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European midwifery Units: A Systematic Review on Maternal Morbidity

Summary

The International evidence on midwifery units suggests these birth settings are associated with positive clinical outcomes, improved service user experience and cost effectiveness compared with obstetric units, for women experiencing low risk pregnancies. However, implementation across Europe has been slow and uneven. We conducted a systematic literature review of European studies reporting on maternal morbidity outcomes for planned MU births. Our findings provide reassurance regarding the consistency and effectiveness of MU care within the European context.

Background

International evidence consistently indicates that midwifery units (MUs) offer an optimal model of care and favourable maternal and perinatal outcomes for healthy women with uncomplicated pregnancies.[1] Despite this evidence and the recent endorsement of midwife-led models of care by the World Health Organisation,[2] access to midwife-led birth settings remains limited across Europe. Policy guidance encouraging health systems transformation in this direction is largely absent. Attempts to introduce midwife-led care alongside established doctor-led models have proven challenging in several countries.[3] To support implementation efforts, a comprehensive picture of current evidence on clinical outcomes of MUs in Europe is needed to inform practice, policy making, and future research.

Our group undertook a broad systematic review with the aim of evaluating maternal and neonatal outcomes for planned MU births across Europe. This paper presents a subset of our findings, focused on maternal morbidity outcomes. Maternal morbidity is largely avoidable and can have long-lasting adverse effects on the mother, the baby and the wider family. It should thus be considered a public health priority.[4]

1. To identify maternal morbidity outcomes reported in the literature on planned MU births in Europe;
2. To synthesise the evidence on similarities and differences between planned MU and Obstetric Unit (OU) births in relation to maternal morbidity outcomes;

In relation to this, we can summarise our objectives for this paper as follows:

3. To identify gaps and opportunities for further research.

Methods

Inclusion and exclusion criteria

Studies were selected for inclusion based on the criteria presented in Table 1. Both comparative and non-comparative studies were included, provided they met the criteria and were of sufficient quality. Comparative studies needed to have both a planned MU and a planned OU arm and all studies needed to report on planned rather than actual birth for each setting. Studies were included if the full text was available in English or in other European languages spoken by the research team. No predefined list of included outcomes was used, in line with objective 1.

Table 1: Inclusion and exclusion criteria

	Inclusion	Exclusion
Intervention	Studies including at least one arm of women who had planned to give birth in an MU, defined as initiation of labour care in an MU (regardless of transfer to OU prior to or after birth)	Studies focusing exclusively on planned birth in an OU or at home, without a comparison cohort of women planning care in an MU
Study design	RCTs, quasi-experimental studies, cohort studies, case-control studies, cross-sectional studies, service audits, mixed-method studies. Outcomes reported according to intention-to-treat or planned place of birth	Exclusively qualitative research Studies reporting on actual rather than planned place of birth
Timeframe	From inception to October 2024	None
Geography	WHO European countries: https://apps.who.int/violence-info/Countries%20and%20areas%20by%20WHO%20region%20-%2012bfe12.pdf	Any other country not listed

Population	Pregnant people who are clinically eligible for a birth in an MU (exact criteria may differ slightly based on context)	Pregnant people who are not clinically eligible for a birth in an MU	
Comparator	For comparative studies, planned OU birth was the comparator treatment of interest.	Comparative studies only comparing between different types of MU or between MU and homebirth.	
Outcome measures	Quantitative clinical maternal and neonatal outcomes and interventions – subset reported in this paper.	Qualitative data	

Search strategy

We searched the following databases: CINAHL, MedLine, EBM – Cochrane Database of Systematic Reviews, Cochrane Methodology Register, MIDIRS, Embase, Emcare, and Social Policy and Practice.

We ran the search on 31/10/2024 using keywords "Birthing Cent*", “Maternal Health”, “Treatment outcome” and their MESH derivatives, combined as described in Table 2, using Boolean operators and synonyms, truncations, and alternative spellings.

Using Covidence software[5] two authors independently screened titles and abstracts and one reviewed full text articles to confirm eligibility.

Table 2: Search strategy

Line	Search 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)	

Data extraction

We extracted information on study characteristics, including author, year of publication, country, study design, sample size, outcomes reported on and their definitions. For each study we documented whether it reported on alongside midwifery units (AMU), which are co-located with an OU, or freestanding midwifery units (FMU), which are on a separate site. We extracted the percentage experiencing the outcome among all planned MU births. Where suitable comparative data were available, we also collated information on the measure of effect, confidence interval and/or p-value (see Appendix).

