Planned Place of Birth in New Zealand: Does it Affect Mode of Birth and Intervention Rates Among Low-Risk Women?

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ABSTRACT: Background: *Midwives providing care as lead maternity caregivers in New Zealand provide continuity of care to women who may give birth in a variety of settings, including home, primary units, and secondary and tertiary level hospitals. The purpose of this study was to compare mode of birth and intrapartum intervention rates for low-risk women planning to give birth in these settings under the care of midwives.* **Methods:** *Data for a cohort of low-risk women giving birth in 2006 and 2007 were extracted from the Midwifery Maternity Provider Organisation database. Mode of birth, intrapartum interventions, and neonatal outcomes were compared with results adjusted for age, parity, ethnicity, and smoking.* **Results:** *Women planning to give birth in secondary and tertiary hospitals had a higher risk of cesarean section, assisted modes of birth, and intrapartum interventions than similar women planning to give birth at home and in primary units. The risk of emergency cesarean section for women planning to give birth in a tertiary unit was 4.62 (95% CI: 3.66–5.84) times that of a woman planning to give birth in a primary unit. Newborns of women planning to give birth in secondary and tertiary hospitals also had a higher risk of admission to a neonatal intensive care unit (RR: 1.40, 95% CI: 1.05–1.87; RR: 1.78, 95% CI: 1.31–2.42) than women planning to give birth in a primary unit.* **Conclusions:** *Planned place of birth has a significant influence on mode of birth and rates of intrapartum intervention in childbirth. (BIRTH 38:2 June 2011)*

Key words: *cesarean section, childbirth, intrapartum intervention, place of birth*

Concern over increasing rates of cesarean section and other obstetric interventions in childbirth have been raised internationally (1). In New Zealand approximately 23.7 percent of all births occur by cesarean section and 66.5 percent are vaginal births, although some of the latter included interventions such as induction of labor, episiotomy, and epidural or spinal analgesia (2). These and other interventions in childbirth have risks for the mother and baby (3–7), and they also have significant economic and other resource implications (8).

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This research was supported by a research grant from Otago Polytechnic, Dunedin, New Zealand.

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Accepted November 4, 2010

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Several studies comparing the outcomes of low-risk women planning to give birth at home with those in hospital settings have shown that the former experience less obstetric intervention, higher rates of vaginal birth (9), and similar rates of perinatal mortality (10–13) compared with those in hospital groups. A large study in the Netherlands (n = 529,688) comparing perinatal mortality and severe perinatal morbidity between planned home births (n = 321,307) and planned hospital births (n = 163,261) in a low-risk group in the care of midwives found no significant differences (14). A recent meta-analysis of maternal and neonatal outcomes in planned home births and planned hospital births similarly found that planned home births were associated with fewer intrapartum interventions, but a twofold to threefold increase in neonatal mortality (15). The study population, however, was not limited to low-risk women or those in the care of qualified midwives. When studies including home births attended by those other than qualified midwives were excluded, the meta-analysis was unable to demonstrate a significant difference in neonatal mortality (OR: 1.57, 95% CI: 0.62–3.98).

Similar results have been found in studies comparing outcomes for women choosing to give birth in birth centers with those in hospitals (16,17). However, authors of a meta-analysis (18) warn of a trend toward higher perinatal mortality in women allocated to ''home-like'' settings (RR: 1.83, 95% CI: 0.99–3.38).

It is difficult to identify differences in maternal or neonatal mortality for those planning to give birth in different settings because of the rarity of these outcomes and the large sample sizes required to achieve adequate study power. Many of these studies are also limited by small sample sizes (19–21) and limited criteria for determining low risk (22), and many confound model of care with place of birth because midwifery-led care and continuity of caregiver are usually only provided in home or birth center settings (16,20). It is difficult, therefore, to determine if the results of these studies are an effect of type of caregiver (midwife, general practitioner, obstetrician); model of care (continuity or fragmented); place of birth; or a combination of these factors. A randomized controlled trial would be the best way to determine differences in mode of birth, intrapartum intervention, and clinical outcomes for women planning to give birth in different settings, but the feasibility of such a study is unlikely (23).

