







# The first alongside midwifery unit in Spain: A retrospective cohort study of maternal and neonatal outcomes

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## Abstract

**Background:** Midwife-led units have been shown to be safer and reduce interventions for women at low risk of complications at birth. In 2017, the first alongside birth center was opened in Spain. The aim of this study was to compare outcomes for women with uncomplicated pregnancies giving birth in the Midwife-led unit (MLU) and in the Obstetric unit (OU) of the same hospital. **Methods:** Retrospective cohort study comparing birth outcomes between low-risk women, depending on their planned place of birth. Data were analyzed with an intention-to-treat approach for women that gave birth between January 2018 and December 2020.

**Results:** A total of 878 women were included in the study, 255 women chose to give birth in the MLU and 623 in the OU. Findings showed that women in the MLU were more likely to have a vaginal birth (91.4%) than in the OU (83.8%) (aOR 2.98 [95%CI 1.62–5.47]), less likely to have an instrumental delivery, 3.9% versus 11.2% (0.25 [0.11–0.55]), to use epidural analgesia, 19.6% versus 77.9% (0.15 [0.04–0.17]) and to have an episiotomy, 7.4% versus 15.4% (0.27 [0.14–0.53]). There were no differences in rates of postpartum hemorrhage, retained placenta, or adverse neonatal outcomes. Intrapartum and postpartum transfer rates from the MLU to the OU were 21.1% and 2.4%, respectively.

**Conclusions:** The high rate of obstetric interventions in Spain could be reduced by implementing midwife-led units across the whole system, without an increase in maternal or neonatal complications.

## KEYWORDS

birth center, childbirth, midwife-led care, midwifery, obstetric unit

## 1 | INTRODUCTION

Midwife-led units (MLU) or birth centers (BC) are birth settings run by midwives with no or minimal medical input.<sup>1</sup> According to the European Midwifery Standards,<sup>2</sup> there are two types of MLUs or BCs, depending on their location: (a) Alongside Midwifery Units (AMUs), within the same building of the hospital Obstetric Unit (OU) and (b) Freestanding Midwifery Units (FMUs), situated in a different building to the OU where transfers are accomplished by car or ambulance.

There is a lack of standardization in definitions and characteristics of MLUs,<sup>3,4</sup> however, in general, they provide care to women with uncomplicated pregnancies and no previous significant obstetric complications, and they should all guarantee a women-centered philosophy of care in a home-like physical space.<sup>2,5,6</sup>

Since the 1990s, there has been an aim to reduce unnecessary birth interventions in different parts of the world, particularly in Europe.<sup>7</sup> The risks and benefits of giving birth in a MLU for mother and baby have been reported in multiple studies.<sup>3,4,8–10</sup> Results from these studies show an improvement in maternal outcomes with similar perinatal outcomes on MLUs when compared to OUs.<sup>11</sup> Scarf et al.'s (2018) findings highlighted that, women planning to give birth in a MLU were two times more likely to have a normal, noninstrumental, vaginal birth than women planning OU births. The birthplace study findings<sup>4</sup> consistently demonstrated no differences in perinatal morbidity and mortality, with significantly fewer interventions during labor, such as episiotomies, epidural analgesia, cesarean birth, or instrumental deliveries for women giving birth in MLUs.<sup>11,12</sup> Moreover, these data show lower odds of labor augmentation, use of general anesthesia, maternal blood transfusion due to severe postpartum hemorrhage, third and fourth degree perineal trauma, and lower rates of admissions to higher level care in women planning birth in non-OUs. Subsequent studies have confirmed the safety of BCs and led to calls for MLUs to be the primary birthplace option for women at low risk of complications during birth.<sup>9,10,14,15</sup> Other significant benefits such as decreased maternal anxiety levels, increased levels of satisfaction, promotion of mobility during labor, less use of analgesia, and increased sense of control have also been associated with MLU births.<sup>1,5,10–14</sup>

Access to birth settings other than the OUs varies among high-resource countries. In Spain, the healthcare system is characterized by its decentralization, wherein each of Spain's 17 regions is responsible for the health services of that community, both public and private. In 2019, within the region of Catalonia, 72% of births took place in public hospitals, 27.3% in private hospitals, and 0.4% at home.<sup>16</sup> The overall cesarean birth rate in Catalonia was

27.4%, with 10.1% instrumental births, and private hospitals having significantly higher rates of obstetric interventions.<sup>17,18</sup> The Health Plan of Catalonia 2016–2020<sup>19</sup> and the World Health Organization's recommendations to promote positive births,<sup>20</sup> set the political intention to revise the model of care for low-risk births.

