Health Evidence Review Commission's Evidence-based Guideline Subcommittee

September 12, 2019

2:00 PM - 5:00 PM

Clackamas Community College
Wilsonville Training Center, Room 111-112
29373 SW Town Center Loop E, Wilsonville, Oregon, 97070

Section 1.0

Call to Order

AGENDA

EVIDENCE-BASED GUIDELINES SUBCOMMITTEE (EbGS)
September 12, 2019
2:00pm - 5:00pm

Clackamas Community College
Wilsonville Training Center, Rooms 111-112
29353 SW Town Center Loop E
Wilsonville, Oregon 97070

Public comment will be taken on each topic per HERC policy at the time at which that topic is discussed. Please sign-in to testify.

#	Time	Item	Presenter
1	2:00 PM	Call to Order	Devan Kansagara
2	2:05 PM	Review of 6/6/2019 minutes	Devan Kansagara
3	2:10 PM	Staff update	Darren Coffman
4	2:15 PM	Review draft coverage guidance: Planned Out-of-Hospital Birth	Moira Ray Val King Cat Livingston
6	4:45 PM	Confirmation of the next meeting, December 5, 2019	Devan Kansagara
7	4:50 PM	Next Topics	Cat Livingston
8	5:00 PM	Adjournment	Devan Kansagara

Note: All agenda items are subject to change and times listed are approximate

MINUTES

Evidence-based Guidelines Subcommittee

Clackamas Community College
Wilsonville Training Center, Rooms 111-112
29353 SW Town Center Loop E
Wilsonville, Oregon 97070
June 6, 2019
2:00-5:00pm

Members Present: Devan Kansagara, MD, Chair; Alison Little, MD, MPH; Angela Senders, ND; Lynnea Lindsey, PhD (by phone until 1:20 pm, then in person); Michael Adler, MD (arrived 1:15 pm)

Members Absent: Eric Stecker, MD; Leslie Sutton.

Staff Present: Darren Coffman; Cat Livingston, MD, MPH; Jason Gingerich.

Also Attending: Stefanie Rogers, MD; Duncan Neilson, MD (Legacy Health); Jason Mandic (Exact Sciences); Sharron Fuchs; Silke Akerson (Oregon Midwifery Council); Adam Obley, MD, Moira Ray MD MPH, Val King MD, MPH, and Craig Mosbaek (OHSU Center for Evidence-based Policy).

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1. Call to Order

Devan Kansagara called the meeting of the Evidence-based Guidelines Subcommittee (EbGS) to order at 2:00 pm.

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2. Minutes Review

Minutes from the 4/4/2019 meeting were reviewed and approved as presented, 4-0 (Adler not present).

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3. Staff Report

Coffman reported that some topics were dropped from the potential coverage guidance topics list for EbGS; some of the new topics to be considered today will replace these topics, and others are more appropriately addressed through the Value-based Benefits Subcommittee (VbBS) rather than be a coverage guidance topic. Topics which were dropped, addressed at VbBS, or which may be addressed by VbBS include pneumatic compression devices for the treatment of lymphedema, liposuction for the treatment of lymphedema, extracorporeal membrane oxygenation, acellular dermal matrix and interventional treatments for lower extremity chronic venous disease.

Little asked about postmastectomy reconstruction using acellular dermal matrix. Gingerich said that Ariel Smits has prepared a recommendation. It will be a difficult topic as there are concerns about harms and a lack of benefit based on evidence, but it is widely used among surgeons. Livingston said that staff

didn't believe the coverage guidance process would help with resolving this issue, so it is going directly to VbBS.

Little asked whether Adler would be a permanent member of EbGS; Coffman said it would likely be permanent.

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4. New Topics

Adam Obley reviewed the scope statements.

On the Scope Statement for Non-Invasive Vagus Nerve Stimulation Devices for Cluster and Migraine Headache (e.g., Gammacore), Senders asked about headache severity and intensity, and whether they were factored into response rate. Obley said response rate is one of the commonly reported outcomes, and includes frequency, severity and duration based on patient report.

For the scope on Percutaneous Occlusion of the Left Atrial Appendage in Atrial Fibrillation (e.g. Watchman), Kansagara said that the attraction is that patients might not have to use anticoagulation, but they still do need it in reality. He suggested an outcome of the ability to discontinue anticoagulation, or only including patients who aren't candidates for anticoagulation. Obley said that there is likely a nontrivial increased risk of stroke for patients who go off anticoagulation. If we do that, we wouldn't capture the stroke risk. If there is an analysis of patients who aren't candidates for anticoagulation or a separate analysis of patients who successfully go off anticoagulation vs. those who remain on it, he's happy to report those results. Kansagara said this is probably worth reporting. Livingston proposed merging bleeding events and other adverse events and add ability to discontinue anticoagulation as an important outcome. *(Note: following the meeting, staff also proposed an additional change to capture this discussion, which would add a question evaluating the impact of the device on patients with a contraindication to anticoagulation).* For harms, Kansagara said one may want to distinguish procedure-related harms from other harms. Kansagara said the best data on procedure-related harms would come from registries.

For Multicomponent Interventions to Improve Screening for Breast, Cervical or Colorectal Cancer, Kansagara raised concerns about the range of frequency in USPSTF recommendations for breast and colon cancer screening. Obley said the goal is to improve adherence to screening intervals recommended by the USPSTF, not more frequent screening. If evidence is found on increasing inappropriate screening, this would be captured.