The New Zealand maternity system is unique and offers an opportunity to examine more closely the effect of place on mode of birth and intrapartum interventions for low-risk women. Women in New Zealand choose a lead maternity caregiver, who may be a midwife, general practitioner, or an obstetrician, although most (75%) choose a midwife (2). The lead maternity caregiver provides continuity of care throughout the woman's pregnancy, labor, birth, and postpartum period. A primary maternity care contract (known as Section 88) details the service specifications for primary maternity care, which standardizes care across the country (24). Self-employed midwives will have ''access agreements'' with their local maternity facilities, and midwives consult directly with obstetric or other consultants when the need arises. An agreed set of referral criteria list the conditions (preexisting, antenatal, intrapartum, or postpartum), for which a consultation or transfer of care is recommended (24).

Women may choose to give birth at home, in primary units, or secondary or tertiary hospitals, and all care is publicly funded, regardless of the planned place of birth. The government provides funding for two midwives to attend every home birth. In all settings lead maternity caregiver midwives will provide all care to low-risk women under their own authority, consulting with obstetricians or other consultants as necessary.

Midwives may perform artificial rupture of membranes and episiotomy on their own authority and prescribe nitrous oxide, narcotic analgesia, and agents to facilitate the third stage of labor. Midwives cannot authorize augmentation of labor, give epidural or spinal analgesia, perform forceps or vacuum extractions, and they need to refer to neonatologists for admission of newborns to intensive care units. Fetal heart rate monitoring practices vary according to individual midwife preferences. Cardiotocographic monitoring is unlikely to be available at home, but it may be available in some primary units and will most likely be available in all secondary and tertiary hospitals. Many midwives provide care in a variety of settings, although despite the availability of birth place options, home and primary birth settings are underused. More than 84 percent of all births in New Zealand occur in tertiary or secondary level hospitals (2).

This study addresses the question: Does planned place of birth influence mode of birth and intervention rates in low-risk women in the care of midwives in New Zealand?

Methods

Data for the study were obtained from the Midwifery Maternity Provider Organisation (MMPO) database. The MMPO assists midwife members with payment claims and collects data on their clientele. Included in the database are demographic information, medical history, pregnancy, labor, birth, and postnatal data, and data on planned (at labor commencement) and actual place of birth. Several groups provide this service, and in 2006 and 2007, MMPO held data for approximately 32 percent of the total births occurring nationally (25).

Midwives complete a pregnancy record in hard or electronic copy. Duplicate hard copies are sent to MMPO, where data are entered into a database. Auditing and validation are performed on the data to check for errors and inconsistencies. Because many of the data fields are not mandated, denominators vary for the outcomes reported in this research. The study population was defined as all low-risk women covered by the MMPO who gave birth in 2006 or 2007. Low risk was determined at the beginning of labor by the following exclusion criteria:

Previous pregnancy: previous cesarean section, stillbirth, postpartum hemorrhage (>1,000 mL), severe pregnancy-induced hypertension, gestational diabetes, Rh sensitization, or ABO incompatibility.

Medical and surgical history: any essential hypertension, diabetes, thyroid disease, drug and/or alcohol abuse, heart disease, pulmonary disease/asthma, any hematological, neurological, renal/urinary tract, or muscular skeletal disorders.

Current pregnancy: any consultation with or transfer of care to another practitioner (usually an obstetrician) during the antenatal period, multiple birth, and antepartum fetal death.

Labor and birth: women who presented in labor before 36 completed weeks of gestation (on or before 36 + 6) or after 42 completed weeks of gestation (after 41 + 6 days), whose labors were induced, whose babies presented by the breech or shoulder, whose babies were in a transverse lie, or those who had an elective cesarean section.

It was not possible from the database to determine the severity of conditions noted in the past history section (e.g., asthma), and robust data were not available on type of practitioner involved in a consultation. To err on the side of caution, we excluded any women with any condition noted in the past history or any consultation with another practitioner. As a result we may have excluded some women who would be considered low risk, and this interpretation is supported by our high exclusion rate (58.5%).

Age and parity parameters were not included as exclusion criteria to allow for subsequent subanalysis of data. Keillands rotation and other forceps deliveries were combined in analysis of relative risk (RR). We were not able to identify socioeconomic status and although we were interested in including body mass index (BMI), poor compliance with recording of height and weight precluded inclusion of BMI in determining the low-risk group. High and low BMI and other conditions arising from an unhealthy BMI (e.g., intrauterine growth restriction, macrosomia, gestational diabetes) and socioeconomic status are listed in the nationally agreed referral guidelines that form part of the service specification under which all midwives provide care. These conditions would have necessitated an antenatal consultation or transfer of care, which would have excluded these women from the low-risk cohort identified for this study.

