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BRIEF REPORT

Maternal and neonatal outcomes in birth centers versus hospitals among women with low-risk pregnancies in Japan: A retrospective cohort study

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Abstract

Aim: In order for low-risk pregnant women to base birth decisions on the risks and benefits, they need evidence of birth outcomes from birth centers. The purpose of this study was to describe and compare the maternal and neonatal outcomes of low-risk women who gave birth in birth centers and hospitals in Japan.

Methods: The participants were 9588 women who had a singleton vaginal birth at 19 birth centers and two hospitals in Tokyo. The data were collected from their medical records, including their age, parity, mode of delivery, maternal position at delivery, duration of labor, intrapartum blood loss, perineal trauma, gestational weeks at birth, birth weight, Apgar score, and stillbirths. For the comparison of birth centers with hospitals, adjusted odds ratios for the birth outcomes were estimated by using a logistic regression analysis.

Results: The number of women who had a total blood loss of >1 L was higher in the midwife-led birth centers than in the hospitals but the incidence of perineal lacerations was lower. There were fewer infants who were born at the midwife-led birth centers with Apgar scores of <7, compared to the hospitals.

Conclusion: This study was the first to compare important maternal and neonatal outcomes of birth centers and hospitals. Additional research, using matched baseline characteristics, could clarify the comparisons for maternal and neonatal outcomes.

Key words: birthing center, hospital, midwife, newborn, parturition.

INTRODUCTION

The International Confederation of Midwives has stated that receiving care during childbirth by a qualified midwife and choosing the place of birth are basic rights of women (ICM, 2014a). Therefore, the essential competencies of midwifery care are to promote and protect the rights and health of women and their babies, provided in trust and partnership with women (ICM, 2014b).

In Japan, when women give birth, they can choose the type of facility: hospitals, obstetricians' clinics, or midwife-led birth centers. Midwifery care is provided in all settings. However, in the midwife-led birth centers, midwives only care for low-risk women with singleton cephalic pregnancies that follow a normal course and each birth center is affiliated with a tertiary hospital in order to facilitate emergency transfers to the hospital. The midwives give professional support in partnership with the women and promote their physiologic process of childbirth. Independent Japanese midwives aspire to support child-bearing women's feelings of satisfaction and competence in their ability to give birth. While supporting cultural practices of nutrition and health habits, midwives also promote positive changes and lifelong health (Gepshtein, Horiuchi, & Eto, 2007).

In a Japanese survey that compared midwifery-led care with obstetrician-led care, the perceptions of

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midwife, women-centered care were higher and were associated with higher satisfaction. There were lower premature ruptures of membranes and greater numbers of women who were exclusively breast-feeding. Maternity blues scores were lower among the women who received midwifery care. In addition, they were prepared physically for birth; for example, staying warm, normal exercise, and a well-balanced dietary intake (Iida, Horiuchi, & Nagamori, 2014). In other surveys, the care policies of most midwife-led birth centers stipulated active birth, including assuming various positions during the second stage of labor (Baba *et al.*, 2016) and the physiological management of the third stage of labor (Kataoka, Nakayama, Yaju, Eto, & Horiuchi, 2015). A Cochrane review found that midwifery-led continuity of care that was provided to pregnant women and newborn babies led to less adverse outcomes (Sandall, Soltani, Gates, Shennan, & Devane, 2016). Furthermore, the midwife's counseling during the early post-partum period significantly reduced postpartum depression (Gamble *et al.*, 2005). These studies indicate that the midwife, as a primary healthcare provider, has a role in improving the childbirth environment; for example, an informed choice of birth place and providing warm support for pregnant women.

Although studies have been conducted that compared independent midwifery care with hospital care in Japan (Iida *et al.*, 2014) and the maternal outcomes of birth centers (Kataoka *et al.*, 2013; Suto, Takehara, Misago, & Matsui, 2015), there is a lack of evidence that compares the risk of perinatal outcomes between birth centers and hospitals. It is necessary for midwives to show the birth outcome data of birth centers in order to establish the benefits and risks, so that low-risk pregnant women can base their decisions on the available evidence.

Therefore, the objective of this study was to describe and compare the maternal and neonatal outcomes of low-risk women who gave birth in midwife-led birth centers and hospitals in Japan.

