

# Outcomes for the First Year of Ontario's Birth Center Demonstration Project

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**Introduction:** In 2014, Ontario opened 2 stand-alone midwifery-led birth centers. Using mixed methods, we evaluated the first year of operations for quality and safety, client experience, and integration into the maternity care community. This article reports on our study of safety and quality of care.

**Methods:** This descriptive evaluation focused on women admitted to a birth center at the beginning of labor. For context, we matched this cohort (on a 1:4 basis) with similar low-risk midwifery clients giving birth in a hospital. Data sources included Ontario's Better Outcomes Registry and Network (BORN) Information System, the Canadian Institute for Health Information, Ontario census data, and birth center records.

**Results:** Of 495 women admitted to a birth center, 87.9% experienced a spontaneous vaginal birth, regardless of the eventual location of birth, and 7.7% had a cesarean birth. The transport rate to a hospital was 26.3%. When compared with midwifery clients with a planned hospital birth, rates of intervention (epidural analgesia, labor augmentation, assisted vaginal birth, and cesarean birth) were significantly lower in the planned birth center group, even when controlled for previous cesarean birth and body mass index. Markers of potential morbidity were identified in about 10% of birth center births; however, there were no short-term health impacts up to discharge from midwifery care at 6 weeks postpartum. Care was low in intervention and safe (minimal negative outcomes and transport rates comparable to the literature).

**Discussion:** In the first year of operation, care was consistent with national guidelines, and morbidity and mortality rates and intervention rates were low for women with low-risk pregnancies seeking a low-intervention approach for labor and birth. Further evaluation to confirm these findings is required as the number of births grows.

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## INTRODUCTION

In March of 2012, the Ontario government announced funding for 2 freestanding, midwifery-led birth centers in Toronto and Ottawa as part of Ontario's Action Plan for Health Care. This strategy aimed to provide “the right care, at the right time, in the right place” with the intent of “shifting health services out of the hospital setting and into non-profit community-based clinics where high quality care could be offered closer to home at lower cost.”<sup>1</sup>

International literature supports the safety of an out-of-hospital birth in a low-risk population in systems in which an out-of-hospital birth is well integrated in a broader maternal-child health program.<sup>2–11</sup> The safety of a planned home birth under midwifery care in Ontario has been established.<sup>12,13</sup> Although a stand-alone birth center already existed in Ontario as part of Six Nations Health Services (where Aboriginal midwives care for women), the 2 new birth centers marked the first instance in which midwifery care by registered midwives has been systematically provided in a new setting since regulation of the profession in 1994.

For context, Ontario midwives complete a 4-year baccalaureate program including extensive clinical and in-

terprofessional placements, including out-of-hospital births. Midwives provide primary care during pregnancy, labor and birth, and the first 6 weeks postpartum. All midwives offer choice of birthplace (home, birth center, hospital), and the midwife follows the client regardless of birthplace. In most cases, 2 midwives attend each birth regardless of location, with no nursing or medical attendance unless a transfer of care occurs. Birth centers are staffed by birth center aides. Midwives with admitting privileges at the birth center accompany their clients in active labor to the birth center or meet them there. Nurses are not employed in the birth centers, and hospital-type interventions (eg, epidural analgesia, electronic fetal monitoring, induction of labor) are not offered. Nitrous oxide is available. All midwives are required to have admitting privileges at one or more hospitals to allow for transfer from a planned home or birth center birth, if required. Admitting privileges are granted based on hospital-specific criteria and proof of licensure. There are waiting lists for midwifery care in the province. Birth centers are required to follow all rules and regulations associated with being an independent health care facility in Ontario, and quality of care is assessed by the College of Midwives of Ontario.

The evaluation of the first year of operation of the birth centers was a mixed-methods study evaluating quality and safety, client experience, and integration into the maternity care community. This article reports on the evaluation of quality and safety.