Planned place of birth was defined as home, primary unit, secondary hospital, or tertiary hospital. Maternity facilities are categorized as such by the New Zealand Ministry of Health. Primary maternity units are designed for women of low obstetric risk providing inpatient labor, birth, and immediate postnatal care but do not offer on-site obstetric, pediatric, or anesthesia services. Secondary hospitals provide on-site obstetric, pediatric, and anesthesia services, and tertiary hospitals provide multidisciplinary specialist teams with the ability to care for the most complex of maternity cases (2). New Zealand is served by 6 tertiary, 18 secondary hospitals, and 57 primary maternity units (2). Planned place of birth is negotiated between the woman and her midwife, and low-risk women can choose to give birth in secondary and tertiary hospitals. Primary birth units are not available in all geographic regions of New Zealand (including some urban centers), and some rural women choose to bypass local primary birth units to give birth in secondary or tertiary hospitals located in urban centers.

The primary outcome of the study was mode of birth, and secondary outcomes of interest included augmentation of labor, artificial rupture of membranes, pharmacological pain management (including the use of epidural and spinal analgesia, nitrous oxide, and narcotics), episiotomy, perineal trauma, blood loss >1,000 mL, 5 minute Apgar score <7, and admission to neonatal intensive care unit. Analysis was planned in advance with multinomial logistic regression controlling for maternal age, parity, ethnicity, and smoking. Adjusting for nulliparity as opposed to parity did not make a substantial difference to results (e.g., the RR for cesarean section was 2.733 adjusting for nulliparity and 2.732 adjusting for parity). All analysis was performed using Stata V10 (26). Outcomes were attributed to the planned place of birth at the onset of labor rather than actual place of birth. The study was approved by the New Zealand Multi-region Ethics Committee.

Results

Data were obtained from the MMPO for a total of 39,677 births. Of these, 16,453 (41.47%) met the study's low-risk criteria. Of this low-risk group, 11.3 percent were planning to give birth at home, 17.7 percent in a primary unit, 45.5 percent in a secondary level hospital, and 25.4 percent in a tertiary level hospital (Fig. 1). Most women gave birth in their planned place of birth; 82.7 percent of those planning a home birth, 90.2 percent planning to give birth in a birth center, 99.8 percent planning to give birth in a secondary hospital, and 99.8