For scoping Patient and Radiologic Factors Influencing Outcomes in Total Knee Arthroplasty, Coffman informed the group that this would normally be a topic for the Health Technology Assessment Subcommittee (HTAS) agenda, but that since the spinal cord stimulation topic was dropped, the June HTAS meeting was cancelled, and the scope was therefore being brought to this group. Staff has consulted with Kathryn Schabel, a joint replacement surgeon on HTAS. This topic was inspired by reports of poor outcomes among some patients undergoing knee replacement. Obley addressed a concern about harms not being an outcome; for this topic, the general effectiveness and safety of knee replacement is accepted. This topic is about identifying the best candidates for knee replacements. In someone without strong indications, the balance of benefits and harms might not be favorable. Kansagara clarified that patient characteristics include comorbidities as well as demographic

characteristics and symptoms. Obley said he would report things related to any of these characteristics. Based on discussion, the subcommittee called out patient-reported disease characteristics in addition to radiological findings in Key Question 3. King said this is a prognosis question, which required adaptation of the GRADE methodology. It would be defined retrospectively by identifying patients who did not get pain or function improvement.

Livingston said the next step with these scope statements is to prioritize the topics and asked the subcommittee for feedback in ranking them in priority. Little said staff should consider the volume of utilization and cost. She asked about Watchman in particular. Livingston said it is expensive and reportedly increasingly common. New York Medicaid is looking into Watchman due to burgeoning use as well. Kansagara agreed this is an important topic; Gingerich agreed to look into the utilization of Watchman on the Oregon Health Plan prior to the August meeting. Senders expressed interest in the vagal nerve stimulation topic.

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5. Planned Out-of-Hospital Birth

Coffman read the following bios and conflict of interest statements for appointed ad hoc experts Duncan Neilson and Stefanie Rogers. Two other appointed experts, Melissa Cheyney and Alice Taylor, were not able to be at the meeting and did not call in. Fuchs inquired about participation of Dr. Amos Grunebaum, who wanted to participate but could not be heard when he called in. Coffman clarified that call-in testimony is only available to appointed experts, and Grunebaum has not been officially appointed. He clarified that the HERC policy is that unsolicited public commenters need to be present at the meeting to give testimony.

Dr. Duncan Neilson is an OB/GYN clinical vice president for Legacy Medical Group's surgical specialties division. He also serves as clinical vice president of Legacy's Women's Services and Surgical Services. He also chaired the Oregon Health Authority's Licensed Direct Entry Midwife Staff Advisory Workgroup. He declared the following conflicts of interest in addition to his employment:

- Chairs the graduate medical education committee and provides ongoing OB-GYN-related Continuing Medical Education, especially advanced fetal monitoring training.
- He leads outreach efforts to community midwives providing out-of-hospital births to improve hospital transfer processes.
- His employer, Legacy Health Systems receives payments for care related to childbirth services and payments related to his participation in OB-GYN educational programs.

He has served the commission as an expert on previous obstetric-related topics, including Elective Induction of Labor, Opportunistic Salpingectomy, Tobacco in Pregnancy and the previous review of Planned Out-of-Hospital Birth.

Stefanie Rogers, MD is board certified in pediatrics and neonatal perinatal medicine. She is the medical director of Providence St. Vincents Neonatal Intensive Care Unit, Northwest Mothers Milk Bank and is a neonatologist at Northwest Newborn Specialists. She declared no conflicts of interest.

Livingston reviewed the process. The draft is not complete and cannot be approved to be posted for comment today; the earliest it would be posted is the September 12 meeting. If it is posted for written comment then, written comments would be reviewed at the December meeting and subsequently

reviewed by the VbBS and HERC in January 2020. The June discussion will be reviewing the recommendations on risk factors from other bodies.

Ray reviewed the additions to the draft coverage guidance since the last meeting. Appendices I & J are based on a guideline from the NICE as well as other lower quality guidelines and standards. She briefly described the various sources of the recommendations, including system level recommendations, and the context for each.

Adler asked whether the direct-entry midwife licensing standards meet the requirement of the American College of Obstetricians and Gynecologists that the birthing attendant has training which meets global standards. King said that in most of the United States, if the state allows direct-entry midwives or licensed midwives to practice, they generally come via a certification which may, but does not necessarily, meet the International College of Midwifery (ICM) global standard. Adler requested clarification. Silke Akerson, director of the Oregon Midwifery Council, said that appointed expert Missy Cheyney is attending a birth and is hoping to call in. She reported that in the United States, most nurse midwives and direct-entry midwives don't meet the ICM standards. One of the main reasons for this is that the ICM standards say that midwives should be able to provide abortions. However, the majority of licensed direct-entry midwives in Oregon have a bachelor's degree in midwifery. There are ways to become an LDEM or CPM without a bachelor's degree.

Kansagara noted that this coverage guidance is different than from some other topics; part of the reason for doing this is that there is limited evidence, and we may need to rely on standards from other places with different healthcare systems to develop this coverage guidance. King said that staff is hearing comments related to concurrent processes for licensure for licensed direct-entry midwives. Those standards are separate from this coverage guidance. If there was agreement on those standards, the Oregon Health Authority could provide Medicaid coverage without needing all the detailed criteria in a HERC coverage guidance; however, there are significant differences. There may be stakeholders who are confused about the separate processes. Ray added that the rules for birthing center licensing are also under review concurrently.

Little asked about the difference between a certified midwife and a licensed direct-entry midwife. King said that a certified midwife is the equivalent of a certified nurse midwife that doesn't have a nursing degree but has equivalent training around childbirth and takes the same exam. There aren't very many certified midwives in America. Livingston referenced Table 2 and suggested we might compare the types of midwives in the table with the various standards. After discussion the subcommittee decided not to add certified midwives, as they are not licensed in Oregon.

Sharron Fuchs spoke from the audience, adding that chiropractic physicians with certification in natural childbirth are also licensed to attend births in Oregon. Others were not aware of this licensure.

Livingston reviewed the balance of benefits and harms, resource allocation, other factors and rationale sections of the GRADE table. Lindsey said that cultural preferences are not mentioned in the values and preferences statement. After discussion, the subcommittee didn't add this, as the values and preferences seem to be strong regardless of what's driving the values and preferences.