METHODS

This retrospective cohort study was conducted in Tokyo, Japan. There was a total of 43 independent midwives who operated midwife-led birth centers at the time of this study. Of these, 19 (44%) midwife-led birth centers that served women with a low-risk pregnancy agreed to participate in the study. Two hospitals, which were not tertiary hospitals, with no neonatal intensive care unit and located in Tokyo, also agreed to participate. The majority of women who delivered in these hospitals had a low-risk pregnancy with no major complication during pregnancy and received active management at the third stage of labor (the routine administration of uterotonics, such as oxytocin or ergometrine, early cord clamping, and controlled cord traction). The Cesarean section rate was 16.8%.

The study periods of the midwife-led birth centers and hospitals were different because of the availability of medical records for data collection: the birth centers contributed data from 2001–2006, one hospital contributed data from 2004–2006, and the other hospital contributed data from January to December, 2008.

Trained researchers and research assistants with midwifery knowledge collected the data directly from the medical records by using a one-page, precoded form. This form was organized by the women's age, parity, mode of delivery, maternal position at the time of delivery, duration of labor, intrapartum blood loss, perineal laceration, number of gestational weeks at birth, birth weight, Apgar scores, and mortality. The inclusion criteria included: vaginal delivery, gestation at ≥22 weeks, singleton, and cephalic presentation. The exclusion criteria were transportation to other facilities, Cesarean section, and twin pregnancies.

The representatives of the midwife-led birth centers and hospitals provided written informed consent after receiving an explanation about the protection of anonymity and privacy of the individual women, the midwife-led birth centers, and the hospitals. No consent was required from the individual women because the data were rendered anonymous before the analysis. The Ethics Review Board of St. Luke's International University (Approval No. 06-027) approved the study.

Descriptive statistics were used to show the characteristics and birth outcomes of the women who gave birth in the birth centers and hospitals. For the comparison of the birth centers with the hospitals, adjusted odds ratios (a ORs) for the birth outcomes were estimated by using a logistic regression analysis, adjusting for age, parity, mode of delivery, and number of gestational weeks, with 95% confidence intervals (CIs). The statistical analyses were conducted by using IBM SPSS Statistics (v. 22.0; IBM Corporation, Armonk, NY, USA).

RESULTS

The characteristics and prenatal outcomes of the 9588 participants are displayed in Table 1. The women who

Table 1 Characteristics and maternal and neonatal outcomes of all women who gave birth at birth centers and hospitals

	Birth centers		Hospitals	
	(*n* = 5379)		(*n* = 4209)	
Characteristics	N	(%)	N	(%)
Age (year)				
<20	20	(0.4)	20	(0.5)
20–29	1537	(28.7)	1273	(30.3)
30–39	3669	(68.6)	2762	(65.7)
≥40	122	(2.3)	147	(3.5)
Missing	31		7	
Parity				
0	1579	(29.4)	2675	(63.6)
1	2345	(43.6)	1235	(29.3)
2	1132	(21.0)	252	(6.0)
3	246	(4.6)	42	(1.0)
≥4	77	(1.4)	5	(0.1)
Mode of delivery				
Spontaneous virginal delivery	5379	(100)	4011	(95.3)
Vacuum extraction	0	(0)	178	(4.2)
Forceps delivery	0	(0)	20	(0.5)
Gestational age of infants (weeks)				
<37	24	(0.4)	98	(2.3)
37–41	5274	(98.2)	4030	(96.4)
≥42	71	(1.3)	54	(1.3)
Missing	10		27	
Maternal position at delivery of baby				
Lateral	1204	(27.9)	706	(17.4)
Kneeling	1004	(23.3)	0	(0)
Hands and knees	675	(15.7)	164	(4.0)
Supine	639	(14.8)	3203	(78.4)
Sitting/birth stool	198	(4.6)	5	(0.1)
Semi-recumbent	178	(4.1)	0	(0)
Standing	110	(2.6)	5	(0.1)
Water births	90	(2.1)	0	(0)
Others	211	(4.9)	4	(0.1)
Unknown/missing	1070		122	
Birth outcomes				
Total blood loss (mL)				
<500	4121	(77.9)	3425	(81.6)
500–999	979	(18.5)	672	(16.0)
1000–1999	189	(3.6)	95	(2.3)
≥2000	4	(0.1)	6	(0.1)
Missing	86		11	
Perineal laceration	2085	(40.9)	2773	(66.1)
Missing	281	(5.2)	16	(0.3)
Birth weight (grams)				
<2500	171	(3.2)	234	(5.6)
2500–3999	5120	(95.3)	3896	(92.7)
>4000	82	(1.5)	72	(1.7)
Missing	6		7	
Apgar score				
<7 at 1 minute	20	(0.4)	115	(2.7)
Missing	322		6	
<7 at 5 minutes	5	(0.1)	26	(0.6)
Missing[1]	1525		8	
Stillbirths	0	(0)	11	(0.3)
missing	0		6	