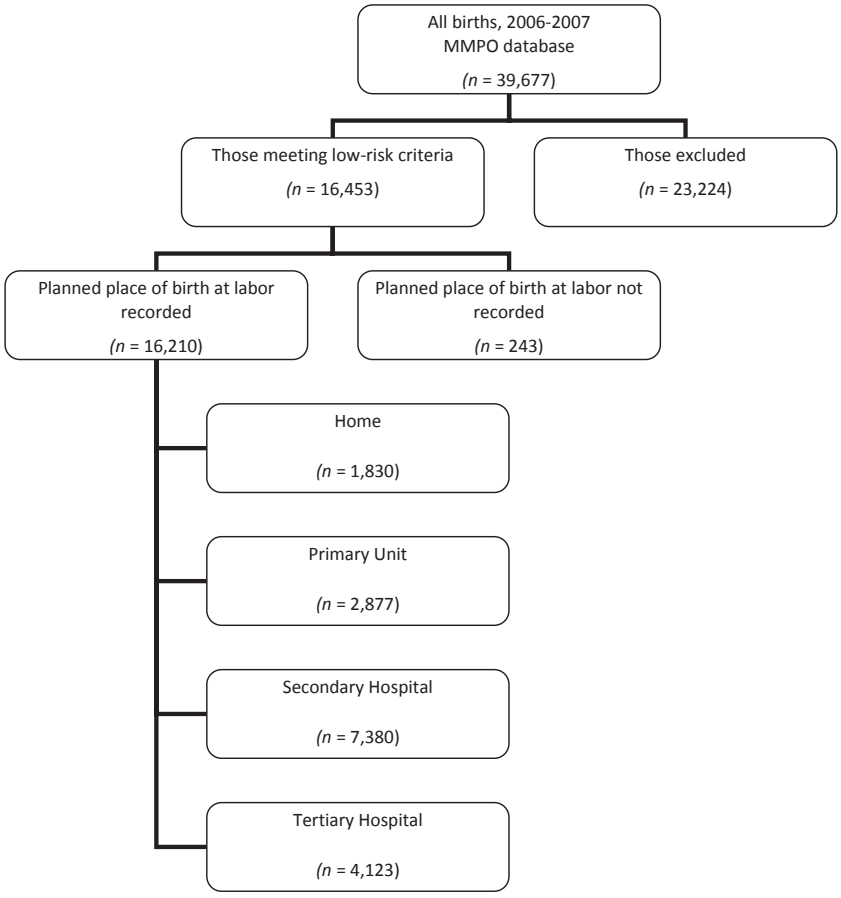

Fig. 1. Sample by planned place of birth.

percent planning to give birth in a tertiary hospital actually gave birth in their planned place of birth. The data on intrapartum transfers (because of complications arising in labor) were not robust; hence, we cannot report on this outcome. The data on planned and actual place of birth include births that accidentally occurred in a place other than a planned place, for example, babies born at home when the planned place of birth was the hospital.

Table 1 shows the mean age, gravida, parity, proportion of nulliparous women, and ethnicity of women for

Table 1. Characteristics of Women by Planned Place of Birth

	Planned Place of Birth					
Characteristics	*Home* (n = *1,830*)	*Primary Unit* (n = *2,877*)	*Secondary Hospital* (n = *7,380*)	*Tertiary Hospital* (n = *4,123*)	*Total* (n = *16,210*)	p
Mean age (SD)	30.4 (5.4)	27.9 (6.0)	27.7 (6.0)	29.3 (5.9)	28.5 (6.0)	<0.001
Mean gravida (SD)	3.0 (1.8)	2.6 (1.6)	2.4 (1.6)	2.1(1.4)	2.4 (1.6)	<0.001
Mean parity (SD)	1.4 (1.4)	1.1 (1.2)	0.9 (1.2)	0.7 (1.0)	1.0 (1.2)	<0.001
Proportion of nulliparas	27.4%	35.9%	45.4%	53.2%	100%	<0.001
Ethnicity						
NZ European (%)	1,383 (12.9)	1,880 (17.5)	4,513 (42.0)	2,963 (27.6)	10,739 (66.2)	
Māori (%)	296 (9.2)	744 (23.1)	1,774 (55.0)	412 (12.8)	3,226 (19.9)	
Pacific Islander (%)	55 (6.7)	115 (14.0)	442 (54.0)	207 (25.3)	819 (5.0)	
Asian (%)	39 (4.3)	92 (10.1)	443 (48.9)	332 (36.6)	906 (5.6)	
Other/not stated (%)	57 (11.0)	46 (8.8)	208 (40.0)	209 (40.2)	520 (3.2)	

Table 2. Mode of Birth by Planned Place of Birth

	Planned Place of Birth				
Mode of Birth	*Home (n = 1,826) No. (%)*	*Primary Unit (n = 2,873) No. (%)*	*Secondary Hospital (n = 7,353) No. (%)*	*Tertiary Hospital (n = 4,095) No. (%)*	*Total (n = 16,147) No. (%)*
Vaginal	1,743 (95.4)	2,722 (94.7)	6,216 (84.5)	2,979 (72.7)	13,660 (84.6)
Vacuum extraction	20 (1.1)	34 (1.18)	352 (4.8)	304 (7.4)	710 (4.4)
Forceps	16 (0.9)	24 (0.9)	161 (2.2)	201 (4.9)	402 (2.5)
Emergency cesarean section	47 (2.6)	91 (3.2)	622 (8.5)	610 (14.9)	1,370 (8.5)