Kansagara asked to what extent we should think of these guidelines as an incentive to improve the system, or whether it should be thought of within the constraints of the system. Neilson said one of the charges is to figure out whether we in Oregon have done enough to assure safety through the

regulations or whether we have not. One of the main reasons for this review was the assertion that we have not done enough and therefore may be responsible for some measurable harms. The question is, do we need to change something? If we decide to do so, those various perspectives are useful in figuring out what we need to change. Kansagara said there are questions about the applicability of some of the guidelines, but part of the reason for doing this is to drive some system change. Neilson said it is a question whether we need to change; this process was initiated because of a question about whether we should change the recommendations, but this subcommittee had initially decided we don't need to change the coverage guidance.

Livingston highlighted that the rationale statement may need to be adapted based on the decisions that are made about indications covered in the evidence versus the guidelines. For instance, if the subcommittee decides to add risk criteria around nulliparity or maternal age, the rationale would need to be revised as these are mentioned in the evidence as having higher risks of neonatal harms.

Adler and Kansagara expressed support for the framework described in these sections. Kansagara asked about operational implementation. Livinston clarified that if, based on individual review, the birth attendant did not follow the coverage criteria, the provider would not be paid by the health plan. If the health plan is the Oregon Health Plan, the recipient could not be balance billed by the provider, just as is true with all providers in the Oregon Health Plan.

Livingston referred to the written comments posted on the member only website. Some of the comments addressed licensing issues and these have been forwarded to the appropriate bodies. Comments related to the evidence, including those by Dr. Grunebaum, will be incorporated into the next version of the draft coverage guidance to be released prior to the September meeting.

Fuchs asked whether Dr. Grunebaum would be allowed to comment by phone. Coffman explained that the Commission does not accept unsolicited comments from the public by phone. Instead, there is a 30-day written comment period, and brief in-person comments are taken at the meetings.

Akerson offered her comments and declared no conflicts of interest outside her employment. She expressed concern about adding extensive guidance when existing outcomes for out-of-hospital birth with midwives in Oregon are excellent. She said it is alarming to see the vast number of restrictions. In addition, the Commission is referring to professional societies external to midwifery with the exception of the American College of Nurse Midwives. The report doesn't refer to the standards or guidelines or statements of the National Association for Certified Professional Midwives, the Home Birth Summit standards about transfer, or the guidelines of the Naturopathic Obstetric Association. In particular, she called out the requirement by the American Academy of Pediatrics for a consultation with a pediatrician within 24 hours of delivery. These recommendations are from organizations that aren't familiary with midwifery. She also clarified that midwives have been licensed since 1993, with a change in licensure in 2012.

She said she has many concerns about the recommendations in the coverage guidance, but highlighted a few. Some items don't have time constraints. For instance, the line on inability to auscultate doesn't have a time attached, and anyone who attends people in labor knows that sometimes there can be difficulty in auscultation due to the woman's position or if she is screaming during pushing. The same is true about heart rate below 110 or above 160. Other requirements are vague. For instance, the hepatic disorders section includes abnormal liver function test as a contraindication without specifying which test or how abnormal the results would have to be. The same is true with "treated with any

medication." If there are changes made they should be about clarifying the current guidance and making it more functional rather than adding additional conditions.

Coffman said there will be additional opportunities to comment. Livingston explained the tables which appear in Appendices I and J of the coverage guidance. The grey cells are clarifications to existing criteria in the current coverage guidance and the blue cells would add new criteria. She said that only the blue and grey cells would be discussed unless a subcommittee member (or an expert or the public) wants to discuss another condition for which the staff recommendation is "no change."

Adler said he would like to add a requirement for transfer at less than 37 weeks 0 days with ruptured membranes, as the critical access hospital where he practices transfers such patients to a higher level of care. King suggested the gestational age limit for the use of steroids for fetal lungs has gone down, and hospitals may be transferring for that and for the need for higher level neonatal care.

For anemia, the subcommittee agreed to change the cutoff from 10.5 to 10 g/dL.

For cancer affecting site of delivery, there was discussion about whether low grade cervical lesions represent cancer; they do not. There was discussion also of adding "active cancer" but no change was made.

For maternal cardiovascular disease, the subcommittee recommended that cardiovascular disease with functional impairment be considered a risk criterion requiring transfer. Fetal cardiovascular anomalies are considered elsewhere in the table.

Under congenital or hereditary anomalies, the subcommittee decided to adopt the ACNM definition "Evidence of congenital anomalies requiring immediate assessment and/or management by a neonatal specialists" as a clarification, and to drop the existing risk factor of "life-threatening congenital anomalies."

Based on Akerson's comments, Livingston discussed the requirement around fetal heart rate. The subcommittee agreed to keep the existing language "repetitive or persistent abnormal fetal heart rate pattern during labor" and not to add language around specific heart rates. Neilson said that defining numbers or defining repetitive or persistent is a matter of active disagreement in the field, so we have to be a little bit vague. For inability to auscultate, the subcommittee changed it to "Inability to adequately follow an intermittent auscultation protocol." Akerson gave the example of a woman on hands and knees screaming, where it would be difficult to auscultate. Neilson said they have the same problem in the hospital, but they still do their best to follow the protocol; the requirement is around using the protocol and excluding women who really require an internal monitor. Akerson said most of the time this occurs during late-stage labor. Neilson agreed this would not be a situation where you would transfer the patient to the hospital. It would be more for patients requiring an internal monitor, usually due to an abnormally thick abdominal wall. Adler expressed support for the language.

The subcommittee also discussed the requirements around abnomally decreased fetal movement. Neilson said that movement is something that the mother perceives but the attendant can also confirm. He said if the provider confirms the fetus is not moving normally, it can be because of anemia due to fetal maternal hemorrhage, which urgently requires hospital care. Most of the time when the mother reports low fetal movement, the provider will detect fetal movement and nothing further is required, but if the lack of movement is confirmed it can be urgent. Adler suggested making it a consultation

requirement, suggesting a nonstress test may be indicated. Neilson said in these cases the fetal heart rate is one of the last signs to appear. Livingston said one of the issues may be that the requirement isn't different depending on when the decreased movement appears. Ray confirmed that the NICE requirement is at onset of labor. Based on discussion, the subcommittee decided to change "abnormally decreased fetal movement" to "abnormally decreased fetal movement antepartum" and leave it as a 2 (consultation), and to add a separate requirement for "abnormally decreased fetal movement at onset of labor" as a 3 (requiring hospital transfer). The subcommittee clarified that the consultation requirements may be a phone consultation by the provider, and not necessarily a visit by the patient to another provider.

