Guideline for discussing choice of birthplace with clients: Methodology and review of evidence

Introduction

Background

In Canada in the early 1900s, nearly all births took place at home. By the 1950s, however, birth had moved swiftly to the hospital and it became the standard of care without being rigorously studied. (1) Despite the many challenges of conducting research on out-of-hospital birth, there is a growing body of robust evidence examining midwifery-led births and the safety of home and birth centre births within and applicable to the context of the Canadian health-care system. (2–14)

As midwives attend a growing proportion of births in Ontario, the need to support both midwives and midwifery consumers in their decision-making process around choice of birthplace grows as well. Recent U.K. updates to the National Institute of Health and Care Excellence (NICE) *Intrapartum Care Guideline* emphasize that "giving birth outside an obstetric unit is the optimal choice for low-risk women."(15) While these U.K.-based recommendations are informative and may provoke interesting discussion in Canada, they underline the need for analysis and guidance based on Canadian research.

Purpose

An Expert Advisory Panel on Choice of Birthplace (the panel) was convened by the Association of Ontario Midwives (AOM) to review current literature on outcomes related to planned place of birth, with a particular emphasis on research conducted within the Canadian context. Evidence on clinical outcomes was reviewed to inform the panel's work; however, the information in the *Guideline for discussing choice of birthplace with clients* is not intended to dictate a course of action in clinical situations. (16) Instead, it is intended to provide guidance for midwives to discuss best available evidence related to choice of birthplace with midwifery clients and their families.

Methodology

The methods employed to develop the guideline, including the review and appraisal of evidence were based on a modified version of the GRADE approach. (17–19)

In the context of research on place of birth, there is a good case to be made that observational studies are the most appropriate study design because outcomes identified as critical to client decision-making are adverse effects. According to a methods guide by Agency for Healthcare Research and Quality (AHRQ) on including non-randomized studies in reviews: "there is widespread agreement that observational studies, particularly those derived from large clinical and administrative databases, should be used routinely to identify and quantify potential adverse events." (20) When studying safety by assessing very rare events (such as mortality and severe morbidity), very large sample sizes are required and easier to obtain through surveillance or other large databases (i.e. observational data).

The GRADE approach was modified to better suit this review. While GRADE's approach to rating the quality of evidence is not as *exclusively* dependent on study design as other approaches, it still poses challenges for research contexts where the best available evidence is provided by observational studies only.

The panel decided to use the strength of the GRADE approach to provide a reproducible, systematic process for developing a guideline, which included defining an explicit question, identifying important outcomes, reviewing, synthesizing, and critically appraising evidence. The GRADE approach's quality assessment process was modified in order to acknowledge that observational studies comprised the best available evidence and that evidence from randomized controlled trials is unlikely to become available or to provide appropriate evidence to assess safety.

Research questions

1. What health outcomes and interventions are associated with **home births** intended at onset of labour compared with **hospital births** intended at onset of labour among those at low risk of complications (as defined by study authors)?
2. What health outcomes and interventions are associated with **birth centre births** intended at onset of labour compared with **hospital births** intended at onset of labour among those at low risk of complications (as defined by study authors)?

Outcomes

Outcomes of interest were selected and ranked according to their clinical significance and importance for birthing parents and their families. The following outcomes were selected by the panel prior to the literature search and data collection:

Critical

- Intrapartum stillbirth and neonatal mortality
- Maternal mortality
- Neonatal encephalopathy
- Meconium aspiration syndrome
- Maternal ICU admission
- Transport to hospital
- Transfer of care

Important

- Hospital admission and readmission
- Neonatal intensive care unit admission
- Postpartum hemorrhage (blood loss > 1000 mL)
- Perineal trauma (3rd-4th degree tears)
- Neonatal sepsis
- Maternal infection
- Episiotomy
- Mode of birth
- Pain relief
- Augmentation of labour
- Experience/satisfaction

During the guideline development process, the panel decided to consider 2 additional outcomes: 1) neonatal resuscitation with positive pressure ventilation and chest compressions and 2) Apgar scores.

Eligibility criteria for study inclusion

Criteria for study inclusion and exclusion were established prior to conducting the literature search. Important methodological considerations for research on place of birth informed some of these criteria. (2,3) Studies were selected for inclusion if: midwifery services were offered in a well-integrated health-care system; the intended place of birth at start of labour was known; and there was a planned hospital birth group for comparison with the planned home birth group or planned birth centre birth group (prospective or retrospective observational studies). Articles must also have been published between 1990 and 2015 and include study participants who were considered to be at low risk of complications. "Low risk" was not defined prior to the search to allow for inclusion based on the definition used by study authors.

Studies were excluded if they were conducted in lower-resource settings not comparable to Canadian standards, if the results were unpublished, only available in abstract form, as conference proceedings or in languages other than English or French.

Search strategy and information sources
Literature searches were completed in August 2015 in the following databases: PubMed, EMBASE and CINAHL Plus. The search strategy was adapted from other birth setting reviews and employed key terms to search for home, birth centre and hospital birth. Panel members were also consulted for additional references. (21-23) The search strategy for all review questions, including search terms and limits for each database, is available in Appendix A (see Table 3 for home birth and Table 4 for birth centre birth).

Study selection
Literature searches identified a total of 1288 references, of which 271 were duplicates. The remaining 1017 studies were imported into Microsoft Excel for screening according to the review's eligibility criteria. We excluded 964 references leaving 53 references for full-text review. Articles included in the full text review were imported, stored, and reviewed for selection using Mendeley version 1.15. (24) Of these 53 articles, 12 were selected: 5 pertained to home birth and 7 pertained to birth centre. An additional study was identified by panel members near the end of the selection process. It was added to the included studies on home birth. Flow diagrams of the study selection process are available in Appendix B (see Figure 1 for home birth and 2 for birth centre birth). (25)

Data collection
Data on characteristics of included studies and outcomes, as well as risk of bias assessments, were entered directly in Review Manager software, version 5.3. (26) For the purpose of this review, outcomes were based on intended – not actual – place of birth at the beginning of labour. Analyzing outcomes based on the intended birth place at the beginning of labour instead of the actual place of birth is consistent with "intention-to-treat" analysis, which is commonly used in randomized controlled trials. Intention to treat is an important methodological consideration for birthplace research to ensure that outcomes are classified correctly (e.g., if a client has planned a home birth and is then transported to a hospital, any negative outcome would be recorded as an outcome of a planned home birth).