[1] Midwives often evaluate the infant's condition only at 1 minute and if the score is adequate they do not score at 5 minutes, therefor it appears as missing data.

delivered in the midwife-led birth centers and in the hospitals had similar ages (mean age of 31.67 years *vs* 31.62 years, respectively). There were fewer primipara women in the midwife-led birth centers than in the hospitals(29.4% *vs* 63.6%, respectively). The women in the midwife-led birth centers used more birthing positions than those in the hospitals.

Table 2 shows the birth outcomes of the women who delivered at the midwife-led birth centers, compared with the women from the hospitals. The women in the midwife-led birth centers had a statistically significant higher rate of total blood loss, of >500 mL (22.1% *vs* 18.4%, respectively, a OR = 1.47, 95% CI = 1.31–1.64; $P < 0.001$), and >1 L (3.6% *vs* 2.4%, respectively, a OR = 1.77, 95% CI = 1.35–2.33; $P < 0.001$). However, the women in the midwife-led birth centers had significantly less perineal lacerations than those in the hospitals (40.9% *vs* 66.1%, respectively, a OR = 0.37, 95% CI = 0.35–0.42; $P < 0.001$).

In terms of the neonatal outcomes, the women who delivered at the midwife-led birth centers had fewer low-birthweight infants (3.2% *vs* 5.6%, respectively, a OR = 0.67, 95% CI = 0.55–0.85; $P = 0.001$) and fewer heavier infants (1.5% *vs* 1.7%, respectively, a OR =0.65, 95% CI = 0.46–0.92; $P = 0.014$) than those who delivered at the hospitals. The Apgar scores at 1 min for the term babies who were delivered at the midwife-led birth centers were lower than for those who were delivered at the hospitals (0.4% *vs* 2.7%, respectively, a OR = 0.17, 95% CI = 0.10–0.28; $P < 0.001$).

DISCUSSION

Midwife-led birth centers are one option for a birthplace in Japan. These birth centers are owned and

Table 2 Maternal and neonatal outcomes of all women who gave birth at birth centers and hospitals by parity

	Birth centers (n = 5379)		Hospitals (n = 4209)					
Characteristics	N	(%)	N	(%)	OR	(95%CI)	aOR*	(95%CI)
Total blood loss (mL)								
≥500	1172	(22.1)	773	(18.4)	1.26	(1.14–1.40)	1.47	(1.31–1.64)
≥1000	193	(3.6)	101	(2.4)	1.54	(1.20–1.96)	1.77	(1.35–2.32)
Perineal laceration	2085	(40.9)	2773	(66.1)	0.35	(0.33–0.39)	0.38	(0.35–0.42)
Birthweight (g)								
<2500	171	(3.2)	234	(5.6)	0.56	(0.46–0.68)	0.67	(0.55–0.82)
4000<	82	(1.5)	72	(1.7)	0.89	(0.65–1.22)	0.65	(0.46–0.92)
Apgar score								
<7 at 1 min	20	(0.4)	115	(2.7)	0.14	(0.09–0.23)	0.17	(0.10–0.28)
<7 at 5 min	5	(0.1)	26	(0.6)	0.21	(0.10–0.54)	0.23	(0.10–0.63)

* aOR: odds ratio adjusted for age, parity, mode of delivery and gestational weeks

operated by independent midwives. In order to keep the option for women who want to have a natural childbirth, including a warm environment with their family, the midwife-led birth centers' safety has to be assured. This study aimed to describe and compare the important maternal and neonatal outcomes of low-risk women who gave birth in midwife-led birth centers and hospitals in Japan. The main findings are: (i) the number of women with post-partum hemorrhage (PPH) was higher for the birth centers than for the hospitals; (ii) the incidence of perineal lacerations in the birth centers was lower than in the hospitals; (iii) fewer babies who were born at the birth centers had Apgar scores of <7; and (iv) there were fewer preterm births at the birth centers than at the hospitals. The current study is the first one to compare these important prenatal outcomes for birth centers and hospitals.