The subcommittee decided to make hepatic disorders including uncontrolled intrahepatic cholestasis of pregnancy and/or abnormal liver function tests a consultation requirement, not a transfer requirement, based on the public comment that the definition was too vague.

For "actively being treated with prescription medication for any medical condition," the subcommittee discussed making it a consultation requirement, but decided it was overly broad and did not add it. They also dropped the proposed consultation requirement for "current medical conditions that may affect pregnancy or are exacerbated due to pregnancy" and "current medical conditions that may affect pregnancy or are exacerbated by pregnancy that require specialized medical care (e.g., cardiac disease, renal disease, pre-existing insulin-dependent diabetes mellitus)." King said the criteria from Canada were designed to pick up other serious conditions that may not be on the list. Livingston suggested that staff might draft similar language appropriate to this context.

There was significant discussion about the gestational age cutoff for postterm births. Neilson said that in well-dated preganancies, risk increases at 41 weeks. However, many women planning out-of-hospital births may not be getting the most accurate dating technology, and without the most accurate technology, menstrual date estimation is likely to overestimate, rather than underestimate, gestational age. After discussion, the subcommittee decided not to change the recommendation around late gestational age. Akerson said she believes the elevation of risk between 41 and 42 weeks is an appropriate amount for an informed consent discussion rather than a requirement to transfer, regardless of the dating method used. Kansagara said it magnifies the uncertainty if you don't know what the dates actually are. Livingston reviewed the two Grunebaum studies included in the coverage guidance, which showed an increased rate of neonatal mortality over 41 weeks. Ray said these studies also included women with previous cesarean sections and breech births. After discussion the subcommittee did not request a change based on the Grunebaum studies.

On page 221, for "history of postpartum hemorrhage or bleeding requiring additional procedures such as Bakri-balloon, dilation and curettage, transfusion, and manual removal of placenta," the subcommittee decided not to add the requirement for transfer. For "history of postpartum hemorrhage requiring intervention, transfusion or pharmacologic management," the subcommittee decided to change the definition to "history of postpartum hemorrhage requiring intervention" and make it a consultation requirement. Neilson said many, but not all, of these should be managed in the hospital.

The subcommittee ran out of time before beginning work on the section on hypertensive disorders and will continue discussion at the September meeting. Ray said staff will keep the document updated with the latest proposals/decisions from the board of direct-entry midwifery.

6. Adjournment

The meeting was adjourned at 5:00 pm. The next meeting is scheduled for September 12, 2019 from 2:00-5:00 pm at Clackamas Community College, Wilsonville Training Center, Rooms 111-112, 29353 SW Town Center Loop E, Wilsonville, Oregon 97070

Section 2.0

Coverage Guidances

Health Evidence Review Commission (HERC)

Coverage Guidance: Planned Out-of-Hospital Birth

DRAFT for EbGS Meeting 9/12/2019

HERC Coverage Guidance

Planned out-of-hospital birth is recommended for coverage for pregnant women who are at low risk for adverse obstetric or birth outcomes *(weak recommendation)*. The high-risk conditions outlined below would either preclude coverage of planned out-of-hospital birth, necessitate a consultation, or require transfer of the mother or infant to a hospital setting.

Coverage of prenatal, intrapartum, and postpartum care is recommended with the performance of appropriate risk assessments (at initiation of care and throughout pregnancy and delivery) and the out-of-hospital birth attendant's adherence to the consultation and transfer criteria as outlined below.

Planned out-of-hospital birth is not recommended for coverage for pregnancies with identified high-risk factors necessitating a planned hospital birth, or when the listed criteria for consultation and transfer of care are not followed by the birth attendant *(strong recommendation)*.

When a high-risk condition develops that requires transfer or planned hospital birth, coverage is recommended when appropriate care is provided until the point the high-risk condition is identified. For women who have a high-risk condition requiring consultation, ongoing coverage of planned out-of-hospital birth care is recommended as long as the consulting provider's recommendations are then appropriately managed by the out-of-hospital birth attendant in a planned out-of-hospital birth setting.

HIGH-RISK CONDITIONS

Conditions in the red (darker) boxes indicate high-risk conditions that require planned hospital birth (when present on intake) or transfer of the mother or infant to hospital-based care (when condition develops).

Conditions in the yellow (lighter) boxes indicate potentially risky conditions that require consultation. Consultations may be with 1) a provider (MD/DO or CNM) who has active admitting privileges to manage pregnancy in a hospital and/or 2) specialty consultation (e.g., hepatologist, hematologist, psychiatrist), when appropriate.

This list of high-risk conditions is not exhaustive, and other medical, obstetric, or fetal high-risk conditions may arise that require consultation and/or transfer to hospital-based care. Having multiple risk conditions requiring consultation may increase the risk sufficiently enough to indicate the need for transfer of care.