Summary measures
Estimates of effect for all outcomes are presented using relative risks and 95% confidence intervals. In certain cases, odds ratios and adjusted odds ratios have been included for comparison if they were reported by original study authors.

Synthesis of results
When appropriate, results from multiple studies were meta-analyzed using Review Manager software, version 5.3. (26) Forest plots of pooled results are provided in Appendix C for evidence related to home birth and Appendix D for birth centre birth; both were compared to hospital birth attended by midwives. Research on pregnancy and birth, including the birthplace research summarized below, suggests that obstetric interventions and adverse health outcomes occur more frequently in first-time births. Therefore, researchers sometimes analyze and report results for first births (nulliparous) separately from second or later births (multiparous). Evidence was summarized by parity when relevant and available.

Critical appraisal and quality of evidence
The critical appraisal of evidence was based on the GRADE approach and completed using GRADEpro GDT software. (18,27) Because the review included only observational studies, the GRADE approach was modified to more accurately assess the quality of the evidence from non-randomized studies using the following criteria across studies for each outcome: risk of bias (also known as study limitations), inconsistency, indirectness, imprecision, and publication bias. Finally, other factors, such as a strong association, were considered for the possibility of upgrading the quality of the evidence.

Strength of recommendation was not considered to be applicable to a resource that provides guidance on discussing best available evidence on outcomes related to planned place of birth rather than offering a suggested course of action in a clinical situation.

REVIEW OF EVIDENCE

Research question 1: home compared with hospital birth intended at onset of labour

What health outcomes and interventions are associated with home births intended at onset of labour compared with hospital births intended at onset of labour among those at low risk of complications?

Search results and description of included studies

Six studies that met previously specified criteria were identified (a new publication was identified after the original search was conducted and was included in the review). These studies were conducted in Ontario by Hutton and colleagues (4,5) and Murray-Davis and colleagues, (28) as well as in British Columbia by Janssen and colleagues using data from 1998 to 2012. (6,7,29) Four observational cohort studies contributed to the quantitative meta-analysis of clinical outcomes. (4–7) The other 2 survey studies contributed qualitative research results, notably on birthplace decision-making and satisfaction with the birth experience, that have informed other knowledge translation activities and resources related to choice of birthplace. (28,29)

The four cohort studies included records for a total of 45 454 midwifery clients. These studies included all provincial perinatal database records for which "home" was indicated as the planned place of birth at the beginning of labour. (4–7) Records selected for inclusion in the hospital birth comparison group were from midwifery clients who intended to give birth in hospital at the beginning of labour and had no clinical conditions or received interventions for which home birth would have been contraindicated or unlikely (i.e., met local eligibility criteria for home birth). In 2 studies, the intended hospital birth group was also matched to the intended home birth group based on parity and previous caesarean section (CS). (4,5)

Summary of evidence

The summary of evidence below presents pooled results from the four cohort studies described above, as well as some results from the individual studies when appropriate. (4–7) The following outcomes the panel considered critical or important to decision-making were not reported in included studies: neonatal encephalopathy, maternal ICU admission, and neonatal sepsis.

Imprecise results for rare outcomes

Individual studies included in the review were not powered to detect differences in very rare outcomes such as mortality and serious morbidity. Despite a large number of study participants included in the studies pooled in this review, the total number of events for rare outcomes was still very low. A small number of events may limit the precision of evidence: a rule of thumb proposed for obtaining precise results is at least 300 events. (30) Thus, future observational studies will likely improve precision and quality of evidence for rare outcomes. (22,23)

An example of improving precision with a larger number of events is provided by a Dutch study of 466 112 intended home births compared with 276 958 intended hospital births. There were 353 perinatal and neonatal deaths among nulliparous study participants: rates were 1.02 per 1000 among planned home births and 1.09 per 1000 among planned hospital births (aOR 0.99, 95% CI 0.79-1.24). Despite 239 perinatal and neonatal deaths among multiparous study participants, the results weren't as precise as the results from the previously mentioned comparison as shown by the slightly wider confidence interval. Rates among multiparous study participants were 0.59 per 1000 among planned home births and 0.58 per 1000 among planned hospital births (aOR 1.16, 95% CI 0.87-1.55). (13)

Maternal mortality

Among the four included studies, there were no maternal deaths.

Perinatal and neonatal mortality

There were 45 intrapartum stillbirths and neonatal deaths in the first 28 days of life (excluding babies born with major congenital anomalies), an overall rate of 1.0 per 1000. (4–7) No studies found evidence of a difference in the likelihood of intrapartum stillbirth and neonatal death when comparing planned home births with planned hospital births. When data on from all four studies were pooled, the rates were 1.1 per 1000 for planned home births and 0.9 per 1000 for planned hospital births (RR 1.26, 95% CI 0.70-2.28, p = .45). (4–7) Similarly, pooled results from the 2 studies that reported additional analyses by parity found no evidence of a difference whether it was a first or subsequent birth. The intrapartum stillbirth and neonatal death rates for nulliparous clients in the studies were 1.9 per 1000 for planned home births and 1.9 per 1000 for planned hospital births (RR 0.99, 95% CI 0.45-2.21, p = .99). Rates for multiparous clients were 0.8 per 1000 for planned home births and 0.4 per 1000 for planned hospital births (RR 1.80, 95% CI 0.60-5.37, p = .29). (4,5)