Within this context, in 2017, the first MLU in the Spanish National Health System was opened in “Fundació Hospital Sant Joan de Déu de Martorell,” Barcelona. This community hospital attends an average of 650 births per year for women that have it as their designated hospital in their healthcare area. Women with low- to high-risk pregnancies, between 32 and 42 weeks, are cared for in the same hospital, while women with very high-risk pregnancies, either due to severe maternal disease or fetal malformation that requires specialized care, are transferred to a reference tertiary care hospital.

Martorell's MLU offers person-centered care to pregnant individuals with uncomplicated pregnancies in a low intervention birth setting, from 32 weeks of pregnancy, during labor, and postnatally until discharge. The birth center is an alongside unit, situated in the same hospital building as the obstetric services but separated from the main OU. The unit is managed exclusively by qualified midwives who attend an average of 100 births per year. The primary objectives of this study are to compare maternal, neonatal outcomes, and obstetric interventions for planned birth in Martorell's MLU with planned births in the OU of the same hospital for women with uncomplicated pregnancies, and to analyze the implementation of this model of midwife-led care in Spain.

## 2 | METHODS

This is a retrospective cohort study that compares birth outcomes between women at low-risk for medical complications who planned to give birth in the MLU and the OU of the same hospital. Women were included in each group with an intention to treat approach, depending on their planned place of birth at the onset of labor and stayed in that group regardless of whether they were transferred from the MLU to the OU during birth or postnatally. Data have been analyzed for participants that met the inclusion criteria and who gave birth between January 2018 and December 2020.

Women who chose to give birth in the MLU were transferred to the midwifery-led team between 32 and 34 weeks of pregnancy for a booking appointment and had regular follow-up visits until labor. Based on criteria from national and international guidelines,<sup>21,22</sup> a multidisciplinary team of midwives, obstetricians,

pediatricians, and anesthetists designed a checklist to define inclusion and exclusion criteria for the MLU (Table 1). Women with high-risk pregnancies who were considered at low risk for birth complications were individually assessed and usually accepted to the MLU (Table 1). If women developed risk factors before the

onset of labor, their care was transferred to the OU; they were, therefore, excluded from the study. If any complication arose, or transfer criteria were met during labor or postnatally (Table 2), women's care was transferred from the MLU to the OU, but they remained in the study, and data were recorded and assessed.

TABLE 1 Pregnancy and birth inclusion–exclusion criteria.

	Inclusion criteria	Individual assessment (medium or high risk for pregnancy, low risk for birth)	Exclusion criteria
Gestational age at labor (weeks)	≥37 and ≤42		≤37 and ≥42
Number fetuses	Singleton		Multiple
Presentation	Cephalic		Breech or transverse
Prepregnancy BMI	≤30	30–40	≥40
Parity	0–3	4	≥5
Hb level at labor	≥10 g/dL	9–10 g/dL	Hb <9 g/dL or hematocrit <25%
Age	<40	≥40	
Pre-existing medical condition		Controlled medical condition (Ex. thyroid disease)	Not controlled medical condition
Obstetric history	Previous:	Previous:	- Previous:
	- Intergenic period <12 months	- Shoulder dystocia	- Uterine surgery (including cesarian section)
	- Previous sterility (>2 years)	- Third degree or cervical tear	- Shoulder dystocia, postpartum hemorrhage (>500 mL), retained placenta
	Actual pregnancy:	Actual pregnancy:	- Fourth-degree tear
	- Urinary infection or asymptomatic bacteriuria	- Uterine fibroids	Actual pregnancy:
		- First trimester hemorrhages	- Recurrent hemorrhages during pregnancy
Active infection		- IVF pregnancy	- Pre-eclampsia
		- Group B streptococcus* (*Inclusion criteria from January 2019)	- Low-lying placenta
			- Active infection: toxoplasmosis, rubella, syphilis, and cytomegalovirus when there is evidence of fetal infection.
Gestational diabetes			- Active genital herpes, HIV, hepatitis B or C
		- Diet controlled* (*Inclusion criteria from September 2018)	- Insulin controlled
Estimated fetal weight (scan)			<P5 or ≥4500 g
Fetal pathology		- Minor abnormality (renal dilation, cleft palate)	- Major abnormality
Amniotic fluid volume			- Oligoamnios/Polyhydramnios
Rupture of membranes	≤24 h with established labor		≥24 h with no established labor
Meconium			Meconium-stained amniotic fluid before onset of labor
Vaginal bleeding		Light vaginal bleeding	Heavy vaginal bleeding