MEDICAL HISTORY OR OBSTETRIC HISTORY	
Cancer	• Cancer affecting site of delivery
Cardiovascular disease	• Cardiovascular disease causing functional impairment

MEDICAL HISTORY OR OBSTETRIC HISTORY	
Cervical conditions	• Insufficiency or cerclage
Collagen-vascular diseases	• Any collagen-vascular disease
Delivery history	• Prior cesarean section
Endocrine Conditions	• Type 1 diabetes • Type 2 diabetes • Endocrine conditions other than diabetes (e.g. hyperthyroidism)
Genetic/heritable disorders	• Family history of genetic/heritable disorders that would affect labor, delivery, or care of newborn. Examples include family history of thrombophilia
Hematologic disorders	• History of thrombosis or thromboembolism • Maternal bleeding disorder
	• Anemia with hemoglobin < 8.5 g/ dL during prior pregnancy • Hemoglobinopathies • History of postpartum hemorrhage requiring intervention
Hypertensive disorders	• Eclampsia • HELLP syndrome (hypertension, elevated liver enzymes, low platelets)
	• History of pre-eclampsia not requiring preterm birth.
Fetal demise or stillbirth	• History of unexplained stillbirth/neonatal death or previous death related to intrapartum difficulty
	• Prior unexplained stillbirth/neonatal death or death unrelated to intrapartum difficulty
Congenital or hereditary disorders	• Prior child with congenital or hereditary disorder

CONDITIONS OF CURRENT PREGNANCY	
Amniotic membrane rupture	• Before 37 weeks 0 days • Pre-labor rupture > 24 hours
Abnormal bleeding in pregnancy	• Antepartum hemorrhage, recurrent • Hemorrhage (hypovolemia, shock, need for transfusion, vital sign instability)
Congenital or hereditary anomaly	• Evidence of congenital anomalies requiring immediate assessment and/or management by a neonatal specialist
	• Requiring medication or uncontrolled

CONDITIONS OF CURRENT PREGNANCY	
Diabetes, gestational	• Diet controlled
Fetal demise or stillbirth	• Fetal demise (after 12 weeks gestation)
Fetal monitoring or movement	• Abnormal fetal heart rate, Doppler, or surveillance studies • Repetitive or persistent abnormal fetal heart rate pattern during labor • Inability to adequately follow an intermittent auscultation protocol • Abnormally decreased fetal movement at onset of labor
	• Abnormally decreased fetal movement antepartum
Fetal presentation	• Breech or noncephalic presentation
Gastrointestinal conditions	• Intrapartum excessive vomiting, dehydration, or exhaustion unresponsive to treatment
Gestational age	• < 37 weeks 0 days • > 42 weeks 0 days
Group B streptococcus	• Unknown carrier state • Lack of informed consent on prophylaxis if mother is GBS positive
Hematologic conditions	• Anemia with hemoglobin < 8.5 g/ dL (current pregnancy) • Suspected or diagnosed thrombosis or thromboembolism • Thrombocytopenia (platelets < 100,000)
	• Hemoglobin < 10 g/dL, unresponsive to treatment
Hyperemesis gravidarum	• Refractory
Hepatic disorders	• Disorders including uncontrolled intrahepatic cholestasis of pregnancy and/or abnormal liver function tests
Additional high-risk conditions to be added based on discussion September 12, 2019	

NEONATAL CONDITIONS
Additional high-risk conditions to be added based on discussion September 12, 2019

Note: Definitions for strength of recommendation are in Appendix A. *GRADE Table Element Descriptions*.

Rationales for each recommendation appear below in the GRADE table.

Table of Contents

Rationale for development of coverage guidances and multisector intervention reports

Coverage guidances are developed to inform coverage recommendations for public and private health plans in Oregon as plan administrators seek to improve patients' experience of care, population health, and the cost-effectiveness of health care. In the era of public and private sector health system transformation, reaching these goals requires a focus on maximizing the benefits and minimizing the harms and costs of health interventions.

HERC uses the following principles in selecting topics for its reports to guide public and private payers:

- Represents a significant burden of disease or health problem
- Represents important uncertainty with regard to effectiveness or harms
- Represents important variation or controversy in implementation or practice
- Represents high costs or significant economic impact
- Topic is of high public interest

HERC bases its reports on a review of the best available research applicable to the intervention(s) in question. For coverage guidances, which focus on diagnostic and clinical interventions, evidence is evaluated using an adaptation of the Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) methodology. For more information on coverage guidance methodology, see Appendix A.

Multisector interventions can be effective ways to prevent, treat, or manage disease at a population level. In some cases, HERC has reviewed evidence and identified effective interventions, but has not made formal coverage recommendations when these policies are implemented in settings other than traditional health care delivery systems because effectiveness could depend on the environment in which the intervention is implemented.

Use of GRADE System

HERC develops recommendations by using the concepts of the GRADE system. GRADE is a transparent and structured process for developing and presenting evidence and for performing the steps involved in developing recommendations. The table below lists the elements that determine the strength of a recommendation. HERC reviews the evidence and assesses each element, which in turn is used to develop the recommendations presented in the coverage guidance box. Estimates of effect are derived from the evidence presented in this document. The level of confidence in the estimate is determined by HERC based on the assessment of two independent reviewers from the Center for Evidence-based Policy.

In some cases, no systematic reviews or meta-analyses encompass the most current literature. In those cases, HERC may describe the additional evidence or alter the assessments of confidence in light of all available information. Such assessments are informed by clinical epidemiologists from the Center for Evidence-based Policy. Unless otherwise noted, statements regarding resource allocation, values and preferences, and other considerations are the assessments of HERC, as informed by the evidence reviewed, public testimony, and subcommittee discussion.

Recommendations for coverage are based on the balance of benefit and harms, resource allocation, values and preferences and other considerations. See Appendix A for more details about the factors that constitute the GRADE table.

GRADE Table

The Resource Allocation, Values and Preferences, and Other Considerations columns of this table appear as rows at the bottom of this table to improve readability.