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## Quick Points

- ◆ Compared with women giving birth in a freestanding midwifery-led birth center, midwifery clients giving birth in hospitals had significantly higher rates of intervention (epidural analgesia, labor augmentation, assisted vaginal birth, and cesarean birth), even when controlling for previous cesarean birth and body mass index.
- ◆ Care in the birth center cohort was consistent with current clinical practice guidelines. The rate of intermittent auscultation was 98.4%, the rate of normal birth was 91.4%, and 85% of women achieved or had the opportunity for successful breastfeeding latch within 2 hours of birth.
- ◆ Our evaluation validates good quality care and safety of the Ontario Birth Centers for women with low-risk pregnancies seeking a low-intervention approach for labor and birth.
- ◆ Findings from this evaluation are consistent with evidence about midwifery in general and out-of-hospital births, specifically in both Ontario and Canada and internationally. These findings support the safety of an out-of-hospital birth in a low-risk population within systems in which an out-of-hospital birth is well integrated in a broader maternal-child health program.

### METHODS

Existing quality health care frameworks<sup>14-16</sup> were reviewed to establish the evaluation framework. The project focused on 6 of the quality domains (safe, effective, people-centered, accessible, integrated, and equitable), but this article focuses specifically on safety, effectiveness, and equitability of care. Integration, accessibility, and person-centered care were measured via focus groups and surveys not included in this article.

### Sample

The study cohort included all women giving birth between January 31, 2014, and February 3, 2015, who began labor planning to give birth at one of the 2 birth centers. Tools created by each birth center to track registrations were used as a basis for confirming the cohort. There were policy differences for admissions between the birth centers. Although both centers accepted low-risk women at term with a healthy fetus who were expected to have an uncomplicated labor and birth, definitions of low-risk differed. Only one center accepted women with one previous cesarean birth desiring vaginal birth. One center restricted admission to women with a prepregnancy body mass index (BMI) less than 40, whereas the other did not. Neither center offered epidural analgesia or augmentation of labor.

### Data Sources

Data sources for the project were the Better Outcomes Registry & Network (BORN) Information System (BIS), the Canadian Institute for Health Information (CIHI) Discharge Abstract Database, the Statistics Canada Census Data for Ontario, birth center records, and birth center logs (Table 1). BORN and CIHI regularly assess and report on data quality.<sup>17,18</sup> Both groups provide extensive training and support for those entering data. The BIS includes built-in validation rules to check logic, conformance, and parameters. As a prescribed registry under the privacy legislation in Ontario (Personal Health Information Protection Act), BORN Ontario is permitted secondary use of data for research with appropriate approvals and agreements. Approval

was obtained from the Children's Hospital of Eastern Ontario's Research Ethics Board in October 2013.

From the BIS, we extracted a matched cohort of similar low-risk midwifery clients with planned hospital births in the same timeframe to act as a control group. This group included women with singleton pregnancies and spontaneous labor. We matched on a 1:4 basis, based on gestational age at birth (within 2 weeks), parity and maternal age (<30, 30-34, 35+), location of residence (postal code forward sortation area), and pregnancy complications (gestational diabetes and hypertension). Further matching on maternal health conditions was not possible because rates were very low because of the low-risk nature of the midwifery clients, as dictated by the midwifery scope of practice. Rates of preexisting maternal health conditions and pregnancy complications were examined for both groups by 2 of the authors (E.G. and E.K.D.) and were determined to be similar and consistent with midwifery care criteria.

The birth center cohort was validated by checking each BIS record with the birth center log. We extracted all data available from the BIS for both cohorts. Three sources of BIS data were used: data entered by the midwife (throughout pregnancy, birth, and the newborn period), data entered by the hospital in cases when a woman was transferred from the birth center, and data entered by the birth center itself. These linked records were then supplemented with record-level linked data from the CIHI Discharge Abstract Database for any additional data elements that were missing in the BIS data. When there were data discrepancies, midwifery-entered data were given precedence over hospital-entered data. If data were missing from midwifery records, we supplemented the records with the data submitted by hospitals. In cases when both data sets were missing, for example a newborn's length of stay in a neonatal intensive care unit (NICU), data was supplemented from the CIHI Discharge Abstract Database.