Table 3. Relative Risk (RR) for Mode of Birth by Planned Place of Birth

Mode of Birth	*Crude RR (95% CI)*	p	*Adjusted RR* (95% CI)*	p†
Vacuum extraction				
Home	0.92 (0.53–1.6)	0.76	0.99 (0.56–1.74)	0.975
Primary	(Ref)			
Secondary hospital	4.54 (3.18–6.47)	<0.001	4.11 (2.86–5.91)	**<0.001**
Tertiary hospital	8.11 (5.66–11.60)	<0.001	6.12 (4.24–8.84)	**<0.001**
Forceps				
Home	1.04 (0.55–1.96)	0.90	1.11 (0.59–2.13)	0.730
Primary	(Ref)			
Secondary hospital	2.94 (1.90–4.52)	<0.001	2.57 (1.66–3.97)	**<0.001**
Tertiary hospital	7.65 (4.99–11.72)	<0.001	5.41 (3.51–8.33)	**<0.001**
Emergency cesarean section				
Home	0.81 (0.56–1.15)	0.24	0.86 (0.60–1.24)	0.424
Primary	(Ref)			
Secondary hospital	2.99 (2.39–3.75)	<0.001	2.73 (2.17–3.44)	**<0.001**
Tertiary hospital	6.13 (4.88–7.68)	<0.001	4.62 (3.66–5.84)	**<0.001**

**Relative risks were adjusted for maternal age, parity, ethnicity, and smoking; †statistically significant* p *values are presented in bold.*

each birth setting. Women planning to give birth at home had a higher mean age, gravida, and parity than those planning to give birth in other settings. The home birth group had a lower proportion of nulliparous women than other groups. Women who identified themselves as being New Zealand European comprised most of the sample (66.2%).

Table 2 describes the mode of birth by planned place of birth. Most of this low-risk group experienced a vaginal birth. Table 3 shows the relative risk of mode of birth by birth place. While mode of birth for those planning to give birth at home was not significantly different, those planning to give birth in secondary and tertiary hospitals had an increased risk of vacuum extraction, forceps and emergency cesarean section compared with women planning to give birth in a primary unit.

Table 4 shows the relative risks for secondary outcomes measured by place of birth. Women planning to give birth in secondary or tertiary level hospitals were also at increased risk of artificial rupture of the membranes, augmentation of labor, pharmacological pain management, episiotomy, and neonatal admission to intensive care when compared with women planning to give birth in primary units. Those planning to give birth at home were at less risk of augmentation of labor, artificial rupture of membranes, pharmacological pain management, episiotomy, and perineal trauma than those planning to give birth in primary units. No differences were found in any birth setting for an estimated blood loss of more than 1,000 mL or a 5 minute Apgar score less than 7.

A total of six neonatal deaths (a death occurring up to 27 days after birth) occurred in the sample, two (0.11%) from women planning a home birth and four (0.15%) from women planning to give birth in the tertiary hospital. No intrapartum, intrauterine deaths were reported.

Discussion

Planning to give birth in a secondary or tertiary unit was associated with an increased risk of assisted or operative modes of birth in this study. Mode of birth was not significantly different for women planning home birth