Outcomes	**Estimate of Effect for Outcome/ *Confidence in Estimate***	
	U.S. Studies	**Non-U.S. Studies**
Mode of Delivery *(Critical outcome)* Data from comparative studies of good (3) and fair (1) methodological quality reported. Findings from poor-methodological-quality studies (14) not included in GRADE table.	Nonoperative Vaginal Delivery (1 study) 93.8% vs. 71.9% for planned home or birth center birth compared to planned hospital birth Absolute risk difference (ARD) = 27.5 Number needed to treat (NNT) = 3 Adjusted Odds Ratio (aOR) 5.63, 95% CI 4.84 to 6.55 Cesarean Delivery (1 study) 5.3% vs. 24.7% for planned home or birth center birth compared to planned hospital birth ARD = 19.4 favoring planned home or birth center birth NNT = 5 aOR = 0.18, 95% CI 0.16 to 0.22	Nonoperative Vaginal Delivery (3 studies) Range from 81% to 92.8% for planned home or birth center birth vs. 64.7% to 86% for planned hospital birth ARD range from 3.0 to 19.0 NNT range from 5 to 33 aOR range from 1.57 to 3.61 in favor of planned home or birth center birth Cesarean Delivery (2 studies) Range from 2.8% to 4.0% for planned home or birth center birth vs. 11.1% to 11.7% for planned hospital birth ARD range from 7.6 to 8.3 favoring planned home or birth center birth NNT range from 12 to 13 aOR range from 0.31 to 0.76 in favor of planned home or birth center birth
	●●○○ (*low confidence, based on 4 good- or fair-methodological-quality observational studies, 1 from U.S.)*	

Outcomes	Estimate of Effect for Outcome/ *Confidence in Estimate*	
	U.S. Studies	**Non-U.S. Studies**
Perinatal or neonatal mortality *(Critical outcome)* Data from comparative studies of good (2) and fair (2) methodological quality reported. Findings from poor-methodological-quality studies (11) not included in GRADE table.	Neonatal death from 0 to 27 days (2 studies) Range from 0.12% to 0.16% for planned home or birth center vs. 0.03% to 0.06% for planned hospital births ARD range from 0.09 to 0.1 in favor of planned hospital birth Number needed to harm (NNH) range from 1,111 to 1,000 Standardized mortality ratio (SMR) 4.13, 95% CI 3.38 to 4.88; aOR 2.87, 95% CI 1.10 to 7.47	Intrapartum or neonatal death from 0 to 7 days (2 studies) Range from 0.06% to 0.15% for planned home or birth center vs. 0.01% to 0.18% for planned hospital birth Adjusted odds ratios not statistically significant across both studies
	●○○○ *(very low confidence, based on 4 good- or fair-quality observational studies, 2 from U.S.)*	
Neonatal Morbidity *(Important outcome)* Data from comparative studies of good (2) and fair (2) methodological quality reported. Findings from poor-methodological-quality studies (16) not included in GRADE table.	Apgar < 7 at 5 minutes (1 study [Oregon]) 2.3% vs. 1.8% for planned home or birth center birth compared to planned hospital birth aOR = 1.31, 95% CI 1.04 to 1.66 Apgar < 4 at 5 minutes (1 study [Oregon]) 0.6% vs. 0.4% for planned home or birth center birth compared to planned hospital birth aOR = 1.56, 95% CI 0.98 to 2.47 Neonatal seizures (1 study [Oregon]) 0.13% vs. 0.04% for planned home or birth center birth compared to planned hospital birth ARD = 0.09 Adjusted risk difference (RD) estimates from two different methods: 0.07, 0.06 in favor of planned hospital birth NNH = 1,111 (from adjusted RD 1,428 to 1,666) aOR 3.60, 95% CI 1.36 to 9.50	Apgar < 7 at 5 minutes (1 study) 1.2% vs. 2.8%, aOR 0.57, 95% CI 0.25 to 1.35 Birthplace Composite (stillbirth after onset of labor care, neonatal death 0 to 7 days, neonatal encephalopathy, meconium aspiration syndrome, brachial plexus injury, fractured humerus or clavicle) International (2 studies): 0.05% to 3.5% for planned home or birth center birth vs. 0.05% to 4.4% for planned hospital birth Adjusted odds ratios not statistically significantly different across both studies

Outcomes	Estimate of Effect for Outcome/ *Confidence in Estimate*	
	U.S. Studies	**Non-U.S. Studies**
	Neonatal intensive care unit (NICU) admission (1 study) 1.7% vs. 2.9% for planned home or birth center birth compared to planned hospital birth ARD = 1.2 favoring planned home or birth center birth Adjusted RD estimates from two different methods 0.95, 0.85 in favor of planned hospital birth NNT = 83 (from adjusted RD 105 to 117) home or birth center births to avoid 1 NICU admission aOR 0.71, 95% CI 0.55 to 0.92 Ventilator support (1 study) 3.8% vs. 3.3% for planned home or birth center birth compared to planned hospital birth ARD = 0.5 in favor of planned hospital birth Adjusted RD estimates from two different methods: 0.97. 1.05 in favor of planned hospital birth NNH = 200 (adjusted 95 to 103) aOR 1.36, 95% CI 1.14 to 1.62	
	●○○○ *(very low confidence, based on 4 good- or fair-quality observational studies, 1 from U.S.)*	

Outcomes	Estimate of Effect for Outcome/ *Confidence in Estimate*	
	U.S. Studies	**Non-U.S. Studies**
Maternal Harm (Important outcome) Data from comparative studies of good (2) and fair (3) methodological quality reported. Findings from poor-methodological-quality studies (15) are not included in GRADE table.	Postpartum hemorrhage of ≥ 1000 ml No U.S. studies of this outcome Maternal blood transfusion (1 study) Unadjusted 0.6% vs. 0.4% for planned home or birth center birth compared to planned hospital birth ARD = 0.2 in favor of planned hospital birth Adjusted RD estimates from two different methods 0.27, 0.28 in favor of planned hospital birth NNH = 500 (adjusted 357 to 370) aOR 1.91, 95% CI 1.25 to 2.93 Third or fourth degree perineal laceration (1 study) 0.9% vs. 1.3% for planned home or birth center birth compared to planned hospital birth ARD = 0.54, in favor of planned home or birth center birth Adjusted RD from two different methods 0.45, 0.54 in favor of planned home or birth center birth NNT = 185, adjusted 222 aOR 0.69 (95% CI 0.49 to 0.98)	Postpartum hemorrhage of ≥ 1000 ml (4 studies) 0.38% to 29.2% for planned home or birth center birth vs. 1.04% to 39.9% for planned hospital birth ARD = 0.66 to 10.7 NNT = 9 to 151 aOR ranged from 0.4, 95% CI 0.3 to 0.6, to 0.88, 95% CI 0.52 to 1.47 Adjusted risk ratio (aRR) 1.10, 95% CI 0.67 to 1.79, p = 0.23 Maternal blood transfusion (1 study) 0.5% to 0.6% for planned home or birth center birth compared to 1.2% for planned hospital birth ARD = 0.2 in favor of planned hospital birth (adjusted 0.27 to 0.28) NNT = 142 to 166 aOR 0.48 (95% CI 0.32 to 0.73) to aOR 1.91 (95% CI 1.25 to 2.93) Third or fourth degree perineal laceration (2 studies) Range from 1.9% to 4.9% for planned home or birth center birth vs. 3.2% to 4.2% for planned hospital birth ARD = 0.6 to 1.3 (adjusted 0.45 to 0.54) NNT = 76 to 166 aOR 0.77, 95% CI 0.57 to 1.05 to aOR 0.90, 95% CI 0.56 to 1.45
	●○○○ *(very low confidence, based on 5 good- or fair-quality observational studies, 1 from U.S.)*	