### Outcomes

Study outcomes measured for the birth centers and the matched cohorts included adherence to guidelines (as a proxy for effectiveness), safety, and equity. The guidelines used as

**Table 1. Data Sources****Better Outcomes Registry & Network (BORN) Information System**

The BORN Information System is a web-based portal that allows collection of detailed information on the health and care of women during pregnancy and birth and their newborns at and after birth. This database has a 100% capture of hospital, home, and birth center births in the province of Ontario. When a woman has care during pregnancy or is admitted to give birth, data are collected from health records, clinical forms, and a patient interview. These data are entered into the database either through a secure website by hospital or midwifery practice group staff or uploaded directly from hospitals that have electronic record capability. Each time point, or encounter, in the BORN system, can be queried separately or combined with other encounters to get the most accurate and complete data for a given pregnancy.

**Canadian Institute of Health Information (CIHI) Discharge Abstracts Database**

The CIHI Discharge Abstract Database contains demographic, clinical (ie, medical diagnoses, interventions, vital disposition at time of discharge), and administrative information resulting from hospitalizations. Diagnoses are coded using the Canadian implementation of the International Classification of Diseases, 10th Revision.

**Statistics Canada census data**

Statistics Canada's PCCF+ is a software package designed to assign postal codes to census dissemination areas using geocoding. Within each dissemination area, a variety of neighborhood-level information from the long form 2006 Canadian Census is available, including highest level of attained education and median household income.

**Birth center records**

Clinical records kept by birth centers on each client cared for in the center, regardless of the eventual place of birth (birth center or hospital). When birth center records were needed to evaluate morbidity or transport issues, blinded charts meeting the review criteria were reviewed onsite with special attention to examination of specific fields in the Ontario Antenatal Record and Birth Center client chart that could be associated with the given outcome.

**Birth center logs**

Data collected specifically by each birth center to address the accessibility and equity indicators set out by the working group.

proxies for effective care were 1) rates of intermittent auscultation in labor, advocated by the Society of Obstetricians and Gynaecologists of Canada (SOGC),<sup>19</sup> 2) rates of achieving a successful latch or having the opportunity to do so within 2 hours of birth (for women who were planning to breastfeed), advocated by the World Health Organization (WHO),<sup>20</sup> and 3) rates of normal birth. The normal birth indicator was based on the combined statement of the SOGC; the Canadian Association of Midwives; and the Association of Women's Health, Obstetric and Neonatal Nurses of Canada following the WHO guidelines.<sup>21,22</sup> We used 3 categories of normal birth. All had to include spontaneous labor and birth, with an opportunity for skin-to-skin contact and/or latch within the first hour of birth. The categories of normal birth included the following: 1) normal birth with absolutely no intervention other than local anesthetic, 2) normal birth with minimal intervention such as artificial rupture of membranes or nitrous oxide for pain relief or local anesthetic, and 3) general normal birth, which included any spontaneous labor resulting in a spontaneous vaginal birth.

For safety outcomes, we selected adherence to birth center admission criteria, transport rates, and outcomes of maternal or newborn morbidity or mortality. We looked at pregnancy complications to assess if admission criteria were met. We compared transport rates to those demonstrated elsewhere in the literature on low-risk out-of-hospital births.

Fetal and maternal clinical events that were markers of severe morbidity were identified based on review of the literature and assessment of what could be measured within the BIS or via data linkage to CIHI.<sup>2,5,7,12,23-30</sup> Specifically for maternal morbidity, we looked for uterine rupture, eclampsia, severe hemorrhage, obstetric shock, obstetric embolism, cerebrovascular event, cardiovascular events, renal failure, fourth-degree lacerations, sepsis, ventilator support, intensive care unit admission, or transfer to hospital for a nonlabor related event. For neonatal morbidity, we looked for cases of Apgar scores of less than 4 at 5 minutes, assisted ventilation for more than 24 hours, intraventricular hemorrhage, meconium aspiration, significant birth trauma, fracture, hemorrhage, sepsis, seizures, chest compressions during resuscitation, unexpected major congenital anomalies, severe growth problems, intrauterine fetal death, and hospital admission or readmission within 4 weeks after discharge from a birth center. In all cases in which a marker of severe morbidity occurred, the clinical record was further evaluated by a member of the working group (D.S.) with experience in full-scope midwifery practice and out-of-hospital births, independent from either center.