Intrapartum	Postpartum
Cord prolapse	Postpartum hemorrhage (>500 mL)
Abnormality of FHR	Retained placenta
Meconium-stained amniotic fluid without imminent birth	Third- or fourth-degree tear
Maternal hypertension (two >140/90 mmHg separated by 30 min)	
Maternal high temperature (one temperature > 38°C or two >37.5°C separated by an hour)	
Delayed first stage of labor	
Delayed second stage of labor	
Analgesia request	

**TABLE 2** Intrapartum and postnatal transfer criteria from MLU to OU.

The research was approved by the Ethics Committee of the Catalan Hospital, Health & Social Services Association (registration number CEI 21/03).

## 2.1 | Definition of variables

The sociodemographic data registered included: age, parity, origin, and Body Mass Index (BMI). The main outcome variable for women was type of birth (normal vaginal birth, instrumental vaginal birth, intrapartum cesarean birth). For the newborn, the main outcome used was Apgar scores less than seven at 5 min.

For the mother, the following secondary outcomes were studied: use of epidural anesthesia (yes/no, general); perineal outcome (intact, first and second-degree tear, third and fourth-degree tear, and episiotomy); postpartum hemorrhage (yes/no); retained placenta (yes/no); and early home discharge at 24 h (yes/no). Transfers from the MLU to the OU during labor and postnatally were also analyzed. Secondary outcomes for the newborn were Apgar scores at 1 min.

## 2.2 | Potential confounders

We adjusted the results for several sociodemographic and obstetric variables known to be potential confounders of obstetric interventions and outcomes. These variables included maternal age, BMI, parity, and origin. Maternal age was categorized as  $\leq 29$  years, 30–34 years, 35–39 years, and  $\geq 40$  years. BMI was classified as  $< 18.5$ , 18.6–24.9, 25.0–29.9, 30.0–34.9, and  $\geq 35$ .<sup>23</sup> Parity was described as 0, 1, 2, 3, and  $\geq 4$ . Countries of origin were categorized as Western Europe, Asia, Eastern Europe, North America, Northern Africa, South America, Sub-Saharan Africa, and Others.

## 2.3 | Data collection

Medical history, obstetric characteristics, and maternal and neonatal outcomes were recorded by obstetric health-care professionals in patient charts and in the hospital's information system. After ethics research committee approval, data from the maternity management reports and anonymized database were collected by the researchers.

## 2.4 | Statistical analysis

Demographic characteristics, maternal outcomes, and neonatal outcomes of women included in the study were described separately by the MLU and the OU. Women in the control group had the same pregnancy risk characteristics as participants in the study group. Differences in maternal and neonatal outcomes were assessed using the chi-squared test ( $\chi^2$ ) as all the study variables were categorical.

Multivariate logistic regression models were used in order to estimate the crude and the adjusted odds ratio (OR/ORa) according to maternal and neonatal outcomes between both groups. Maternal outcomes assessed in this study were type of birth, use of epidural analgesia, perineal outcomes, presence of a postpartum hemorrhage, retained placenta, and early discharge. Data were also analyzed for women who intended to give birth in the MLU at the onset of labor, but were transferred to the OU during labor or postnatally. Women who underwent a cesarean birth were excluded for the analysis of the perineal outcomes. The main neonatal outcome used was the Apgar score less than 7 at 5 min after birth. Adjusted analysis included the following variables: age, BMI, origin, and parity. Statistical significance was considered when  $p$ -value was  $< 0.05$ . Missing values were less than five percent for maternal and neonatal outcomes and were excluded from

**TABLE 3** Sociodemographic and obstetric characteristics of women with uncomplicated pregnancies in the MLU and the OU, Martorell, Spain, 2018–2020 ( $N=878$ ).