Intrapartum stillbirth was compared as a separate outcome. Overall, rates of intrapartum stillbirth were 0.5 per 1000 for planned home births compared with 0.3 per 1000 for planned hospital births (RR 1.48, 95% CI 0.54-4.02, p = .44). (4–6) Only one study provided results based on parity, indicating rates of 0.8 per 1000 for planned home births and 0.3 per 1000 for planned hospital births among nulliparous clients (RR 3.00, 95% CI 0.31-28.83, p = .34) and 0.1 per 1000 for births planned at home and hospital among multiparous clients (RR 1.00, CI 95% 0.06-15.98, p = 1.00). (5)

Neonatal death in the first 7 days of life was also examined, though it was reported by only one study. Overall, neonatal death did not differ based on planned place of birth; rates were 0.4 per 1000 for planned home births and 0.6 per 1000 for planned hospital births (RR 0.71, 95% CI 0.23-2.25, p = .57). Among nulliparous clients, rates of neonatal death in the first 7 days of life were 1.0 per 1000 for planned home births and 1.2 per 1000 for planned hospital births (RR 0.80, 95% CI 0.21-2.98, p = .74); whereas for multiparous clients, rates were 0.1 per 1000 for planned home births and 0.3 per 1000 for planned hospital births (RR 0.50, 95% CI 0.05-5.51, p = .57). (5)

Neonatal interventions and health outcomes

Resuscitation with positive pressure ventilation and chest compressions

The 2 studies using Ontario data reported neonatal resuscitation with positive pressure ventilation (PPV) and chest compressions and found no evidence of a difference between planned home births, 2.7 per 1000, and planned hospital births, 2.8 per 1000 (RR 0.98, 95% CI 0.66-1.45, p = .92). (4,5) One of the 2 studies also provided results by parity: 5 per 1000 newborns of nulliparous clients who planned to give birth at home needed resuscitation with PPV and chest compressions compared to 4.5 per 1000 in the planned hospital birth group (RR 1.11, 95% CI 0.59-2.10, p = .75). Rates among multiparous clients were 1.1 per 1000 in the planned home birth group and 1.2 per 1000 in the planned hospital birth group (RR 0.89, 95% CI 0.34-2.30, p = .81). (5)

Neonatal intensive care unit

Admission to the neonatal intensive care unit (NICU) was reported by one study; 15 per 1000 planned home births and 17 per 1000 planned hospital births resulted in newborns with a NICU stay of more than 4 days (RR 0.89, 95% CI 0.68-1.16, p = .37). (4) Another study found that newborn admission to hospital after birth was more likely in the planned home birth group (29 per 1000) than newborn *re*admission after birth in the planned hospital birth group (12 per 1000) (RR 1.39, 95% CI 1.04-1.85, p = .02). The study authors, Janssen and colleagues, explain that the most common "reason for readmission of neonates to hospital in North America is hyperbilirubinemia", which may explain the increased likelihood observed for infants born at home given those born in the hospital would perhaps have a longer stay instead of a *readmission*. (7) There was no data on hyperbilirubinemia (neonatal jaundice) in any of the studies.

Apgar scores

Results for Apgar scores were not pooled because 2 studies excluded infants born with serious congenital anomalies, (6,7) while the 2 others did not. (4,5) The rates of Apgar score below 7 at 5 minutes varied from 7 to 9 per 1000 for planned home births and 9.0 to 12.0 per 1000 for planned hospital births. (4–7) One of the studies provided results by parity. Among nulliparous clients, there was no evidence of a difference in rates of Apgar score below 7 at 5 minutes between planned home births, 14.7 per 1000, and planned hospital births, 13.5 per 1000 (RR 1.09, 95% CI 0.76-1.58, p = .64); however, newborns of multiparous clients who planned to give birth at home were less likely to have an Apgar score below 7 at 5 minutes than those in the planned hospital birth group, 3.7 per 1000 and 7.4 per 1000 respectively (RR 0.49, 95% CI 0.31-0.78, p = .002). (5)

Meconium aspiration syndrome

Two studies reported meconium aspiration syndrome and found that the rate was lower for births planned at home, 2.9 per 1000, compared with births planned in the hospital, 6.6 per 1000 (RR 0.47, 95% CI 0.23-0.93, p = .03). (6,7)

Composite measure of neonatal mortality and morbidity

Because serious adverse neonatal health outcomes are very rare, researchers sometimes combine a number of outcomes together and report a *composite measure of neonatal mortality and morbidity*. The primary outcome in 2 of the studies included in the review was a composite measure of neonatal mortality and morbidity. (4,5) Results were not pooled because the composite measures were different.

In one study, the composite was defined as: "death (stillbirth or neonatal death 0–27 days, excluding lethal anomalies and fetal demise before the onset of labor); Apgar score of less than 4 at 5 minutes of age; neonatal resuscitation requiring both positive pressure ventilations and cardiac compressions; admission to a neonatal or pediatric intensive care unit with a length of stay greater than 4 days; or birthweight less than 2,500 g." (4) No evidence was found of a difference in likelihood of severe adverse neonatal outcomes for planned home births compared with planned hospital births overall (24 per 1000 v. 28 per 1000; RR 0.84, 95% CI 0.68-1.03, p = .09); for nulliparous clients (35 per 1000 v. 37 per 1000; RR 0.94, 95% CI 0.70-1.27, p = .70); or for multiparous clients (18 per 1000 v. 24 per 1000; RR 0.75, 95% CI 0.56-1.00, p = .05). (4)

In the other study with a composite measure as primary outcome, it was defined as: stillbirth (fetal death after the onset of labour); neonatal death within 28 days of birth; Apgar score below 4 at 5 minutes; and infant resuscitation requiring positive pressure ventilation (PPV) and cardiac compressions. (5) No evidence was found of a difference in likelihood of severe adverse neonatal outcomes for planned home births compared with planned hospital births overall (3.91 per 1000 v. 3.83 per 1000; RR 1.02, 95% CI 0.68-1.55, p = .92); for nulliparous clients (7.45 per 1000 v. 7.20 per 1000; RR 1.03, 95% CI 0.62-1.72, p = .90); or for multiparous clients (2.01 per 1000 v. 2.01 per 1000; RR 1.00, 95% CI 0.49-2.04, p = 1.00). (5)