To determine if any of the potential safety issues (appropriate admissions, transports, or morbidity or mortality) was associated with the clinical care provided within the birth centers, something related to a center itself, or a systems issue generated by the location, each birth center chart was reviewed

in entirety from admission to discharge. Comparator data on these outcomes from the matched midwifery hospital birth cohort was not obtained, as the main purpose of the evaluation was to establish safety of care provided in the birth centers, not the hospitals.

For equity outcomes, we looked at the proportion of women in both the lowest material and social deprivation quintiles and the proportion with no health insurance and compared these across the groups. Pampalon's deprivation index for Canada<sup>31</sup> was merged into our files using the maternal residential postal code. The deprivation index is based on census-derived socioeconomic data at the neighborhood level. Individuals are assigned a material deprivation quintile and a social deprivation quintile based on the characteristics of the population living in the census dissemination area in which they reside. The index results can point toward disparities in population health status and service use.

### Analysis

Outcomes were analyzed with women grouped according to their planned place of birth at the onset of labor (as opposed to their actual place of birth). All indicators reported from the BIS were calculated as percentages, with the total number of women in the numerator being divided by the total number of women in the denominator, excluding women with missing data for one or more of the data elements used to define the indicator. To assess the associations between the planned birth location (birth center vs hospital) and the outcomes of epidural analgesia, labor augmentation, vacuum or forceps, cesarean birth, and NICU admission, risk ratios were estimated using multivariate log binomial regression models after adjusting for BMI and previous cesarean birth. The analyses were conducted using SAS version 9.4 (SAS Institute, Cary, NC).

### RESULTS

During the evaluation period, 495 women were admitted to a birth center: 175 in Ottawa and 320 in Toronto. These women were compared with a matched cohort of 1980 women in midwifery care who planned on giving birth in a hospital (hereafter referred to as the *matched midwifery hospital birth cohort*). General characteristics of the 2 groups are presented in Table 2.

Intervention rates were significantly higher in the matched midwifery hospital birth cohort: 2 times higher rates of augmentation, 2.5 times higher rates of epidural analgesia, 1.9 times higher rates of assisted birth, and 1.5 times higher rates of cesarean birth (Table 3). When controlled for previous cesarean birth and BMI, the risk ratios were higher for all interventions in women giving birth in hospital, except for NICU admission.

Women admitted to a birth center and not transported during the intrapartum period had an intermittent auscultation rate of 98.4%. In the matched midwifery hospital birth cohort, the rate was 42.4%.

Of women who intended to breastfeed and gave birth at a birth center, 85.1% achieved or had the opportunity for successful latch within 2 hours of birth. The cohort of women

**Table 2. Characteristics and Labor and Birth Experiences of Women Admitted to the Ontario Birth Centers from January 2014 to February 2015**

Characteristics	Birth Center	Matched Midwifery
	Admissions (N = 495) n (%)	Hospital Birth Cohort (N = 1980) n (%)
<b>Age range, y</b>		
<20	10 (2.0)	25 (1.3)
20-24	38 (7.7)	151 (7.6)
25-29	113 (22.8)	468 (23.6)
30-34	209 (42.2)	836 (42.0)
35-39	115 (23.2)	452 (22.8)
≥40	10 (2.0)	48 (2.4)
<b>Parity</b>		
Nulliparous	292 (59.0)	1168 (59.0)
Multiparous	201 (41.0)	812 (41.0)
<b>Previous cesarean birth</b>	8 (1.6)	108 (5.5)
<b>BMI category</b>		
<21	192 (38.8)	533 (26.9)
21-25	217 (43.8)	928 (46.9)
26-30	64 (12.9)	337 (17.0)
31-35	14 (2.8)	110 (5.6)
36-40	4 (0.8)	44 (2.2)
≥41	4 (0.8)	28 (1.4)
<b>Spontaneous labor</b>	486 (98.2)	1973 (99.6)
<b>Women giving birth in the birth center</b>	373 (75.4)	0 (0.0)
<b>Transports to hospital (maternal or neonatal)<sup>a</sup></b>	130 (26.3)	12 (0.6)
Maternal transports, nulliparous	101 (83.5)	4 (50.0)
Maternal transports, multiparous	20 (16.5)	4 (50.0)
Neonatal transports, nulliparous	15 (93.8)	3 (60.0)
Neonatal transports, multiparous	1 (6.2)	2 (40.0)

Abbreviation: BMI, body mass index.

