ones you think might be important, and ones the author missed*	
b) Have they taken account of the confounding factors in the design and/or analysis?	☐Yes ☐ No ☐ Can't Tell
CONSIDER: • *look for restriction in design, and techniques e.g. modelling, stratified-, regression-, or sensitivity analysis to correct, control or adjust for confounding factors*	
17. a) Was the follow up of subjects complete enough?	☐Yes ☐ No ☐ Can't Tell
CONSIDER: • *the persons that are lost to follow-up may have different outcomes than those available for assessment* • *in an open or dynamic cohort, was there anything special about the outcome of the people leaving, or the exposure of the people entering the cohort*	
b) Was the follow up of subjects long enough?	☐Yes ☐ No ☐ Can't Tell
CONSIDER: • *the good or bad effects should have had long enough to reveal themselves*	
Section B: What are the results?	
18. What are the results of this study?	☐Yes ☐ No ☐ Can't Tell
CONSIDER: • *what are the bottom line results* • *have they reported the rate or the proportion between the exposed/unexposed, the ratio/rate difference* • *how strong is the association between exposure and outcome (RR)* • *what is the absolute risk reduction (ARR)*	

19. How precise are the results?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: • *look for the range of the confidence intervals, if given*	
20. Do you believe the results?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: • *big effect is hard to ignore* • *can it be due to bias, chance or confounding* • *are the design and methods of this study sufficiently flawed to make the results unreliable* • *Bradford Hills criteria (e.g. time sequence, dose-response gradient, biological plausibility, consistency)*	
Section C: Will the results help locally?	
21. Can the results be applied to the local population?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: • *Is a cohort study the appropriate method to answer this question* • *If the subjects covered in this study could be sufficiently different from your population to cause concern* • *If your local setting is likely to differ much from that of the study* • *If you can quantify the local benefits and harms*	
22. Do the results of this study fit with other available evidence?	☐ Yes ☐ No ☐ Can't Tell
23. What are the implications of this study for practice?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: • *one observational study rarely provides sufficiently robust evidence to recommend changes to clinical practice or within health policy decision making* • *for certain questions, observational studies provide the only evidence* • *recommendations from observational studies are always stronger when supported by other evidence*	

APPRAISAL SUMMARY: *List key points from your critical appraisal that need to be considered when assessing the validity of the results and their usefulness in decision-making.*		
Positive/Methodologically sound	Negative/Relatively poor methodology	Unknowns

Referencing recommendation:

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Example:

Critical Appraisal Skills Programme (2024). CASP (insert name of checklist i.e. qualitative studies Checklist.) [online] Available at: insert URL. Accessed: insert date accessed.

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Assessment of Risk of Bias for RCTs

Bernitz 2011	Chapman 1986	Waldenström 1997
low	unclear	low
low	low	low
unclear	low	low
low	high	unclear
low	low	unclear
low	high	unclear
low	low	low
low	low	low
low	high	low
low	low	low
low	low	low
low	unclear	unclear
unclear	unclear	unclear