Mode of birth

Overall, rates of spontaneous vaginal birth were very high in both groups: 91% for planned home births and 85.9% for planned hospital births (RR 1.06, 95% CI 1.05-1.07, p < .00001). Though rates were low in both groups, 3.1% for planned home births and 5.5% for planned hospital births, those who planned to give birth at home were less likely to have an assisted vaginal birth with forceps or vacuum (RR 0.56, 95% CI 0.52-0.62, p < .00001). (4–7) The rates were higher among nulliparous study participants, 7.6% for planned home births and 10.6% for planned hospital births (RR 0.71, 95% CI 0.64-0.80, p < .00001) and much lower among multiparous participants, 0.7% for planned home births and 1.8% for planned hospital births (RR 0.40, 95% CI 0.31-0.52, p < .00001). (4,5)

CS rates were also low among study participants, 5.8% for planned home births and 8.6% for planned hospital births (RR 0.69, 95% CI 0.65-0.74, p < .00001). Rates for nulliparous clients were 12.7% for planned home births and 16.3% for planned hospital births (RR 0.79, 95% CI 0.74-0.86, p < .00001).

Rates of CS were much lower among multiparous study participants, 1.9% for planned home births and 3.7% for planned hospital births (RR 0.52, 95% CI 0.45-0.60, p < .00001). (4–7) Results for multiparous clients in the study by Janssen and colleagues were inconsistent with the 2 other studies (its confidence interval did not overlap with the other studies). (7) Unlike the 2 other included studies, (4,5) the planned home birth and planned hospital birth comparison groups were not matched based on previous CS: 88 multiparous clients with a previous CS were included in the planned home birth group, whereas multiparous clients with previous CS were excluded from the planned hospital birth group. (7) Fewer CS occurred in the hospital birth group, which might be explained in part by the differences between the 2 groups. However, this study contributed only 7.1% to the pooled results that show clients planning to give birth at home were less likely to have a CS than clients planning to give birth in the hospital. (4–7)

Obstetric interventions and health outcomes

Rates of obstetric interventions and adverse health outcomes were consistently low among all midwifery clients in the included studies, whether they planned to give birth at home or in a hospital. Those who planned to give birth at home compared with those who planned to give birth at a hospital were less likely to experience certain interventions and adverse health outcomes. Some of these differences may be attributable to the availability of interventions, variation in practice, differences in client preferences in different places of birth or to other factors that may be difficult to measure.

Episiotomy

Rates of episiotomy were 4.1% for all planned home births and 6.1% of all planned hospital births, from pooled results of 3 studies (RR 0.68, 95% CI 0.62-0.74, p < .00001). (4–6) For nulliparous clients, the rates of episiotomy were 9.5% for planned home births and 12.4% for planned hospital births (RR 0.77, 95% CI 0.69-0.85, p < .00001); for multiparous clients, the rates were 1.2% for planned home births and 2.4% for planned hospital births (RR 0.52, 95% CI 0.43-0.63, p < .00001). (4,5) One of the studies assessed episiotomy among vaginal births only: rates were 3.1% for planned home births and 6.8% for planned hospital births (RR 0.46, 95% CI 0.36-0.58, p < .00001). (7)

Augmentation of labour with oxytocin

Augmentation of labour with oxytocin occurred in 6.4% of planned home births compared with 19.1% of planned hospital births (RR 0.61, 95% CI 0.58-0.65, p < .00001). (4,5,7) Results by parity were obtained directly from study authors. For nulliparous clients, the rates of augmentation of labour with oxytocin were 20.3% for planned home births and 26.9% for planned hospital births (RR 0.76, 95% CI 0.70-0.82, p < .00001) and for multiparous clients, the rates were 2.5% and 6.3% (RR 0.39, 95% CI 0.33-0.46, p < .00001). (5)

Pharmacologic pain relief

Use of pharmacologic pain relief was strongly associated with planned place of birth. Rates for planned home birth and planned hospital births respectively were: any pharmacologic pain relief, 16.4% and 43.2% (RR 0.38, 95% CI 0.37-0.39, p < .00001); (4,5) narcotic pain relief, 2.0% and 8.0% (RR 0.28, 95% CI 0.25-0.31, p < .00001); (4–7) epidural, 9.9% and 21.5% (RR 0.45, 95% CI 0.43-0.47, p < .00001); (4–7) and nitrous oxide, 4.2% and 20.5% (RR 0.22, 95% CI 0.20-0.23, p < .00001). (4,5,7) Rates of use of different pain relief options by parity were obtained from study authors and are presented in Table 1 and Table 2 of the *Guideline*; however, relative risks were not calculated for each option. (5) For nulliparous clients, the rates of use of any pharmacologic pain relief were 34.3% for planned home births and 60.8% for planned hospital births (RR 0.56, 95% CI 0.54-0.59, p < .00001) and for multiparous clients, the rates were 6.9% for planned home births and 33.8% for planned hospital births (RR 0.20, 95% CI 0.19-0.22, p < .00001). (4,5)

Perineal trauma

Perineal trauma (defined as 3rd and 4th degree tears in all included studies) occurred in 1.4% of planned home births compared with 2.4% of planned hospital births (RR 0.58, 95% CI 0.49-0.65, p < .00001). (4–7) One study reported this outcome by parity. Rates of perineal trauma were lower for nulliparous clients who planned to give birth at home, 3.1%, compared to those who planned to give birth in hospital, 4.7%, (RR 0.67, 95% CI 0.53-0.83, p-value not available). Similarly, multiparous clients who planned a home birth were less likely to have perineal trauma, 0.3%, than those who planned a hospital birth, 1.0% (RR 0.33, 95% CI 0.21-0.51, p-value not available). (5)

Postpartum hemorrhage

Postpartum blood loss was measured slightly differently in all four studies; therefore, results were not pooled. Despite different definitions across studies, rates of postpartum hemorrhage (PPH) were consistently lower in the planned home birth group compared with the planned hospital birth group.