	Midwife-led unit ( $N=255$ )		Obstetric unit ( $N=623$ )		<i>p</i> -Value*
Maternal age, median (range)	33 (21–43)		30 (17–44)		0.004
Maternal age, <i>n</i> (%)					
≤29	55	21.6%	293	47.0%	<0.001
30–34	104	40.8%	177	28.4%	
35–39	87	34.1%	126	20.2%	
≥40	9	3.5%	27	4.3%	
Origin, <i>n</i> (%)					
Western Europe	212	83.1%	305	49.0%	
Asia	3	1.2%	19	3.0%	<0.001
Eastern Europe	5	2.0%	9	1.4%	
North America	1	0.4%	0	0.0%	
Northern Africa	12	4.7%	213	34.2%	
Other	1	0.4%	0	0.0%	
South America	15	5.9%	54	8.7%	
Sub-Saharan Africa	6	2.4%	23	3.7%	
BMI, <i>n</i> (%)					
<18.5	10	3.9%	23	3.7%	<0.001
18.6–24.9	208	81.6%	376	60.4%	
25.0–29.9	29	11.4%	147	23.6%	
30.0–34.9	6	2.4%	62	10.0%	
≥35	2	0.8%	15	2.4%	
Hospital area, <i>n</i> (%)					
Inner area	87	34.3%	584	94.2%	<0.001
Outer area	167	65.7%	36	5.8%	
Unknown	1		3		
Parity, <i>n</i> (%)					
0	149	58.4%	262	42.1%	<0.001
1	81	31.8%	219	35.2%	
2	19	7.5%	99	15.9%	
3	4	1.6%	33	5.3%	
≥4	2	0.8%	10	1.6%	
Gestational age, <i>n</i> (%)					
37–39 + 6 weeks	105	41.3%	280	53.9%	0.184
40–40 + 6 weeks	97	38.2%	141	27.2%	
41–41 + 6 weeks	48	18.9%	96	18.5%	
≥42 weeks	4	1.6%	2	0.4%	
Unknown	1		4		

Abbreviations: MLU, midwifery led unit; OU, obstetric unit.

\**p*-Value express the presence of statistically significant differences between categories using Pearson's chi-squared test.

the analyses. Statistical analyses were performed through the SPSS statistical package (version 23.0).

### 3 | RESULTS

Throughout the study period, a total of 1955 individuals gave birth in the hospital, of which 878 women met

inclusion criteria and therefore were included in the study. A total of 255 (29%) were admitted in labor into the MLU, and 623 (71%) into the OU.

In relation to the sociodemographic factors, significant differences were found (Table 3). Women planning to give birth in the MLU were predominantly from Western Europe (83.1%), between 30 and 39 years old (74.9%) with normal BMIs (81.6% versus 60.4%), while

women from the OU group were mostly from Western Europe and Northern Africa (83.2%); they tended to be younger, between 20 and 34 years old (75.4%) and were more likely to be overweight or obese (34.0% versus 14.6%). Regarding parity, a higher proportion of women in the MLU were primiparous (58.4%) compared to the OU group (42.1%). The percentage of women expecting their second child, was similar in both groups (MLU: 31.8% vs. OU: 35.2%). However, the MLU had a significantly lower number of women expecting their third or subsequent child compared to the OU (9.9% vs 22.8%). No significant difference was found in relation to gestational age; 98.4% and 99.6% of women gave birth in the MLU and the OU respectively, between 37 and 41 + 6 weeks.

In our study, 65.7% of women who gave birth in the MLU referred themselves from a different healthcare area. On the contrary, most women from the OU (94.2%) came to the hospital because this was their designated hospital.

### 3.1 | Maternal outcomes

Table 4 shows maternal and neonatal outcomes by birth setting. Women planning to give birth in the MLU were more likely to have a normal, unassisted vaginal birth (91.4%) than women planning to give birth in the OU (83.8%) and were less likely to have an instrumental birth (3.9% vs. 11.2%). There were no differences in intrapartum cesarean birth rates between the groups (4.7% vs. 5.0%).