Analysis

A list of maternal morbidity outcomes was developed. For each, we counted the number of reporting studies and compiled a frequency range for Midwifery Units (MUs), using the lowest and highest reported rates. For studies undertaking a comparison between planned MU and OU, we considered reported differences in

baseline characteristics between the groups and assessed the approach the authors had taken to deal with confounding. Only measures of effect derived from a robust approach were included in a narrative summary of the comparative findings. Meta-analyses were not included as most studies were observational and there was considerable variety in the populations studied, sample sizes, intervention characteristics, outcome definitions and reported measures of effect (e.g. OR vs RR).

The review used published research data; thus no ethical approval was required. However, we ensured the included studies upheld ethical standards.

Critical appraisal

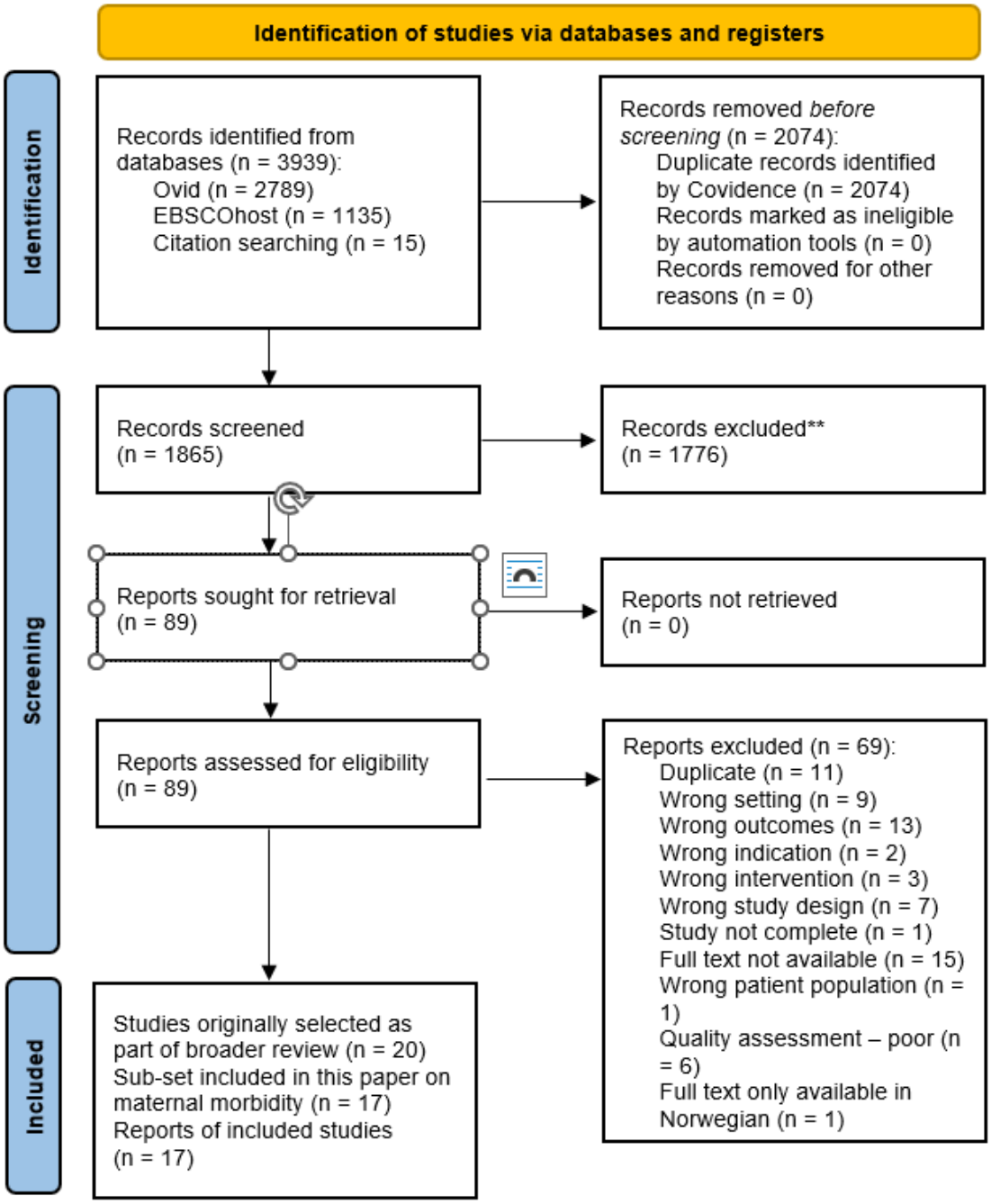
We assessed methodological quality using tools from the Critical Appraisal Skills Programme.[6]

Results

Included studies

An initial 3939 records were identified. Following de-duplication 1865 titles and abstracts were screened. Of these, 89 full texts were reviewed. 20 eligible studies were identified, of which 17 were retained for this paper as they reported on relevant outcomes. For further detail, see the flowchart in Figure 1.