One study also reported PPH by parity. (5) Rates for nulliparous clients were 3.2% for planned home births and 3.6% for planned hospital births (RR 0.89, 95% CI 0.71-1.12, p-value unavailable). Rates for multiparous clients were 2.1% for planned home births and 2.7% for planned hospital births (RR 0.77, 95% CI 0.63-0.95, p-value unavailable). (5)

Table 1: Postpartum hemorrhage for planned home births compared to planned hospital births

Postpartum hemorrhage definition (reference)		Home (%)	Hospital (%)	Relative risk, confidence interval, p-value
PPH with estimated blood loss > 1000 mL	(4)	0.8	1.2	RR 0.68, 95% CI 0.49-0.96, p = .03
PPH documented in database entry	(5)	2.5	3.0	RR 0.82, 95% CI 0.70-0.96, p = .01
PPH documented in chart	(6)	4.4	5.3	RR 0.84, 95% CI 0.53-1.34, p = .46
PPH not defined by authors	(7)	3.8	6.0	RR 0.63, 95% CI 0.51-0.78, p < .0001

Infection and fever

Rates of infection were 0.7% for planned home births and 3.5% for planned hospital births (RR 0.20, 95% CI 0.08-0.49, p = .0005). (6) Rates of fever were 0.7% for planned home births and 1.4% for planned hospital births (RR 0.46, 95% CI 0.28-0.76, p = .003). (7) Results for these outcomes were not available by parity.

Transport to hospital and transfer of care

Among planned home births, the actual place of birth was home for about 75% to 80% overall, 55% to 60% for nulliparous clients and 85% to nearly 90% for multiparous clients. (4–6) Rates of ambulance transport to hospital from home during or immediately following birth varied from 3.6% in one study (6) to 5.4% in another, (4) and were 8.2% for nulliparous clients and 3.9% for multiparous clients. (4) Rates of emergency service calls were comparable to rates of transport for nulliparous clients (8.5%) but higher for multiparous clients (7.9%). (5) Transport may or may not have occurred when paramedic services were called to the home during or immediately after birth. For instance, paramedic services may be called in cases of a client's precipitous birth before the midwives arrive at the intended birth setting.

One study reported intrapartum transfer of care from midwife to physician in 12.5% of planned home births and 19.0% of planned hospital births (RR 0.66, 95% CI 0.61-0.71, p-value unavailable). The authors of this study explain that the rate of intrapartum transfer of care may be higher for planned hospital births due to institutional protocols and standards that may restrict midwives from providing care to their full scope of practice. Rates were much higher for nulliparous clients, 27.8% for planned home births and 34.7% for planned hospital births, than for multiparous clients, 4.5% for planned home births and 10.7% for planned hospital births. In both groups, less than 3% had a postpartum transfer of care to a physician, regardless of parity. (4)

Research question 2: Birth centre compared with hospital birth intended at onset of labour

What health outcomes and interventions are associated with birth centre births intended at onset of labour compared with hospital births intended at onset of labour among those at low risk of complications?

Search results and description of included studies

Given their recent introduction into the Canadian health-care system outside of Quebec, there were no published Canadian studies comparing midwifery clients at low risk of complications planning to give birth in birth centres to midwifery clients planning to give birth in hospitals. A study was conducted to evaluate midwifery services in the Quebec birth centre pilot projects; however, the comparison group was composed of hospital births attended by physicians, not midwives. (31)

Although studies were not yet published at the time this guideline was written, some evidence on outcomes is available about birth centres in Ontario. Better Outcomes Registry Network (BORN) Ontario completed an evaluation of Ontario's birth centre demonstration project, which includes an analysis of outcomes from the Toronto Birth Centre and the Ottawa Birth and Wellness Centre. These results are not formally included in the outcome tables below, as the numbers are still small; however, outcomes reported in the evaluation are consistent with published research on planned home births attended by midwives in Ontario. (32,33) Because the equipment, services, health-care providers and pain relief options available to clients at home births and in birth centres in Ontario are comparable, midwives can refer to Canadian evidence on planned home birth when discussing outcomes associated with planning a birth centre birth in addition to data from Ontario birth centres and comparable international research presented below.

In the absence of published Canadian research, the review of birth centres was expanded to include international research from jurisdictions where midwifery and free-standing birth centres are well-integrated into the health-care system. Research from other settings, such as the United States, did not meet study inclusion criteria mainly because they lack comparison groups. Studies with large numbers of participants have demonstrated the safety of birth centres and their association with low rates of obstetric interventions within the U.S. health system. (34–39) Because of differences regarding the integration of midwifery, however, birthplace research conducted in the U.S. may not be generalizable to the Canadian health-care system.

Five studies that met inclusion criteria were identified (one study was published in 2 different articles). These studies were conducted in England, (8,40) New Zealand, (9,10) Australia (41) and Japan (42) using data from 2006 to 2010. Two observational cohort studies (published in 3 articles) contributed to the quantitative meta-analysis of clinical outcomes. (8–10) The other 3 survey studies contributed qualitative information, notably on satisfaction with the birth experience.

The 2 cohort studies included records for a total of 45 289 participants. The prospective cohort study conducted in England compared outcomes of intrapartum care in birth centres (free-standing midwifery units) and a stratified sample of hospital obstetric units. (8) The retrospective cohort study conducted in New Zealand relied on a perinatal health databases for data collection and extraction. Included in this review were results from the study for those who planned to give birth at a birth centre (primary unit) and those who planned to give birth at a hospital (secondary or tertiary unit). (9,10)

Summary of evidence

The summary of evidence below presents pooled results from the 2 cohort studies described above, when available. (8–10) Given event rates for most outcomes were not reported in the study conducted in New Zealand, (9,10) results for most outcomes are from the Birthplace in England study. (8) Although odds ratios and adjusted odds ratios were reported by study authors, relative risks were calculated and are presented below to ensure consistency with the evidence on home birth.