<sup>a</sup>Transport totals for maternal or neonatal indications do not equal the overall transport rate. If the woman-newborn dyad was transported to a hospital, only the individual with the clinical indication was used to calculate the overall transport rate. The 12 transports to a hospital in the matched cohort of hospital admissions were those who used the ambulance service for transport to a hospital, rather than transports from the birth center to a hospital.

admitted to a birth center, regardless of location of the birth, had a slightly lower rate at 83.2%. In the matched midwifery hospital birth cohort, the rate was 80.5%.

Overall rates of normal birth among all 3 categories (previously described), were higher in the birth center than in the matched midwifery hospital birth cohort admissions. In the broadest of normal birth classifications, 91.4% of women who delivered in a birth center experienced a normal birth.

**Table 3. Association between Planned Hospital Admission and Labor Interventions, Birth Type, and NICU Admissions for a Matched Midwifery Hospital Birth Cohort from January 2014 to February 2015**

Labor Interventions and Birth Type	Birth Center Admissions (N = 495), n (%)	Matched Midwifery Cohort of Hospital Admissions (N = 1980), n (%)	Unadjusted Risk Ratio (95% CI)	Adjusted Risk Ratio <sup>a</sup> (95% CI)
Received augmentation <sup>b</sup>	62 (12.5)	485 (24.5)	2.0 (1.5-2.5)	2.0 (1.6-2.5) <sup>c</sup>
Received epidural analgesia	78 (15.8)	787 (39.7)	2.5 (2.0-3.1)	2.5 (2.0-3.1) <sup>c</sup>
<b>Birth type</b>				
Spontaneous vaginal	435 (87.9)	1567 (79.1)	1.0 (Ref)	1.0 (Ref)
Assisted: vacuum or forceps <sup>d</sup>	22 (4.4)	174 (8.8)	2.0 (1.3-3.1)	1.9 (1.3-3.0) <sup>c</sup>
Cesarean <sup>d</sup>	38 (7.7)	239 (12.1)	1.6 (1.1-2.2)	1.5 (1.1-2.1) <sup>c</sup>
<b>NICU admission</b>	27 (5.5)	141 (7.1)	1.3 (0.9-2.0)	1.3 (0.9-2.0)

Abbreviations: BMI, body mass index; NICU, neonatal intensive care unit.

<sup>a</sup>Log binomial regression modelling adjusted for BMI (<30, ≥30), and previous cesarean birth (yes, no).

<sup>b</sup>Pharmacologic augmentation only; includes only cases in which oxytocin or prostaglandin were used. Pharmacological augmentation was only administered in a hospital but may have followed transport from a birth center.

<sup>c</sup>P < .05.

<sup>d</sup>Any assisted vaginal birth or cesarean birth was done in a hospital.

For normal birth with minimal interventions, 89.1% met the criteria, and 60.7% experienced birth with no interventions. For women admitted to a birth center (including those transported), the respective rates were 78.9%, 69.2%, and 47.4%. In the matched midwifery hospital birth cohort, the corresponding rates were 69.2%, 33.4%, and 21%.

### Morbidity and Mortality

There were no cases of maternal mortality and one fetal death. In this case, the woman was transported to hospital immediately upon admission to the birth center when no fetal heart-beat was heard.

About 10% of birth center admissions met predefined criteria for review because markers for potential severe morbidity or mortality were noted (Table 4). After review, 92% of these cases had clear documentation of appropriate risk screening and care aligned with protocols. In 4 cases (8%), there was a discrepancy between the decision to admit and the admission protocols. Chart review could not confirm that admission criteria were met. One case demonstrated limited prenatal care, another lower-than-expected fundal height, the third a high prepregnancy BMI, and the fourth a low hemoglobin. None of these cases resulted in preventable mortality, nor did data in the BIS demonstrate any prolonged impact up to the 6-week point of discharge from midwifery care.