Figure 1: PRISMA flowchart



The observational, with the exception of 3 trials, and were conducted in 10 European countries. Three were published prior to the year 2000, but most were published after 2010. Twelve studies reported on AMUs, three on FMUs, and two on both. Included studies were deemed to be of sufficient overall quality. More specifically, 12 studies were comparative and dealt adequately with confounding, thus providing usable data on the comparison between MU and OU. The latter are indicated by an asterisk (*) in Table 3.

Table 3: Included studies

	Autho					
1	Alcara					
2	*Bern					
3	*Birth			AMU, FMU, OU, home	Prospe	
4	Chapr					
5	David					
6	*Eide					
7	*Gaud					
8	*Hermus	2017	Netherlands	AMU, OU, home	Prospective cohort	3455
9	Huitfeldt	2016	Norway	FMU	Prospective cohort	808
10	Merz					
11	*Overgaard	2012	Denmark	AMU, OU	Prospective cohort	1678
12	*Palau-Costafreda	2023	Spain	AMU, OU	Retrospective cohort	878
13	*Prelec	2014	Slovenia	AMU, OU	Prospective cohort	1917
14	*Rollet	2024	France	AMU, OU	Retrospective cohort	15618
15	*VanderKooy	2016	Netherlands	AMU, OU, home	Before/after study	3724
16	*Waldenström	1997	Sweden	AMU	Randomized controlled trial	1860

17	*Welffens	2019	Belgium	AMU, OU	Retrospective cohort	984

Narrative synthesis of findings

The findings are presented below by reported outcome. Unless otherwise specified, the rates are reported for mixed parity cohorts. All reported confidence intervals (C.I.) were set at 95% confidence levels.

- Postpartum haemorrhage (PPH) >500ml: Four studies reported on this outcome, reporting rates between 1.3% and 5.8% of planned MU births.[7–10] Out of three comparative studies, one retrospective matched cohort study from Denmark reported a lower rate for planned FMU births (RR 0.4, C.I. 0.3-0.7),[7] while two other cohort studies found no difference.[9,10]

- PPH >1000ml: Six studies reported on this outcome. Rates for planned MU births varied between 1.3 and 5%,[7,11–13] with a higher rate reported for nulliparae in a study that stratified by parity (6.6%).[14] One trial in Norway,[11] two prospective cohort studies from Norway and the Netherlands,[14,15] one matched cohort study from Denmark,[7] and one before/after study from the Netherlands[12] all found no significant difference between MU and OU. A nationwide cohort study from France used a composite outcome of severe PPH, defined as “1000 mL blood loss +/− red blood cell transfusion +/− secondary procedure”.[13] Although rates were low in all settings, they were higher for planned AMU birth at 2.4% versus 1.1% in OU (AOR 2.37, 95% C.I. 1,29-4.36). The authors attributed this to variation in the practice of prophylactic uterotonic administration in the 3rd stage, less commonly performed in MUs.

- Retained placenta or MROP: Three comparative studies reported on retained placenta or manual removal of retained products (MROP), which affected between 1.2% and 4.2% of planned MU births, with no difference between MUs and Ous.[9,10,16].

- Blood transfusion: This was reported as a distinct outcome in six studies, with rates for planned MU births ranging from 0.0% to 1.5%[8,9,14,17–19] - the highest rate of 1.5% being reported for nulliparae in Hermus’s study, which stratified by parity. A trial in Sweden and a prospective cohort study in the Netherlands found no difference between MU and OU.[14,19] The Birthplace in England cohort study found no difference in blood transfusion rates between AMUs and OUs, but they did find that the rate was significantly lower for FMUs compared with OUs (AOR 0.48, 95% C.I. 0.32-0.73).[17]

- Admission to a higher level of care/ ICU: The Birthplace study also reported on maternal admission to a higher level of care, such as an ICU.[17] For this rare outcome (0.5% for FMU and 0.9% for AMU), the study found no difference between AMU and OU, but the rate was lower for FMU compared with OU (AOR 0.32, 95% C.I. 0.13-0.84).[17] A cohort study in France reported 0 ICU admissions for AMU but 8 women (0.1%) were admitted from the OU group.[13]