Maternal mortality

No maternal deaths were reported in studies included in the review. (8–10)

Perinatal and neonatal mortality

Perinatal and neonatal death was reported by only one study. There were 7 intrapartum stillbirths and 10 early neonatal deaths (within the first 7 days of life). (8) Similar to studies described above, this study was not powered to detect differences in likelihood of these very rare outcomes. Rates of intrapartum stillbirth were 0.4 per 1000 for planned birth centre births and 0.2 per 1000 for planned hospital births (RR 2.33, 95% CI 0.52-10.40, p = .27). Rates of early neonatal death were 0.4 per 1000 planned birth centre births and 0.3 per 1000 planned hospital births (RR 1.74, 95% CI 0.50-6.02, p = .38). (8)

Additional analyses by parity also found no evidence of a difference in likelihood of intrapartum stillbirth or neonatal death. Among nulliparous study participants, rates of stillbirth were 0.2 per 1000 for planned birth centre births and 0.1 per 1000 for planned hospital births (RR 2.05, 95% CI 0.13-32.75, p = .61). Among multiparous study participants, rates were 0.5 per 1000 for planned birth centre births and 0.2 per 1000 for planned hospital births (RR 2.23, 95% CI 0.37-13.36, p = .38).(8) Early neonatal death rates among nulliparous clients were 0.6 for planned birth centre births and 0.4 per 1000 planned hospital births (RR 1.53, 95% CI 0.34-6.85, p = .58). Among multiparous clients, rates were 0.3 for planned birth centre births and 0.1 per 1000 planned hospital births (RR 2.97, 95% CI 0.27-32.76, p = .37). (8)

Neonatal interventions and health outcomes

Neonatal intensive care unit

Admission to the NICU was the only intervention-related outcome reported; rates of admission were 17 per 1000 for planned birth centre births and 28 per 1000 for planned hospital births (RR 0.62, 95% CI 0.53-0.73, p < .00001). (8)

Apgar scores

Relative risks were not calculated for Apgar scores. The rates of Apgar score below 7 at 5 minutes were 8.0 per 1000 for planned birth centre births and 10.0 per 1000 for planned hospital births. Among nulliparous participants, rates of Apgar score below 7 at 5 minutes were 10.8 per 1000 for planned birth centre birth and 13.5 per 1000 for planned hospital births, and among multiparous participants, 5.7 per 1000 and 8.4 per 1000, respectively. (8)

Meconium aspiration syndrome, encephalopathy and sepsis

Rates of meconium aspiration syndrome were 1.1 per 1000 for planned birth centre births compared with 1.4 per 1000 births planned in the hospital (RR 0.75, 95% CI 0.38-1.47, p = .40). Rates of encephalopathy were 1.7 per 1000 for planned birth centre births compared with 2.1 per 1000 for planned hospital births (RR 0.79, 95% CI 0.46-1.36, p = .39). There were no cases of neonatal sepsis in the planned birth centre group compared with 8 cases (rate of 0.40 per 1000) in the planned hospital group (RR 0.10, 95% CI 0.01-1.78, p = .12). (8)

Composite measure of neonatal mortality and morbidity

A composite measure of neonatal mortality and morbidity was designed by researchers conducting the Birthplace in England study. As described in the study's protocol: "a composite outcome [gives] the study more power to detect differences in safety between planned places of birth than a single outcome, which would have a lower incidence." (8) The composite measure included: intrapartum stillbirth, early neonatal death, neonatal encephalopathy, meconium aspiration syndrome, brachial plexus injury, fractured humerus or clavicle. No evidence was found of a difference in likelihood of experiencing outcomes comprising the composite measure for planned birth centre births compared with planned hospital births for all parity (3.7 per 1000 v. 4.1 per 1000; RR 0.88, 95% CI 0.61-1.29, p = .52); for nulliparous clients (4.6 per 1000 v. 4.9 per 1000; RR 0.94, 95% CI 0.58-1.53, p = .81); or for multiparous clients (2.8 per 1000 v. 3.2 per 1000; RR 0.87, 95% CI 0.48-1.59, p = .66). (8)

Mode of birth

Overall, rates of spontaneous vaginal birth were high in both groups: 90.9% for planned birth centre births and 76.6% for planned hospital births (RR 1.20, 95% CI 1.19-1.21, p < .00001). (8,9) For nulliparous clients, rates were 81.0% for planned birth centre births and 62.1% for planned hospital births (RR 1.31, 95% CI 1.28-1.33, p < .00001) and for multiparous clients, they were 97.7% and 88.8% (RR 1.10, 95% CI 1.09-1.11, p < .00001). (8)

Two studies included in the review reported results for assisted vaginal birth; pooled results found that overall those who planned to give birth at a birth centre were less likely to have an assisted vaginal birth than those who planned to give birth in a hospital. (8,9)

Rates of assisted vaginal birth with vacuum were 2.5% for planned birth centre births and 7.0% for planned hospital births (RR 0.33, 95% CI 0.30-0.37, p < .00001). (8,9) Only one study reported results by parity. It found the rates were higher among nulliparous study participants, 5.7% for planned birth centre births and 11.3% for planned hospital births (RR 0.50, 95% CI 0.44-0.57, p < .00001) and much lower among multiparous study participants, 0.4% and 3.7% (RR 0.11, 95% CI 0.08-0.17, p < .00001). (8)

Rates of assisted vaginal birth with forceps were similar to rates with vacuum. Overall, rates were 2.7% for planned birth centre births and 5.4% for planned hospital births (RR 0.46, 95% CI 0.41-0.51, p < .00001). (8,9) Again, the study that reported results by parity found that rates were higher among nulliparous study participants, 6.1% for planned birth centre births and 10.6% for planned hospital births (RR 0.58, 95% CI 0.51-0.65, p < .00001) and much lower among multiparous study participants, 0.8% and 2.0% (RR 0.38, 95% CI 0.27-0.52, p < .00001). (8)