The analysis of secondary outcomes shows that women in the MLU were less likely to receive epidural analgesia (19.6% vs. 77.9%) and that they had a lower chance of having an episiotomy (7.4%) than women in the OU (15.4%). First- and second-degree tears were more common in the MLU than the OU (65.7% vs. 53.2%) with no difference in rates of third- and fourth-degree tears (0.8% vs. 0.7%). There were no significant differences between postpartum hemorrhage (2.4% vs. 2.9%) and retained placenta rates (1.2% vs. 1.5%). When data were adjusted for age, BMI, parity, and nationality (Table 5), women from the MLU showed reduced odds of instrumental delivery (aOR 0.25, 95% CI 0.11–0.55), less use of epidural analgesia (aOR 0.15, 95% CI 0.04–0.17), and lower chances of having an episiotomy (aOR 0.27, 95% CI 0.14–0.53). They also had highly increased odds of having a normal vaginal birth (aOR 2.98, 95% CI 1.62–5.47) compared with women that planned OU births.

Women from the MLU had shorter in-hospital stays, within 24 h of birth, than women from the OU group (28.2% vs. 7.7%, aOR 6.98, 95% CI 4.93–10.2).

### 3.2 | Neonatal outcomes

There were no significant differences in Apgar scores less than seven at 5 min (0.8% vs. 0.3%) or in Apgar scores less than 7 at 1 min (0.4% vs. 1.9%) between groups, even when adjusting for age, BMI, parity, and nationality.

### 3.3 | Transfers from the MLU to the OU

Among women in the MLU, 54 women (21.18%) were transferred to the OU during labor and six women (2.4%) were transferred postnatally (Table 4). Transfer rates were higher for nulliparous women (86.6% of all transfers) than multiparous women (13.3% of all transfers). Transfers to the OU before birth were mainly due to maternal request for epidural analgesia (63.0%). Other transfer causes were delayed first or second stage of labour (24.1%), abnormal fetal heart rate, meconium-stained amniotic fluid (11.1%), and maternal hypertension (1.8%). Postnatal transfers to the OU were mainly due to higher degree tears (50%), retained placenta (33.3%), and postpartum hemorrhage (16.6%) (data not shown).

## 4 | DISCUSSION

This is the first study that compares maternal and neonatal outcomes between MLUs and OU in Spain, due to the introduction of the first public MLU in 2017. Findings align with other studies from high-income countries,<sup>11,12,14,24–26</sup> demonstrating the safety and viability of this model of care for women with uncomplicated pregnancies at the onset of labor.

Despite the highly medicalized model of labor care established in Spain in recent history, more women are seeking an alternative model of care that, while being safe for them and their babies, focuses attention on their holistic needs and experiences. Over the three-year period of this study, women showed increasing interest in midwife-led models of care; interest rates increased from 25.6% in 2018 to 36.5% in 2020.

In our study, women that chose to give birth in the MLU were more likely to be older, born in a Western European country, have a normal BMI (18.5–24.9) and to be expecting their first child. This is in line with data from similar studies showing that women who plan to give birth in a MLU tend to be from Western Europe, older and with higher education levels.<sup>12,27</sup> As the first Spanish MLU and the only public alternative to medical labor care at the time, most women from the MLU were self-referred from outside their designated hospital, looking for a home-like environment

**TABLE 4** Description of maternal and neonatal outcomes by birth setting: MLU and OU, 2018–2020 ( $N=878$ ).

	Midwife-led unit ( $N=255$ )		Obstetric unit ( $N=623$ )		<i>p</i> -Value*
	<i>n</i>	%	<i>n</i>	%	
Type of birth					
Normal vaginal birth	233	91.4%	522	83.8%	0.003
Instrumental vaginal birth	10	3.9%	70	11.2%	
Intrapartum cesarean birth	12	4.7%	31	5.0%	
Epidural anesthesia					
Yes	50	19.6%	483	77.9%	<0.001
No	205	80.4%	136	21.9%	
General	0	0%	1	0.2%	
Unknown	0		3		
Perineal outcome <sup>a</sup>					
Intact	63	26.0%	181	30.7%	0.012
First- and second-degree tear	159	65.7%	314	53.2%	
Third- and fourth-degree tear	2	0.8%	4	0.7%	
Episiotomy <sup>b</sup>	18	7.4%	91	15.4%	
Unknown	1		2		
Postpartum hemorrhage					
Yes	6	2.4%	18	2.9%	0.658
No	249	97.6%	605	97.1%	
Retained placenta					
Yes	3	1.2%	9	1.5%	0.002
No	252	98.8%	610	98.5%	
Unknown	0		4		
Early discharge (24 h)					
Yes	72	28.2%	48	7.7%	<0.001
No	183	71.8%	573	92.3%	
Unknown	0		2		
Intrapartum transfer	54	21.18%	0	—	<0.001
Postpartum transfer	6	2.4%	0	—	
Apgar score <7 at 1 min					
	5	0.4%	12	1.9%	0.121
Unknown	1		0		
Apgar score <7 at 5 min					
	2	0.8%	2	0.3%	0.957
Unknown	1		0		

Abbreviations: MLU, midwifery led unit; OU, obstetric unit.