Table 4. Relative Risk (RR) for Secondary Outcomes by Planned Place of Birth

Secondary Outcomes	*Crude RR (95% CI)*	p	*Adjusted RR (95% CI)**	p†
Augmentation of labor				
Home	0.60 (0.51–0.69)	<0.001	0.63 (0.55–0.74)	**<0.001**
Primary	(Ref)			
Secondary hospital	1.96 (1.78–2.15)	<0.001	1.91 (1.73–2.10)	**<0.001**
Tertiary hospital	1.98 (1.79–2.20)	<0.001	1.87 (1.68–2.08)	**<0.001**
Artificial rupture of membranes				
Home	0.59 (0.50–0.69)	<0.001	0.63 (0.53–0.74)	**<0.001**
Primary	(Ref)			
Secondary hospital	1.50 (1.35–1.66)	<0.001	1.49 (1.34–1.65)	**<0.001**
Tertiary hospital	1.48 (1.33–1.66)	<0.001	1.51 (1.35–1.70)	**<0.001**
Pharmacological pain management				
Home	0.14 (0.11–0.16)	<0.001	0.14 (0.12–0.17)	**<0.001**
Primary	(Ref)			
Secondary hospital	1.51 (1.38–1.66)	<0.001	1.49 (1.36–1.64)	**<0.001**
Tertiary hospital	1.82 (1.65–2.01)	<0.001	1.64 (1.47–1.82)	**<0.001**
Episiotomy				
Home	0.55 (0.39–0.78)	<0.001	0.57 (0.40–0.82)	**0.002**
Primary	(Ref)			
Secondary hospital	2.10 (1.72–2.56)	<0.001	1.88 (1.54–2.30)	**<0.001**
Tertiary hospital	3.97 (3.25–4.85)	<0.001	2.91 (2.37–3.57)	**<0.001**
Perineal trauma				
Home	0.77 (0.68–0.86)	<0.001	0.74 (0.65–0.84)	**<0.001**
Primary	(Ref)			
Secondary hospital	0.95 (0.87–1.04)	0.260	0.83 (0.76–0.91)	**<0.001**
Tertiary hospital	1.27 (1.15–1.40)	<0.001	0.91 (0.82–1.02)	0.098
Estimated blood loss >1,000 mL				
Home	0.93 (0.53–1.65)	0.811	0.94 (0.52–1.67)	0.826
Primary	(Ref)			
Secondary hospital	1.20 (0.80–1.79)	0.381	1.20 (0.80–1.81)	0.378
Tertiary hospital	1.47 (0.96–2.24)	0.076	1.39 (0.90–2.16)	0.138
5 min Apgar score <7				
Home	0.82 (0.41–1.65)	0.577	0.81 (0.39–1.68)	0.577
Primary	(Ref)			
Secondary hospital	1.43 (0.90–2.27)	0.129	1.39 (0.87–2.22)	0.164
Tertiary hospital	1.59 (0.97–2.60)	0.066	1.58 (0.95–2.61)	0.077
Admission to NICU				
Home	0.98 (0.65–1.47)	0.919	1.00 (0.66–1.50)	0.984
Primary	(Ref)			
Secondary hospital	1.44 (1.08–1.91)	0.013	1.40 (1.05–1.87)	**0.021**
Tertiary hospital	1.87 (1.39–2.53)	<0.001	1.78 (1.31–2.42)	**<0.001**

**Relative risks were adjusted for maternal age, parity, ethnicity, and smoking; †statistically significant* p *values are presented in bold.*
NICU = *neonatal intensive care unit.*

compared with those planning to give birth in a primary unit. The risk of interventions, such as augmentation of labor, artificial rupture of membranes, episiotomy, and pharmacological pain management, in childbirth was also higher for women planning to give birth in secondary and tertiary hospitals compared with those planning to give birth in primary units. Higher rates of episiotomy in these settings may be related to higher vacuum extraction and forceps delivery rates. Babies of women planning to give birth in these settings also had an increased risk of being admitted to neonatal intensive care, although no differences were reported in 5 minute Apgar scores of less than 7. Increased rates of admission to the neonatal intensive care nursery may be associated with increased rates of labor interventions and assisted modes of birth in secondary and tertiary hospital settings or because of the availability of these facilities in hospital settings.

Women planning to give birth at home had less risk of augmentation of labor, artificial rupture of membranes, perineal trauma, and episiotomy than those planning to give birth in primary units. It is not surprising to find

lower rates of pharmacological pain management and artificial rupture of membranes in women planning to give birth in primary settings (including home) because these women would be more motivated toward avoiding these interventions. However, it is difficult to explain the profound differences found in the risk of augmentation of labor and mode of birth among various birth settings. Women planning to give birth in hospital settings may be more amenable to intrapartum interventions, although clinical need should be the major driver for intervention. Although many midwives provide care across a variety of settings, it is also possible that those who are more amenable to intervention prefer to provide care in hospital settings. However, they do not authorize or perform many of the interventions (such as augmentation of labor, assisted or operative modes of birth), and again, it should be clinical need rather than clinician predisposition that drives these interventions.

Unlike other studies that confound caregiver and model of care with birth setting, the women in this study were all in the care of midwives, providing continuity of care, which usually continues when a woman transfers from home or a primary unit to a secondary or tertiary hospital. Robust criteria for identifying a low-risk cohort of women were employed in the study. The significant differences found in mode of birth among settings in this study can therefore be more precisely associated with place rather than caregiver or model of care. Although this study cannot illuminate the effect of place on the nuances of decision making and behavior (of caregivers and childbearing women), these aspects might be fruitful lines of inquiry for future studies.

Two other studies comparing midwife-led care for women planning home and hospital births have found similar results. Janssen et al compared outcomes for a matched cohort of low-risk women in Canada who planned to give birth at home with a midwife, in hospital with a midwife, and in hospital with a physician (27). Midwifery-led care resulted in lower rates of assisted and operative modes of birth, and more significantly, the risk of assisted modes of birth (RR: 0.41, 95% CI: 0.33–0.52) and cesarean section (RR: 0.76, 95% CI: 0.64–0.91) was significantly lower for the planned home (midwife-attended groups) compared with the planned hospital (midwife-attended) groups.