CS rates were also low among study participants in both studies: 3.5% for planned birth centre births and 10.9% for planned hospital births (RR 0.32, 95% CI 0.29-0.35, p < .00001). (8,9) The rates for nulliparous clients were 6.9% for planned birth centre births and 15.8% for planned hospital births (RR 0.43, 95% CI 0.39-0.48, p < .00001). Rates of CS were lower among multiparous study participants, 0.8% for planned birth centre births and 5.2% for planned hospital births (RR 0.14, 95% CI 0.11-0.20, p < .00001). (8)

Obstetric interventions and health outcomes

Episiotomy

Rates of episiotomy were 8.8% for planned birth centre births and 19.2% of planned hospital births (RR 0.46, 95% CI 0.43-0.49, p < .00001). For nulliparous clients, the rates of episiotomy were 16.5% for planned birth centre births and 29.1% for planned hospital births (RR 0.57, 95%CI 0.53-0.61, p < .00001); for multiparous clients, the rates were 2.3% for planned birth centre births and 7.6% for planned hospital births (RR 0.30, 95% CI 0.25-0.35, p < .00001). (8)

Augmentation of labour

Those who planned to give birth at a birth centre were less likely to have their labour augmented with oxytocin than those who planned to give birth at a hospital. Overall, rates were 7.8% for planned birth centre births and 23.3% for planned hospital births (RR 0.33, 95% CI 0.31-0.36 p < .00001). For nulliparous clients, the rates were 15.1% for planned birth centre births and 34.7% for planned hospital births (RR 0.43, 95% CI 0.41-0.47, p < .00001) and for multiparous clients, the rates were 1.6% and 10.0% (RR 0.16, 95% CI 0.13-0.19, p < .00001). (8)

Pharmacologic pain relief

Rates of epidural or spinal pain relief were 11.1% for planned birth centre births compared with 29.7% for planned hospital births (RR 0.37, 95% CI 0.35-0.40, p < .00001). For nulliparous clients, the rates of use of epidural or spinal pain relief were 19.8% for planned birth centre births and 41.2% for planned hospital births (RR 0.48, 95% CI 0.45-0.51, p < .00001) and for multiparous clients, the rates were 3.7% for planned birth centre births and 16.3% for planned hospital births (RR 0.23, 95% CI 0.20-0.26, p < .00001). (8)

Non-pharmacologic pain relief

Use of non-pharmacologic pain relief was also strongly associated with planned place of birth. Those who planned to give birth in a birth centre were more likely to use immersion in water for pain relief (46.6%) than those who planned to give birth at a hospital (9.3%) (RR 5.00, 95% CI 4.76-5.24, p < .00001). The strong association persisted when results were stratified by parity. For nulliparous clients, the rates were 52.6% for planned birth centre births and 11.7% for planned hospital births (RR 4.50, 95% CI 4.24-4.77, p < .00001) and for multiparous clients, the rates were 41.5% for planned birth centre births and 6.6% for planned hospital births (RR 6.32, 95% CI 5.82-6.87, p < .00001). (8)

Perineal trauma

One study also reported incidence of perineal trauma (defined as 3rd and 4th degree tears), which occurred in 2.3% of planned birth centre births compared with 3.2% of planned hospital births (RR 0.72, 95% CI 0.63-0.83, p < .00001). There was no difference in likelihood of perineal trauma for nulliparous clients whether they planned to give birth at a birth centre (4.0%) or a hospital (4.5%) (RR 0.88, 95% CI 0.75-1.03, p = .11). However, multiparous clients who planned to give birth at a birth centre were less likely to experience perineal trauma (0.9%) compared with those who planned to give birth in a hospital (1.6%) (RR 0.53, 95% CI 0.39-0.73, p < .0001). (8)

Postpartum hemorrhage

Postpartum blood loss was measured differently in both studies; therefore, results were not pooled. The rate of PPH requiring blood transfusion was lower in the planned birth centre group compared with the planned hospital group (8); however, there was no difference in blood loss > 1000 mL based on planned place of birth. (10) One study also reported rates of blood transfusions by parity. (8) Rates for nulliparous clients were 0.8% for planned birth centre births and 1.6% for planned hospital births (RR 0.49, 95% CI 0.75-1.03, p < .0001). Rates for multiparous clients were 0.4% for planned birth centre births and 0.7% for planned hospital births (RR 0.56, 95% CI 0.39-0.73, p = .01). (8)

Table 2: Postpartum hemorrhage for planned home births compared to planned hospital births

Postpartum hemorrhage definition (reference)		Birth centre (%)	Hospital (%)	Relative risk, confidence interval, p-value
PPH with blood transfusion	(8)	0.6	1.2	RR 0.48, 95% CI 0.37-0.63, p < .00001
PPH with estimated blood loss > 1000 mL	(10)	1.1	1.4	RR 0.78, 95% CI 0.53-1.13, p = .19

Admission to intensive care unit

Though maternal admission to intensive care unit was not reported in either study, one study reported results on maternal admission to higher level of care. (8) "Higher level of care" included admission to: High Dependency Areas (considered pre-ICU), Intensive Care Units (ICU) and other specialist units. Admission to recovery units following operative delivery was not included in this outcome. Rates of admission to higher level of care were low in both groups, but lower for planned birth centre births. For all parity, rates were 0.2% for planned birth centre births and 0.6% for planned hospital births (RR 0.36, 95% CI 0.23-0.56, p < .00001). For nulliparous clients, rates were 0.3% and 0.8% (RR 0.37, 95% CI 0.21-0.64, p = .0004) and for multiparous clients, rates were 0.1% and 0.4% (RR 0.39, 95% CI 0.19-0.82, p = .01). (8)

Transport to hospital and transfer of care

One study reported the percentage of births that actually occurred where they were intended: overall, 90.2% of planned birth centre births occurred at a birth centre and 99.8% of planned hospital births occurred in hospital. (9)

Another study reported transfer to hospital from out-of-hospital settings based on the timing of the transport. (8) Overall, 21.9% of planned birth centre births transferred to the hospital during labour or immediately after birth; rates of transfer were 36.3% for nulliparous clients and 9.4% for multiparous clients. Intrapartum transfers to hospital occurred in 16.5% of planned birth centre births overall, 29.6% for nulliparous clients and 5.3% for multiparous clients. Postpartum transfers to hospital occurred in 4.8% of births overall, 5.9% for nulliparous clients and 3.9% for multiparous clients. (8)

Rates of ambulance and emergency transports or calls to emergency services were not reported in studies included in this review. Transfer of care from midwives to a physician were not reported either.