Assessment of Risk of Bias for Cohort Studies

Alcaraz-Vidal 2024	BirthplaceinEnglandCollaborativeGroup 2011	David 1999	David 2009	Eide 2009	Gaudineau 2012	Gotthvall 2004	Gottvall 2005	Hermus 2017	Huitfeldt 2016	Merz 2020	Overaand 2012	Palau-Costafreda 2023	Prelec 2014	Rollet 2024	vanderKooy 2015	Wellens 2019
low	low	low	low	low	low	low	low	low	low	low	low	low	low	low	low	low
low	low	low	low	low	low	low	low	low	unclear	low	low	low	low	low	low	low
low	low	low	low	low	low	low	low	low	low	low	low	low	low	low	low	low
low	low	low	low	low	low	low	low	low	low	low	low	low	low	low	low	low
low	low	low	high	low	low	unclear	low	unclear	low	unclear	low	low	low	low	low	low
low	low	low	high	low	low	low	low	unclear	low	low	low	low	low	low	low	low
low	low	unclear	low	low	low	low	low	low	low	low	low	low	low	low	unclear	unclear
low	low	low	low	unclear	low	low	low	low	low	low	low	low	low	low	low	low
low	low	low	low	low	low	low	low	low	unclear	low	low	low	low	low	low	low
low	low	low	unclear	low	low	low	low	low	low	low	unclear	unclear	unclear	low	unclear	unclear
unclear	low	unclear	unclear	low	unclear	unclear	unclear	low	low	low	low	unclear	low	low	unclear	unclear
unclear	low	unclear	unclear	low	low	low	unclear	unclear	low	unclear	low	low	low	low	unclear	low
low	low	unclear	unclear	low	unclear	unclear	unclear	low	unclear	unclear	low	unclear	low	low	low	low

Appendix VI

Manuscript Types

The European Journal of Midwifery considers the following types of articles:

- Research Papers – reports of data from original research.
- Review Papers – comprehensive, authoritative, reviews within the journal's scope.
- Short Reports – brief reports of data from original research.
- Methodology Papers – Papers that present different methodological approaches that can be used to investigate problems in a relevant scientific field and to encourage innovation.
- Policy Case Studies – brief articles on policy development at a regional or national level.
- Study Protocols – articles describing a research protocol of a study.
- Letters to the Editor – a response to authors of an original publication, or a very small article that may be relevant to readers.
- Editorials – articles written by members of the Editorial Board.

Research Papers

Articles reporting research may be full length or brief reports. These should report original research findings within the journal's scope. Papers should generally be a maximum of 4000 words in length, excluding a maximum of 5 tables, references, and abstract of the article, whilst it is recommended that the number of references should not exceed 36.

Review Papers

Comprehensive, authoritative, reviews within the journal's scope. There are two types of review papers:
- systematic review papers: respond to a specific research question, accrue from criterion-based selection of sources, include a quantitative synthesis and a statistical method (meta-analysis), and should adhere to **PRISMA guidelines**. Guidelines used for abstracting data and assessing data quality and validity should be noted in methods section.
- narrative review papers: the research question may be broad, and the scope of this review is to discuss a specific topic and keep the readers up-to-date about it. This type of review does not necessarily include a methodological approach and its synthesis is usually qualitative. Narrative reviews should include in a developments section, with details regarding data sources used, keywords applied, time restrictions and study types selected. Developments should be based on actual review articles.
All review papers should be generally less than 6000 words, excluding abstract, tables, figures and references. References should not exceed 50. Conclusion of the reviews should be specific and stem from the findings.

Short Reports

Brief reports of data from original research. Short reports are shorter versions of original articles, may include one table or figure, should not exceed 1500 words, and it is recommended that the number of references should not exceed 15. Short reports are suitable for the presentation of research that extends previously published research, including the reporting of additional controls and confirmatory results in other settings, as well as negative results. Authors must clearly acknowledge any work upon which they are building, both published and unpublished.

Policy Case Studies

The objective of this type of brief article is to foster regional academic midwifery, maternal and child health activities and to provide a forum for sharing ideas, examples of policy activities, for people working in in the field to present their regional successes or challenges in the area of Midwifery. Such brief articles should be accompanied by a high-resolution picture or example of the material used or presented. The word count for the text should not exceed 1500 words.

Study Protocols

This article type can be for proposed or for ongoing research and should contain the background, research hypothesis, rationale a detailed methodology of the study. The **SPIRIT 2013 Checklist guidelines** ideally should be applied. Study protocols submitted for publication must have received ethics approval. Protocols of randomized trials should follow the **CONSORT guidelines** and must have a trial registration number, while observational studies should follow **STROBE guidelines.**

Methodology Papers

Methodology Papers will present different methodological approaches that can be used to investigate problems in a relevant scientific field and to encourage innovation. It is suggested that case studies or practical examples, which can be existing ones, are included to demonstrate the consistency and applicability of the methodology.
Methodology papers should be generally less than 6000 words, excluding abstract, tables, figures and references. References should not exceed 50.