Outcomes	Estimate of Effect for Outcome/ *Confidence in Estimate*	
	U.S. Studies	**Non-U.S. Studies**
Breastfeeding *(Important outcome)* Longest outcome data from a single fair-methodological-quality studies (1) reported (non-U.S.). Findings from poor-methodological-quality studies (7) or of short follow-up duration (1) not included in GRADE table.	*No U.S. studies with long-term outcomes identified.*	Exclusive breastfeeding at 6 months postpartum 4% to 22% for planned home or birth center birth vs. 1% to 9% ARD = 3 to 13 NNT = 7 to 33 aOR 2.24, 95% CI 1.14 to 4.03
	●○○○ *(very low confidence, based on 1 fair-quality observational study)*	
Resource Allocation: Planned out-of-hospital birth is likely to cost much less than planned hospital birth given both the lower number of maternal surgical interventions and decreased costs associated with setting. Serious neonatal morbidity could result in highly expensive and potentially long-term expensive care, but these events are rare. Transfers of care from the out-of-hospital to hospital setting, both intrapartum and postpartum, would also decrease the cost favorability. However, overall, resource allocation is expected to be in favor of planned out-of-hospital birth.		
Values and Preferences: Women deciding about birth setting are likely to have strong values and preferences toward a specific place (out-of-hospital or hospital). Women would prefer health care choices that improve the health of both the mother and the infant. In the context of informed consent, women's values vary widely in how they weigh the rare—but sometimes severe—risks to the infant associated with out-of-hospital birth in the U.S. against the less severe—but more common—maternal harms associated with hospital birth. For women who prefer out-of-hospital birth, their assessment of the benefit to the mother from reduced medical interventions may outweigh any risk of harms to the infant, since these harms are quite rare. Women who prefer out-of-hospital birth often have strongly held values about birth as a natural process and preferences to give birth in a less institutional setting. For women who prefer hospital birth, the increased risk of harms to the infant and availability of obstetric interventions, including pain management and emergency interventions, may weigh much more strongly than a higher chance of vaginal delivery. Overall, there is high variability in values and preferences regarding planned out-of-hospital birth.		

Outcomes	Estimate of Effect for Outcome/ *Confidence in Estimate*	
	U.S. Studies	**Non-U.S. Studies**
Other Considerations: Much of the evidence and guidelines informing this coverage guidance might not have direct applicability in the Oregon setting. Some of the guidelines are based in places where out-of-hospital birth and out-of-hospital birth attendants are well-integrated into the health care delivery system, which is not uniformly the case in Oregon. In addition, minimum requirements for education and training are less stringent in Oregon than in these other contexts. Expectations and regulatory standards for birth attendants regarding acceptable risk levels for out-of-hospital births are different and less variable in other health systems reviewed in this coverage guidance.		
Balance of benefits and harms: An assessment of the balance of benefits and harms is significantly limited by the low or very low confidence in the outcomes. The balance of benefits and harms favors planned out-of-hospital birth in dyads without significant risk factors. The evidence suggests a benefit to the mother (with lower rates of cesarean section) for planned out-of-hospital birth. However, evidence also suggests harms to the neonate (a significantly increased fetal/neonatal death rate with planned out-of-hospital birth, although these events remain rare). Some higher-risk conditions are associated with even greater risk of fetal/neonatal death including (but not limited to) advanced maternal age, postdates, nulliparity, prior cesarean delivery, multiple gestation, and breech presentation. Guidelines in areas with robust systems of care suggest numerous specific risk criteria for which risks outweigh benefits. In consideration of the limited evidence and current ~~the existing~~ guidelines, for women with certain risk factors, the balance of benefits and harms weighs against coverage of out-of-hospital birth.		
Rationale: In the Oregon setting, the balance of benefits and harms for out-of-hospital birth appears favorable for the mother, but less favorable or unfavorable to the infant, depending on risk factors. This assessment is largely based on very low-quality~~,~~ but consistent evidence. The Commission recognizes the high value many women place on choosing their birth setting and holds that value in tension with concerns about the personal and societal costs of potential catastrophic harms to the infant in the out-of-hospital setting. Resource allocation favors out-of-hospital birth as less costly for low-risk births, although frequent transfers of care and rare severe harms to the infant could affect the population-level cost. In Oregon, out-of-hospital births are not universally well-integrated into the health care system, potentially resulting in ~~potentially disruptive interruptions~~ delays and poor coordination of care at critical times during pregnancy, labor, and delivery. In addition, ~~regulatory~~ standards of care and educational requirements for birth attendants are highly variable in Oregon. In balancing these considerations, the Commission recommends coverage for out-of-hospital birth for women at low risk of adverse obstetric or birth outcomes with specific requirements for risk assessment and requirements for consultation or transfer for specific high-risk conditions. The recommendation is weak because of the very low confidence in the evidence and ~~that~~because our recommendation includes pregnancies		