As would be expected, there was a higher proportion of primipara and multipara women with a PPH in the birth centers. The primary reason was that the women from the midwife-led birth centers did not receive prophylactic uterotonics. Furthermore, there was a larger proportion of multipara women who delivered at the midwife-led birth centers than at the hospitals. The parity of ≥3 is one of the risk factors for PPH (Sheldon *et al.*, 2014); therefore, it can be considered as a cause of the higher rate of women with a PPH at the birth centers. The hospitals in this study used oxytocin or ergometrine as a prophylactic uterotonic at the third stage of labor. There is considerable evidence that the use of oxytocin or ergometrine during the third stage of labor reduces the incidence of PPH (Liabsuetrakul, Choobun, Peeyananjarassri, & Islam, 2007; Westhoff, Cotter, & Tolosa, 2013); hence, the hospitals had a lower rate of PPH. This study also showed that the duration of the third stage of labor was significantly shorter in the hospitals than in the birth centers. The active management of the third stage of labor in order to reduce its duration and the amount of blood loss has had mixed reviews (Fenton, Baumeister, & Fogarty, 2005; Kashanian, Fekrat, Masoomi, & Sheikh Ansari, 2010; Magann *et al.*, 2005). Some researchers question the necessity of the active management of the third stage of labor for low-risk pregnant women, as side-effects interfere with the natural process of bonding (Fahy, 2009; National Institute for Health and Care Excellence, 2014). The survey results of the management policies in Japanese midwife-led birth centers during the third stage of labor found late cord clamping (71.4%) and no controlled cord traction (40.0%) (Kataoka et al., 2015). Compared to active management, early cord clamping and controlled cord traction have not significantly reduced the incidence of PPH (Hofmeyr, Mshweshwe, & Gülmezoglu, 2015; McDonald, Middleton, Dowswell, & Morris, 2013).

The Japanese guidelines for midwifery care management were revised in 2009 and 2014 (Japanese Midwives Association, 2014). Henceforth, when women are at risk of a PPH, midwives can use uterotonics under the direction of obstetricians. The data of this current study were collected before the guidelines were revised, so the risk to women who deliver at midwife-led birth centers since then should not be overestimated.

The incidence of perineal laceration in the midwife-led birth centers was lower than in the hospitals. The intensity of perineal pain is higher with increased perineal laceration (Macarthur & Macarthur, 2004) and affects the ability of women to take care of their baby

(Sleep, 1991). Prolonged perineal pain is associated with post-partum depressive symptoms (Chang *et al.*, 2016). Therefore, less perineal lacerations were an important outcome for the better physical and psychological health of the women from the birth centers.

The women who delivered in the midwife-led birth centers had a lower risk of preterm birth and a low Apgar score, compared to the women in the hospitals. In this study, the newborn outcomes in the midwife-led birth centers were better than those in the hospitals. However, the differences and similarities of the women's risk between the midwife-led birth centers and the hospitals should be considered when interpreting these outcomes.

There were several study limitations. The current study showed only the birth outcomes according to the actual place of birth, instead of including those who intended to deliver in a midwife-led birth center and who were transferred to a tertiary hospital. Therefore, this study underestimated the outcomes, especially the gestational age, Apgar score, and number of stillbirths. Also, it was not possible to distinguish between the ante-partum and intrapartum stillbirths. In addition, although two hospitals were chosen, mainly for low-risk women, high-risk pregnant women might have been included. The results from retrospective designs using medical records are subject to numerous potential recording errors and thus the results must be interpreted cautiously. Therefore, in order to adjust for the background or risk of the women, a matched prospective cohort study or national dataset should be the next step. In 2004, the Japanese Midwives Association published the Japanese guidelines for midwifery care management in order to assure a high level of midwifery care and to ensure the safety of pregnancies and neonates (Japanese Midwives Association, 2014). Therefore, the more recent data might reflect that change.

CONCLUSION

This study is the first one to compare the important maternal and neonatal outcomes of midwife-led birth centers and hospitals in Japan. The incidence of PPH was higher for the midwife-led birth centers than for the hospitals but the number of perineal lacerations was lower. Fewer babies who were born at the midwife-led birth centers had an Apgar score of <7 and there were fewer preterm births than at the hospitals. Additional research in matched baseline characteristics could help to further clarify the maternal and neonatal outcomes at birth centers.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Y. K. and E. H. designed this study; Y. K. and C. K. carried out the data analysis; Y. K. and Y. M. drafted the paper and revised the manuscript; all the authors approved the final version of the manuscript.

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