- Episiotomy: Episiotomy rates for planned MU births varied widely across 12 reporting studies, with two single-centre retrospective cohort studies reporting the widest variation between 33.8% in Slovenia,[9] to 4.7 Germany.[20] While a prospective cohort study from the Netherlands and a trial from Norway found no difference between planned MU vs OU births,[11,14] several other comparative studies found lower rates for planned MU. These include the Birthplace study (for AMU vs OU, AOR 0.62, 95% C.I. 0.50 - 0.77; for FMU vs OU, AOR 0.40, 95% C.I. 0.32 - 0.51),[17] a prospective cohort study in Norway (with the OU as reference category, OR 1.6, 95% C.I. 1.0-2.4),[15] a retrospective cohort study in France (AOR 0.33, C.I. 0.30-0.36),[21] one in Spain (AOR 0.47, C.I. 0.28-0.80) [16] and one in Belgium (AOR 0.31, C.I. 0.17-0.56) [10]. Prelec et al also reported lower rates in their study in Slovenia (p=0.001).[9]

- 3rd or 4th degree tears / obstetric anal sphincter injuries (OASI): Fifteen studies reported on OASI. In the majority, rates for planned MU birth varied between 0.6% [18] to 3.2% (rate for AMUs in the Birthplace study).[17] An exception was a prospective cohort study in Norway which reported an exceptionally high rate at 14% (no significant difference between settings).[15] The next highest rate of 4% was reported for nulliparae in a prospective cohort study in the Netherlands, and in this study the OU rate for nulliparae was significantly lower (p<0.01).[14] On the other hand, six comparative studies reported no difference between MU and OU.[7,10–13,16,17]

Discussion

The literature identified variable rates reported on PPH and on perineal outcomes.

Among healthy women experiencing physiological pregnancies, the overall risk of PPH was low across all settings. Despite using different definitions, Overgaard's matched cohort study and the Birthplace in England cohort study both found more favourable PPH outcomes in planned FMU births compared with planned OU, with Birthplace also finding lower odds of ICU admission.[17] Rollet's cohort study,[13] on the other hand, found a higher risk of severe PPH for women in the planned AMU group,

without however affecting ICU admission rates. This unusual finding calls for further research to describe management practices for the 3rd stage of labour in different settings. Fahy suggests that while the terms 'expectant management' and 'physiological third-stage care' are often used interchangeably, in reality they are not synonymous.[22] A clearer understanding of the physiological implications of different forms of care during this delicate stage, including the influence of the environment on the risk of PPH, is essential to advance knowledge on both prevention and effective management when required. As Begley et al. stated in their Cochrane review, in a population at mixed risk for PPH, active management of the 3rd stage offers certain advantages but is also associated with several disadvantages.[23] Consequently, careful consideration of how to support physiological processes to minimise the risk of PPH is required. Ultimately, a balanced approach that places women and birthing people's preferences and experiences at the centre of care remains paramount.

Reflecting on the perineal outcome findings, the evidence clearly points towards lower rates of episiotomy in planned MU births. A striking feature is, however, the variability between studies conducted in different countries. Hermus et al., for example, reported similarly high episiotomy rates (approximately 40%) across homebirth, MU and OU settings in the Netherlands,[14] These comparable rates may be explained based on the consistency of care provider, as community midwives in the Netherlands attend all women experiencing physiological labour, regardless of setting. However, the justification for such high overall rates remains unclear and may reflect differences in midwifery practice or service culture. For OASI, the majority of studies reported no significant differences between settings.

Methodologically, the included studies displayed substantial heterogeneity in study design, outcomes measure definitions and reporting, as well as providing limited description of clinical practices. This made interpretation of the results challenging. We note that in addition to presenting intention-to-treat analyses of planned place of birth, analyses of clinical interventions and outcomes by actual birth setting would also be important. For example, In Hermus et al., only 31% of nulliparous women who intended to give birth in MU ultimately did so.[14] Consequently, nearly 70% of the outcomes attributed to MU were in fact based on births occurring in the OU. This has important implications for the interpretation of outcomes and practices. Such more detailed analyses would allow, for example, for consideration of mode of delivery in relation to PPH. Additionally, consistency in the definition of MU is essential. Across the reviewed literature, definitions and organisational characteristics of MUs varied, potentially influencing the model of care provided and the resulting outcomes. Finally, we note the lack of evidence on other aspects of maternal health and wellbeing, such as mental health.

Conclusion

Despite some heterogeneity among the included studies, the overall findings indicate that the risk of experiencing PPH and severe perineal tears is low for women experiencing physiological labour, regardless of whether they plan birth in an MU or an OU. The likelihood of episiotomy varies across Europe but tends to be lower with planned MU birth. The FMU literature suggests that these settings are associated with the most favourable outcomes. Further research is warranted to explore how differences in organisational structure, clinical practice and professional culture may contribute to these findings.

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