Maternal and/or newborn transport to hospital occurred in 26.3% (130/495) of birth center admissions: 24.4% had a maternal indication, and 3.2% had a neonatal indication (Table 5). The maternal urgent transport rate, defined as any transport for any indication other than pain management and prolonged labor, was 15.6%, representing 63.6% of all maternal transports. Prolonged labor was the most frequent reason for transport, with 8.9% of admissions transported.

Of the women (or their newborns) transported to hospital from a birth center (n = 130), 33.8% were transported by emergency medical services and 83.5% of these were nulliparous. Less than 1% of the matched midwifery hospital birth cohort used emergency medical services, and most were calls for transport to the hospital in labor.

**Table 4. Numbers of Cases Identified for Secondary Review for Maternal and Neonatal Morbidity or Mortality in the Ontario Birth Center Cohort (N = 50)<sup>a</sup>**

Clinical Event	n
<b>Severe maternal morbidity<sup>b</sup></b>	
Potential severe hemorrhage <sup>c</sup>	9
Fourth-degree laceration	1
Potential sepsis <sup>d</sup>	6
<b>Severe neonatal morbidity or mortality<sup>e</sup></b>	
Chest compression during resuscitation	1
Unexpected major congenital anomaly	1
Small for gestational age: ≤3rd percentile	9
Large for gestational age: ≥97th percentile	10
NICU admission >48 h	7
Hospital admission or readmission within 4 wk after discharge from a birth center	8
Intrauterine fetal demise	1

Abbreviation: NICU, neonatal intensive care unit.

<sup>a</sup>Numbers add up to more than 50 as some cases had more than one qualifying event.

<sup>b</sup>For maternal outcomes, there were no cases of uterine rupture, eclampsia, obstetric shock, obstetric embolism, cerebrovascular event, cardiovascular events, renal failure, ventilator support, intensive care unit admission, or transfer to hospital for a nonlabor related event.

<sup>c</sup>In the absence of timely Canadian Institute for Health Information (CIHI) data on severe hemorrhage requiring transfusion or hysterectomy, any documentation of hemorrhage resulting in a transport from the birth center and/or associated with a hospital stay greater than 48 hours was used as a proxy to estimate the potential number of cases of severe hemorrhage or hysterectomy.

<sup>d</sup>In the absence of timely CIHI data on sepsis, any birth center admission with fever or perinatal infection documented were used as a proxy to estimate the potential number of cases of sepsis.

<sup>e</sup>For neonatal outcomes, there were no cases of Apgar scores of less than 4 at 5 minutes, assisted ventilation greater than 24 hours, intraventricular hemorrhage, meconium aspiration, significant birth trauma, fracture, hemorrhage, sepsis, or seizures.

### Equity

The Ottawa and Toronto groups had similar proportions of clients in both the lowest material and social deprivation quintiles: 3.6% in Ottawa and 3.7% in Toronto. For the matched midwifery hospital birth cohort, 3.3% were in this deprivation category.

**Table 5.** Frequency of Reason for Maternal or Newborn Transports among Admissions to Ontario Birth Centers from January 2014 to February 2015

Transport Indications	Transports by Parity, n (%)			Total Birth Center Clients (N = 495), n (%)
	Total Transports	Nulliparous	Parous	
<b>Maternal (n = 121)</b>				
Fetal well-being concerns	20 (16.5)	18 (90)	2 (10)	20 (4.0)
Pain management	13 (10.7)	11 (85)	2 (15)	13 (2.6)
Prolonged labor	44 (36.4)	41 (93)	3 (7)	44 (8.9)
Other maternal conditions or complications <sup>a</sup>	20 (16.5)	15 (80)	5 (20)	20 (4.0)
Other fetal conditions or complications <sup>b</sup>	10 (8.3)	8 (80)	2 (10)	10 (2.0)
Neonatal conditions or complications <sup>c</sup>	2 (1.7)	2 (100)	0 (0)	2 (0.4)
Postpartum hemorrhage	12 (9.9)	7 (58)	5 (42)	12 (2.4)
<b>Newborn (n = 16)</b>				
Respiratory distress	7 (43.8)	7 (100)	0 (0)	7 (1.4)
Maternal clinical indications	3 (18.8)	3 (100)	0 (0)	3 (0.6)
Other neonatal clinical indications <sup>d</sup>	6 (37.5)	5 (83)	1 (17)	6 (1.2)

<sup>a</sup>Other maternal includes any other reason for unplanned maternal transport such as hypertension, fever, antepartum hemorrhage, etc.