\**p*-Value calculated through chi-squared test.

<sup>a</sup>Women who underwent a cesarean birth were excluded. Episiotomy includes also the episodes that include episiotomy + tear.

<sup>b</sup>Includes episiotomy + tear.

and women-centered, respectful birth care. Lack of evidence-based information about different models of care and previous experiences within the system could explain why a high number of women having their third and fourth baby chose to give birth in an OU. Equally, language barriers and uneven access to reliable information during pregnancy could be another reasonable explanation for the low percentage of non-Western European women choosing the

MLU.<sup>28</sup> Since 2019, the MLU team started paying special attention to working with different ethnic groups, informing them of the benefits and characteristics of the MLU model of care for low-risk women, while understanding cultural barriers that may hinder access to this service.

The results demonstrate that for women with uncomplicated pregnancies, planning to give birth in a MLU is safer than planning to give birth in an OU. Furthermore,

**TABLE 5** Crude and adjusted odds ratio (OR) of maternal and neonatal outcomes by birth setting: midwife-led unit and obstetric unit.

	OR 95% CI	aOR 95% CI <sup>a</sup>
Type of birth		
Normal vaginal birth	<b>2.05 (1.26–3.33)</b>	<b>2.98 (1.62–5.47)</b>
Instrumental vaginal birth	<b>0.31 (0.16–0.64)</b>	<b>0.25 (0.11–0.55)</b>
Intrapartum cesarean birth	0.94 (0.48–1.87)	0.75 (0.33–1.69)
Epidural anesthesia		
Perineal outcome <sup>b</sup>		
Intact	0.84 (0.61–1.17)	1.13 (0.71–1.79)
First- and second-degree tear	<b>1.63 (1.21–2.20)</b>	<b>1.18 (1.21–2.71)</b>
Third- and fourth-degree tear	1.22 (0.22–6.72)	0.55 (0.50–6.25)
Episiotomy	<b>0.47 (0.28–0.80)</b>	<b>0.27 (0.14–0.53)</b>
Postpartum Hemorrhage	0.81 (0.32–2.10)	0.65 (0.22–1.94)
Retained placenta	1.09 (0.33–4.59)	1.03 (0.24–6.13)
Early discharge (24h)	<b>4.18 (2.72–7.72)</b>	<b>6.98 (4.83–10.02)</b>
MLU transfers		
Apgar score <7 at 1 min	1.02 (0.36–2.92)	0.83 (0.13–5.10)
Apgar score <7 at 5 min	1.14 (0.34–1.35)	<b>0.99 (0.98–0.99)</b>

Note: Statistically significant differences marked in bold.

<sup>a</sup>Adjusted for age, BMI, parity, and nationality.

<sup>b</sup>Women who underwent a cesarean birth were excluded. Episiotomy includes also the episodes that include episiotomy+tear.

they are more likely to have a normal vaginal birth and less likely to have an instrumental birth compared with those planning birth in the OU. Interestingly and in contrast to other similar studies,<sup>29–32</sup> differences were not found in cesarean birth rates between the two groups. However, from the beginning of the study, the cesarean rate for the study sample (women at low-risk for birth complications) decreased from 15% in 2018 to 7.5% in 2020. The overall cesarean rate in the hospital since the introduction of the MLU went from 24% in 2018 to 16% in 2020. These data suggest that the implementation of a MLU model of care in a usually more interventionist setting such as an OU, can have an influence on the care provided across units, and may benefit both low- and high-risk women.

In terms of the use of epidural anesthesia, rates were lower in the MLU group (9.6%), than in the OU group (77.9%). This was expected because epidural anesthesia is not available in the MLU. However, this analysis differs from the existing data from the studies carried out in OU settings in Spain,<sup>33</sup> in which 83.7% of women with low- and medium-risk pregnancies chose to use epidural

anesthesia. Our findings have more similarities to the existing European literature with models of care similar to ours.<sup>34</sup> Corroborating earlier research,<sup>31</sup> episiotomy rates were performed more commonly in the OU than the MLU, with no difference between rates of third and fourth-degree tears between the two groups.