In New Zealand, Miller recruited 12 midwives and compared outcomes for low-risk nulliparous women in their care planning to give birth in a hospital or at home (28). Even though the same midwives provided care in both settings, outcomes varied significantly—the hospital group had higher rates of assisted modes of birth (11.2% vs 1.8%), cesarean section operations (9.5% vs 2.8%), and various obstetric interventions during labor compared with the home birth group. Together with the results of our research, these studies lend weight to the thesis that place of birth has a significant effect on childbirth outcomes.

Several qualitative studies in New Zealand, for example, have demonstrated that midwifery practice is influenced by place (28–31). Midwives find it more difficult to facilitate normal birth in obstetric hospital settings because of constraints brought about by the physical (lack of space, appropriate supports, baths, privacy, freedom of movement), and discursive (dominance of biomedical constructs and power relations) contexts.

An emerging body of literature is exploring the way that the built environment influences human physicality, behavior, and wellbeing (32–34). Ulrich, for example, found that patients with a view of nature from their window had a shorter hospital stay and required fewer analgesics than those facing a brick wall (35). In maternity care, researchers have begun to consider the way that the built environment affects maternal and infant outcomes (30,36–40). One hypothesis is that medicalized settings increase the anxiety levels of laboring women. Heightened anxiety results in increased catecholamine production, reducing blood flow to the uterus and inhibiting the release of oxytocins, which can result in prolonged labor and fetal distress, common causes of intervention in childbirth (41).

This study has several limitations. As a retrospective study, it is vulnerable to selection bias, and although the sample is low-risk women, those choosing to give birth in primary settings (including home) will have different motivations from those planning to give birth in secondary and tertiary hospitals. This factor has undoubtedly influenced some outcomes reported here, such as pharmacological pain management and artificial rupture of membranes.

The use of an existing database has limitations. The data that we were able to collect were limited to the fields already established in the database, and our ability to use the data also depended on the degree to which practitioners completed the various fields. We would have liked, for example, to have included BMI parameters in our exclusion criteria, but found that these fields were not completed reliably. We were also unable to identify socioeconomic status with the existing data. As mentioned previously, however, it is likely that women who had conditions arising from these factors would have been excluded from the study sample.

It is difficult to comment on the representativeness of the women included in this study because no national data are available on a low-risk cohort of women. The median age for all women giving birth in New Zealand in 2004 (the latest year available) was 30.3 years compared with 28.5 years in our low-risk cohort. The proportion of nulliparous women giving birth nationally was 43.6 percent compared with 47.2 percent in our study, and the proportion of women identifying

themselves as European was 57.1 percent nationally and 66.2 percent in our study (2).

This study was not powered to detect differences in perinatal mortality. Multiple comparisons using a large data set invariably show some results that reach significance by chance. However, most significant results presented here demonstrated significance to an alpha level of at least 0.01 or less, rather than the 0.05 level.

Although a randomized controlled trial would be the most appropriate design to evaluate the study question, such a study is unlikely to be feasible. The next best methodology would be a prospective cohort study, although it would bring its own challenges, including gaining the cooperation of practitioners who may already feel burdened by their current documentation and data entry requirements.

Conclusions

For women in New Zealand in the care of midwife lead maternity caregivers, significant differences were found in mode of birth and intrapartum interventions depending on the planned place of birth. Although some differences can be attributed to the motivations of women choosing to give birth at home, in primary units, or secondary and tertiary hospitals, or to the motivations of the midwives attending them, it is difficult to explain differences in other factors such as the risk of augmentation of labor and emergency cesarean section. Although this study was not powered to detect significant differences in neonatal mortality or morbidity, no differences for planned place of birth were noted. Interventions in labor and assisted modes of birth expose women and their babies to additional risks and also come at a financial cost to the health service. It is important, therefore, that interventions are driven by clinical need, are used judiciously, and demonstrate benefit to the mother and her baby. It is also important that maternity caregivers explore factors that may assist them to better support women and encourage physiological birth where appropriate. This study suggests that place of birth is an important factor worthy of further investigation.

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