<sup>b</sup>Other fetal conditions or complications might include meconium or malpresentation.

<sup>c</sup>Maternal transport to accompany the newborn who required enhanced care.

<sup>d</sup>Other neonatal clinical indications might include low glucose, small for gestational age, or unexpected anomaly.

Midwifery care in Ontario is provided regardless of provincial health insurance coverage. In the birth center cohort, 17% of admissions were without coverage. Among the matched midwifery hospital birth cohort, the rate of noninsurance was 3.2%. For context, in the first year of midwifery data collection in the BIS (fiscal 2012–2013), 6% of midwifery clients overall were without coverage.

## DISCUSSION

Our evaluation validates that women with low-risk pregnancies seeking a low-intervention approach for labor and birth receive good quality care (as evidenced by adherence to national guidelines) and safe care (as evidenced by low rates of morbidity and mortality) in the Ontario birth centers. Rates of intervention for these midwifery clients were lower among birth center admissions than those with planned hospital births. Although selection bias may contribute to this finding (highly motivated, low-risk women choosing a birth center experience), similar rates are reported elsewhere. Outcomes from the American National Birth Center Study demonstrate a 93% spontaneous vaginal birth rate, a 1% assisted vaginal birth rate, and a 6% cesarean birth rate among a much larger cohort of 15,574 women.<sup>5</sup> The 2010 Cochrane review on alternative institutional settings for low-risk birth also demonstrated an increased likelihood of spontaneous vaginal birth with decreased use of analgesia, anesthesia, and oxytocin augmentation.<sup>8</sup>

Care in the Ontario birth centers during the first year met recommendations associated with provincial and national guidelines and national standards related to fetal surveillance, normal birth, and breastfeeding.<sup>19,21</sup> Use of intermittent auscultation for fetal surveillance was over 98%. Although the SOGC fetal surveillance guideline<sup>19</sup> does not specify a target, it does state that intermittent auscultation is the preferred method of fetal surveillance for healthy women at term in

spontaneous labor. With almost every woman laboring and delivering in the birth centers having auscultation, this guideline was certainly met. For context, in the Canadian survey of women about their maternity care experiences,<sup>32</sup> only a small proportion of women (6.5%) experienced exclusive auscultation during labor by stethoscope, Doppler, or fetoscope (ie, continuous electronic fetal monitoring was not used during labor).

Women intending to breastfeed were provided with the opportunity to initiate this shortly after birth, whether in a birth center (85% initiated) or after transport to a hospital (83% initiated). The WHO/United Nations International Children's Emergency Fund Baby Friendly Hospital Initiative<sup>20</sup> recommend that an attempt to breastfeed happen within 30 minutes of birth, and this was documented through picklist options available within the BIS. This rate is likely underreported because of the design of the early attachment and feeding data element in the BIS, which requires an extra step of clicking to view all picklist options. Statistics Canada reported in 2011 and 2012 that 89% of Canadian women initiated breastfeeding soon after their child's birth,<sup>33</sup> and we would expect initiation to be higher in this motivated, low-risk population. Thus, a concern about underreporting is warranted.

Similarly, rates of normal birth, although without pre-established targets, were also high, but not as high as the midwifery members of our team expected; they believed almost all women would fit into these categories. Again, this may relate to the same breastfeeding data entry issue described above that affects normal birth rates. To further evaluate this potential data entry discrepancy, a subsequent analysis included the options of "opportunity to latch in first hour" and "latch attempted in second hour." This analysis produced higher rates at 83.3% for those admitted to and 85.1% for those giving birth in a birth center. The matched midwifery hospital birth cohort also improved, with a latch achieved rate of 62.3%

using the initial criteria and 81.6% once adjusted to include more picklist options. Further work is required. It is important to note that overall prevalence of intervention was higher in the hospital cohort (augmentation, epidural analgesia, assisted vaginal, and cesarean birth), which supports international literature on lower intervention rates in out-of-hospital births.<sup>7,10,13</sup>