Letters to the editor

A letter to the Editor is a brief report that is within the journal's scope and of particular interest to the community, but not suitable as a standard research paper. A maximum of ten articles may be included in the references. Letters to the Editor may be edited for clarity or length and may be subject to external peer review at the Editors' discretion. Letters intended for publication should be a maximum of 500 words, contain 10 references, and up to one table or figure. These rules apply both for research letters, and letters that respond to articles published in the journal. Letters to the editor are subject to editorial editing so as to streamline the article with the journal's style. Corrections to published articles are also published as a letter and linked to the corrected version of the article.

Editorials

Editorials are written by the Editorial Board and may reflect current articles within the European Journal of Midwifery or discuss significant national or international initiatives relevant to midwifery or maternal and child health or the academic development of Midwifery.

Manuscript Formatting

General instructions

The authors are encouraged to consult previous relevant publications in EJM to assist them in the preparation of the manuscript, especially the references and tables. We support the use of Checklists during manuscript preparation. Checklists are available for a number of study designs, including:

- randomized trials (**CONSORT**),
- systematic reviews (**PRISMA**),
- observational studies (**STROBE**),
- meta-analyses of observational studies (**MOOSE**) and
- qualitative studies (**RATS**).

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All manuscripts should be submitted in a Word format, they should be single column and 1.5 spaced. Margins should be one inch at the top, bottom and sides of the page. Font size should be 11-pt or 12-pt, standard font in 'Arial' or 'Times New Roman' typeface. Manuscripts should be formatted in full justified paragraphs and headings should be left-aligned. Maths should be editable text.

Title Page

The Title page should list the title of the article and suggestions for a short running title of no more than 60 characters (including spaces). Also include the authors names, affiliations and contact details including email address for the corresponding author. Affiliations should contain each author's department, institution (institute, university), city, country.

The Title of the article should be clear, concise and highlighting the research topic. It should not include rhetorical questions, literary language, quotations and special symbols.

Abstract

Authors are asked to supply a structured abstract of 250 words. For research articles, systematic reviews and brief reports, the abstract is limited to 250 words and should be structured as follows: Introduction, Methods, Results, and Conclusions. Abstracts for narrative reviews, study protocols and methodology papers are unstructured. Letters do not have an abstract.

Keywords

Include six keywords that describe your paper for indexing and for web searches of your manuscript.

Main Text

Research papers, systematic review papers and short reports sections are: Introduction, Methods, Results, Discussion, and Conclusions. Narrative review papers are not necessarily structured. It is suggested though to include the sections Introduction, Developments and Conclusion. Study protocols consist of Introduction, Methods, Discussion, and Conclusions. Methodology papers should consist of Introduction, Methodological approach, Case studies or Practical examples, Discussion, Conclusions. Policy case studies consist of Introduction, Commentary and Conclusion.

Use the guidelines below to structure these sections:

1. A short introduction which should end with the study's aims. The introduction should state clearly the objective of the

paper as well as the context of the research or analysis.
2. A methods section which should describe the study design, setting, participants, measures, variables and statistical analysis performed. This section should also include information on the study's ethics procedures. AI technology use should be described in detail (data collection, analysis, figure generation). The tool, version and prompts should be described too.
3. A results section, which should describe the study's main findings and important aspects within the tables.
4. A discussion section, which should include a discussion of the study's main findings, comparisons with other studies, potential policy implications, the study's strengths and limitations.
5. A conclusions section, which should be short, concise and based on the results of the current study. General conclusions that do not stem from the manuscript's results should be avoided.