Choice of birth setting at the onset of labor did not seem to affect postnatal complications, such as postpartum hemorrhage and retained placenta, which were similar in both groups.

With respect to neonatal results, because of the sample size, and the low incidence of neonatal mortality and morbidity in developed countries, a bigger sample is needed to obtain clearer conclusions on perinatal mortality, but there were no significant differences in low Apgar scores between the two groups. Larger international studies show no differences in neonatal outcomes between alongside MLUs and OUs.<sup>11,12,24</sup>

Women that chose the MLU pathway tended to have a shorter stay in the hospital than women who chose to give birth in the OU. This could be related to the reduction in interventions during labor and mode of birth, which facilitated shorter hospital stays.<sup>35</sup> The reduction in days of hospitalization could have an influence to the health system, reducing the cost per birth. Results from cost-effectiveness studies performed in different contexts show a general reduction of cost per birth for MLU models of care.<sup>30,36–38</sup>

In our study, the average transfer rate from the MLU to the OU was 23.58%, with a higher transfer rate in labor (21.18%) than postnatally (2.4%). The evidence available shows that transfer rates vary between studies with similar MLU models of care. Focusing specifically on transfers before birth, rates vary from 14.0% in Ireland<sup>31</sup> to 21.2% in England,<sup>12</sup> being higher for nulliparous women. A higher rate of transfers for nulliparous women has also been described in other studies.<sup>4,10</sup> Our study correlates with these data, as the analysis also show a higher rate of transfers for nulliparous women (86.6%) compared to multiparous women (13.3% of all transfers).

Most transfers were nonurgent, with transfer for pain relief (epidural) being the most common reason for transfer (63%). Transfers from one model of care to another can affect negatively women's childbirth experience.<sup>39–41</sup> Women who were transferred to the OU remained under the care of the same midwife in the hopes of reducing negative experiences and fear associated with transfer. More urgent transfers, including for fetal heart tones abnormalities or meconium-stained amniotic fluid, were less common (11.1%).

Following intrapartum transfer from the MLU to the OU, most women had vaginal births (59.2%), 22.2% had a cesarean delivery, and 18.5% an instrumental birth.



## 4.1 | Strengths and limitations

The main strength of our study was the ability to compare outcomes between the newly implemented MLU model of care and the OU, in the Spanish Health Care System. The assignment of women by planned place of birth at labor onset and strict inclusion and exclusion criteria for both the study and the control group, strengthen the quality of the study. The fact that women remained in the same group throughout the study, regardless of the outcome of labor, helped to minimize bias.

On the contrary, the sample size of the study is relatively small, making the analysis of less frequent maternal outcomes, such as higher degree tears and specific newborn complications, difficult to compare. In the future, if this model of care is implemented within the Spanish Health Care System, multicentric studies should be carried out to increase the study group numbers.

Second, despite the fact that we were able to control relevant potential confounders, such as age, BMI, parity, and nationality, the analysis of other confounders, such as educational levels, socioeconomic status or maternal level of information about different labor models of care, could also be very useful. However, the study was performed in the MLU and the OU of the same institution, with the same guidelines and obstetric professionals, controlling possible differences in practice between institutions and guidelines.

Finally, a retrospective observational design was used for this study, with all the limitations this implies. As women may not agree to the idea of being randomized for place of birth,<sup>42</sup> a prospective observational study could be a better approach for future research.<sup>12</sup>

## 5 | CONCLUSIONS

Once again, MLUs have proven to be a safer model of care for women and babies with low-risk pregnancies. Moreover, our findings suggested that the implementation of this model of care may also benefit women delivering in OUs, as cesarean birth rates decreased significantly for all women once the MLU was opened. However, further research will be required to confirm this tendency. It can also be concluded that uneven access to evidence-based information about different models of care, can lead to inequalities within the healthcare system that may influence birthing people's labor experiences and birth outcomes.

The available evidence about the benefits of midwife led units and the increasing interest in this model of care should encourage governments to implement MLUs within public healthcare systems and researchers to continue evaluating this topic.

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## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from Fundació Hospital Sant Joan de Déu de Martorell. Restrictions apply to the availability of these data, which were used under license for this study. Data are available from the author(s) with the permission of Fundació Hospital Sant Joan de Déu de Martorell.

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