Conclusion

Canadian research examining outcomes of midwife-attended births in different settings is consistent with findings from studies looking at comparable health-care systems, such as England, New Zealand, the Netherlands and Norway. In jurisdictions where midwifery services are well-integrated into the health-care system, evidence shows that planning to give birth at home or in a birth centre is as safe as planning to give birth in a hospital for midwifery clients at low risk of complications. It is also associated with a decreased need for obstetric and neonatal interventions. Some of these differences may be attributable to the availability of interventions, variation in practice, differences in client preferences in different places of birth or to other factors that may be difficult to measure.

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Appendix A

Table 3: Search strategy for the review of evidence for home birth

	Search terms	Limits
PubMed	("home childbirth" OR homebirth OR "home birth" OR "home delivery" OR "out of hospital birth" OR (childbirth AND (out-of-hospital OR "out of hospital"))) AND (Ontario OR Canada)	Publication date after 1990
Ovid EMBASE	exp home delivery/ OR "home birth" OR "home childbirth" OR homebirth AND (Ontario OR Canada)	Publication date after 1990
CINAHL	(home childbirth (MH Exact subject heading) OR homebirth OR "home birth" OR "home delivery" OR "out of hospital birth" OR (childbirth AND (out-of-hospital OR "out of hospital"))) AND (Ontario OR Canada)	Publication date after 1990 Exclude MEDLINE records

Table 4: Search strategy for the review of evidence for birth centre birth

	Search terms	Limits
PubMed	"Birthing Centers"[Mesh]	Publication date after 1990
	"birthing centers" OR "birthing center" OR "birthing centre" OR "birthing centres" OR "birth centers" OR "birth center" OR "birth centres" OR "birth centre" OR (childbirth AND (out-of-hospital OR "out of hospital")) [All fields]	Publication date after 2015
Ovid EMBASE	exp maternity ward/ AND ("maternity home" or "birthing centers" or "birthing center" or "birthing centre" or "birthing centres" or "birth centers" or "birth center" or "birth centres" or "birth centre" or (childbirth and (out-of-hospital or "out of hospital")))	Publication date after 1990
CINAHL	MM "Alternative Birth Centers"	Publication date after 1990 Exclude MEDLINE records

Appendix B

Figure 1: Flow diagram of study selection for the review of evidence on planned home birth

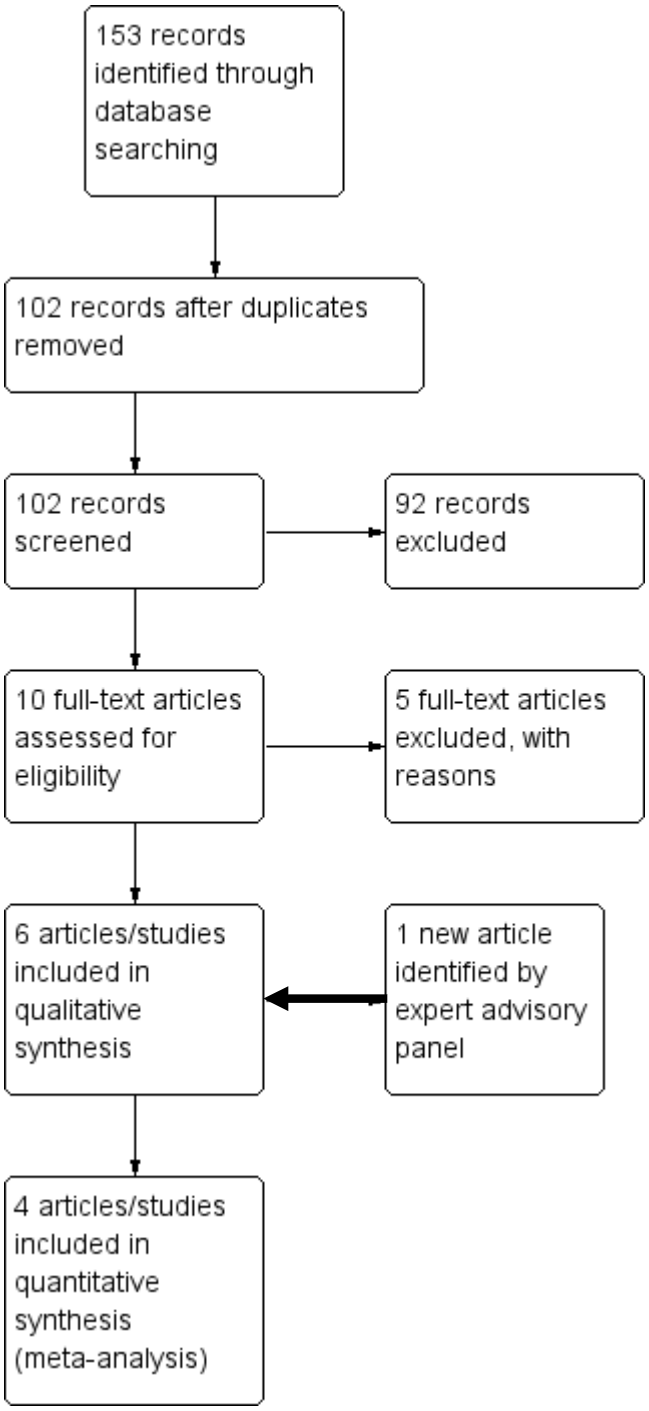

Figure 2: Flow diagram of study selection for the review of evidence on planned birth centre birth