Declaration of Interests

Declare any competing interests for each author. The European Journal of Midwifery adheres to the International Committee of Medical Journal Editors (ICMJE) Recommendations for the Conduct, Reporting, Editing and Publication of Scholarly Work in Medical Journals. The author names on the ICMJE forms should be identical to the names in the manuscript.

Funding

All sources of funding for the research reported should be declared. The role of the funding body in the design of the study and collection, analysis, and interpretation of data and in writing the manuscript should be declared. The sentence should begin: "This work was supported by". Proposal numbers should be complete and accurate and provided in parentheses as follows: "(proposal number xxxx)". The funding statement should only report grants awarded that are directly relevant to the study.

Acknowledgements

This section is for acknowledging individuals and institutions whose support the authors wish to mention (it is not compulsory). Please acknowledge anyone who contributed towards the article who does not meet the criteria for authorship including anyone who provided professional writing services or materials. If the study was based on a pre-print, thesis, or conference proceedings, it should be mentioned in the Acknowledgments. If an AI was used to support the writing of the manuscript, this should be mentioned in the Acknowledgments.

Authors' contributions

The individual contributions of authors to the manuscript should be specified in this section. Guidance and criteria for authorship can be found in our editorial policies. The authors have the option to give a brief outline of their contribution. Please use initials to refer to each author's contribution in this section.

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Tables, Figures and Supplementary material

Tables and Figures should be placed at the end of the manuscript and be numbered sequentially in order of appearance in the text. However authors should ensure that every table or figure is referred to in the body of the text. Each table or figure should be accompanied by a short, descriptive title (including the place, year and sample size) and in the footnote should define any acronyms, abbreviations or symbols used, statistical methods applied and any other information needed so that the table or figure may stand alone in the HTML and pdf version of the manuscript. Superscripts used to refer to table footnotes should be lowercase alphabetical symbols. Captions should be given separately in editable form and not part of the table or figure. Numbers in the table should not contain commas, and numbers less than unity should have a zero in front of the decimal point. Decimal numbers should be represented with the use of a full stop.

The number of actual tables (no sub-tables) that an article can contain **should not exceed five.** However, they have to be of value as determined by peer review. Extra tables can be included in the Supplementary material. The content of the tables should be such that the data are of sufficient resolution for comfortable reading. Tables should be submitted in their original Word format (not via Excel), and they should be legible. Avoid using vertical rules. Horizontal rules should be used only above and below column headings and at the bottom of the table. Do not create a table using only tabs or spaces to create columns. Tables should not duplicate material contained in the main text.

The number of figures **should not exceed four.** Extra figures can be included in the Appendix. Figures can be submitted in greyscale, black or white or in color as the journal is published online. The journal prefers that figures be created in Excel. Do not embed a figure file as a picture into Excel or Word, but submit them as individual files. The data of figures should be attached in a Word format. Size the figure to the column or page width of the journal, and set the resolution at 300 dpi or greater. Figures containing a large amount of text, particularly flow diagrams, should be send in an editable form.

Supplementary material should be submitted as a single file that includes all the supplementary material (figures, tables, questionnaires, etc.). If the authors wish to change the Supplementary file they would need to resend it corrected, as a final version before publication. The authors should be aware that supplementary files are not proofread or corrected by the production team.

References

We recommend **no more than 36 references,** these must be numbered sequentially, as they first appear in the text. They should be superscripted and where more than one reference is cited, these should be separated by a comma, for example, 1, 12, 16, while for a continuous sequence of numbers, give the first and last number of the sequence separated by a hyphen, for example, 4-7. The Reference list should thus be sequentially numbered using plain text (i.e. without use of footnote or endnote etc). Please check the reference list and ensure that there is no duplication of references.

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(Note: Use et al. instead of names after the 6th author)
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Kjellstrom Tord, Lemke Bruno, Otto Matthias. Climate conditions, workplace heat and occupational health in South-East Asia in the context of climate change. WHO South East Asia J Public Health. 2017;6(2):69-73.

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