We are unsure why similar low-risk women have higher rates of intervention when choosing to give birth in a hospital. Registered midwives in Ontario are mandated to provide choice of birthplace; therefore, health care providers in both cohorts likely held similar care philosophies. However, even among low-risk women, there would be self-selection and gradation of risk. Women may be planning for a no- or low-intervention experience but want the back-up of epidural analgesia offered in hospitals. And it is possible that hospital policies may inadvertently drive other interventions, especially around the use of electronic fetal monitoring or time limits for certain phases of labor.

Transport rates for the birth center cohort were similar to those in some of the literature but higher than in other studies. Hutton et al's much larger study of 11,493 planned home births in Ontario had a 24.4% rate of hospital transport, which was significantly lower in multiparous women (14.3%) than in nulliparous women (45.6%).<sup>13</sup> Ontario birth center overall transport rates were higher than Hutton et al's study but were lower for nulliparous women. In US birth centers, there was a lower transport rate at about half our rate (12% after birth center admission), again with a much higher sample size (15,574).<sup>5</sup> Similar to Stapleton et al's study,<sup>5</sup> the largest proportion of our transports was for prolonged labor. We found a low neonatal transport rate, as in the larger studies, demonstrating appropriate care and risk assessment in labor. It is possible that the small sample size during this early phase, a higher rate of nulliparous admissions (59.9% in the birth center evaluation compared with 47.2% in the Stapleton et al study), and a very cautious approach in a new clinical setting might have contributed to higher transport rates.

Rates of morbidity were low among the birth center cohort. Perinatal asphyxia has an incidence of 1 to 6 per 1000 live full-term births.<sup>34</sup> Stapleton et al demonstrated an intrapartum fetal mortality rate of 0.47 per 1000 among birth center admissions and a neonatal mortality rate of 0.40 per 1000, excluding anomalies.<sup>5</sup> Hutton et al<sup>13</sup> found no difference in the composite outcome of stillbirth, neonatal death, or morbidity with an absolute risk of 0.39% in both the home and hospital groups studied. It is therefore not surprising that in this small cohort that we report on there were minimal cases of serious fetal or newborn morbidity. The positive findings from this preliminary evaluation may serve to reassure women about the safety of a birth center experience.

The discrepancy between numbers of clients with no provincial insurance coverage delivering at the birth center versus hospital (17% vs 3%) likely relates to costs. Women who had not yet met the residency requirements to start the provincial health insurance plan would receive a bill for hospital services, whereas midwifery care and birth center services were provided regardless of provincial insurance coverage.

## Strengths and Limitations

Full data capture on all births in the birth centers and access to the provincial birth registry for full outcomes for the matched control group were strengths of this study. However, because the rates of adverse perinatal events are low in this predominantly healthy population, our ability to fully measure safety was somewhat limited. We were unable to obtain CIHI data on transfusion, hysterectomy, and sepsis within the timelines of the evaluation. Consequently, we had to use proxy measures to identify potential cases of sepsis and severe hemorrhage for review of maternal morbidity cases. This resulted in a lower threshold for severe maternal morbidity than originally planned. Although the BIS was enhanced prior to care commencing at the birth centers to capture information necessary for the evaluation, as with any new system, the phase-in approach and evaluating data collection and quality requires time.

## CONCLUSION

Findings from this evaluation of the first year of care in birth centers in Ontario are consistent with evidence about midwifery in general and out-of-hospital births both specifically in Ontario, Canada, and internationally. For women who were admitted and gave birth in these centers, care related to normal birth, breastfeeding, and intermittent auscultation were consistent with guidelines, and morbidity and mortality rates and intervention rates were low. Transfer rates were similar to home birth transfers in another Ontario study. As the number of women having a birth center experience continues to grow, further data will accumulate to add to the literature on the safety and quality of birth care offered out of hospital.

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## CONFLICT OF INTEREST

The authors have no conflicts of interest to disclose.

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