Outcomes	Estimate of Effect for Outcome/ *Confidence in Estimate*	
	U.S. Studies	**Non-U.S. Studies**
with certain ~~higher~~ risk ~~conditions that are allowed~~ factors (nulliparity and advanced maternal age) for which evidence suggests planned out-of-hospital birth results in a higher infant death rate. ~~To reduce the risk of infant harm, the Commission has specified risk factors and coverage criteria based on standards of care, guidelines, and regulatory requirements from settings where there appears to be less risk associated with out-of-hospital birth.~~ The Commission recommends noncoverage of planned out-of-hospital birth when the specified risk factors exist, when required risk assessments are not performed, or when criteria for consultation or transfer of care are not followed by the birth attendant. This is a strong recommendation because of concern about the serious risks to the infant and the likelihood that systems issues might further exacerbate these risks.		
Coverage Recommendation: See box language for details.		

Note: GRADE table elements are described in Appendix A. A GRADE Evidence Profile is in Appendix B.

Background

The vast majority of births in Oregon and the U.S. occur in hospitals, although an increasing number of women choose to give birth in settings outside the hospital, including in homes or birthing centers. In the U.S., out-of-hospital births (planned or unplanned) represented 1.6% of all live births in 2017, an 85% increase from 2004 to 2017. The rate of out-of-hospital births varied greatly from state to state: the lowest rates were in Alabama (0.43%), Louisiana (0.46%), New Jersey (0.51%), and Rhode Island (0.51%). The highest rates of out-of-hospital births occurred in Alaska (7.9%), Montana (4.1%), Washington (3.8%), Idaho (3.8%), Oregon (3.6%), and Pennsylvania (3.5%) (MacDorman & Declercq, 2016). While the 2003 revision of the U.S. Standard Certificate of Live Birth included language clarifying if a birth location in the home was planned or unplanned, the implementation was staggered over the next fifteen years (Center for Disease Control and Prevention [CDC], 2017a). While this addition may help to identify the population of births intentionally occurring in the home or birth center, women planning an out of hospital birth but who transferred to and ultimately delivered in a hospital setting may be misattributed as having had a planned hospital birth.

The Oregon legislature passed a bill in 2011 (HB 2380) requiring birth certificates to include the question, "Did you go into labor planning to deliver at home or at a freestanding birthing center?" In 2017, planned out-of-hospital births accounted for 1,758 (4.0%) of the 44,160 births in Oregon. Compared to women who planned hospital births, women who planned out-of-hospital births were more likely to be 30 years or older (61% vs. 49%), White non-Hispanic (85 vs. 67%), and college-educated (49% vs. 32%) (Oregon Health Authority [OHA], 2019).

Table 1. Planned Attendant for Planned Out-of-Hospital Births, Oregon, 2017

Attendant	Number	Percentage
Doctors (MDs) and Doctors of Osteopathic Medicine (DOs)	0	0%
Naturopathic Physicians	238	14%
Certified Nurse Midwives	548	31%
Licensed Direct-Entry Midwives	794	45%
Unlicensed Direct-Entry Midwives	136	8%
Other	42	2%
TOTAL	1,758	100%

Table 1 shows the planned attendants for 2017 planned out-of-hospital births and that 85% of births were attended by one of the three types of midwives. Among planned hospital births, 79% were attended by MDs or DOs, and 21% (n = 8,937) were attended by midwives, all of whom were certified nurse midwives (CNMs). Among the planned out-of-hospital births, 280 (16%) resulted in an intrapartum transfer to a hospital, and another 30 (2%) involved a neonatal transfer (OHA, 2018).

In the U.S., birth attendants with a range of education and training requirements can practice in out-of-hospital settings. Table 2 shows the training and licensing requirements for various birth attendants in Oregon. With prior authorization, the Oregon Health Plan reimburses licensed out-of-hospital birth

providers for prenatal, labor and delivery, and postpartum care (OHA, 2017). Thus, unlicensed direct-entry midwives are not eligible Oregon Health Plan providers. However, unlicensed direct-entry midwives and other attendants constitute nearly 10% of all planned out of hospital births (OHA, 2019).

Table 2. Training and Licensing Requirements for Birth Attendants in Oregon

	Unlicensed Direct-Entry Midwives	Licensed Direct-Entry Midwives (LDEMs)	Certified Nurse Midwives (CNMs)	Naturopathic Doctors (NDs)	Osteopathic or Allopathic Doctors (DOs/MDs)	Chiropractors (DCs)
Accredited Training Program		√* *or judged to have equivalent training		√* *Additional training that meets board standards		√* *Additional training that meets board standards
Undergraduate Degree			√	√	√	√ * Chiropractic school or college
Graduate Degree			√	√	√	
Postgraduate Training					√	
Settings	Home	Home, birth center	Home, birth center, hospital	Home, birth center	Hospital	Home, birth center
Licensing Board	None	Board of Direct-Entry Midwifery	Oregon State Board of Nursing	Oregon Board of Naturopathic Medicine	Oregon Medical Board	Board of Chiropractic Examiners

About 60% of out-of-hospital births were in the mother's home, and about 40% were in freestanding birth centers. There are 15 licensed birth centers in Oregon, mostly located in the Willamette Valley, in the cities of Portland, Aurora, Dundee, Salem, Corvallis, and Lebanon. Southern Oregon birth centers are located in Springfield, Medford, Grants Pass, and Gold Beach (not currently providing birthing services at the center); Klamath Falls and Bend also have birth centers (OHA 2019b). Licensed birth centers in Oregon must have policies and procedures that meet North American Registry of Midwives standards (OAR 333-076-0670). Nine of the 15 licensed birth centers in Oregon are accredited by the American Association of Birth Centers, which has national standards for birth centers.

The level of integration of home birth within health care systems can be a factor in the differences in outcomes among studies of out-of-hospital births from different countries. Regulations of out-of-hospital births, provider qualifications, and accessibility of emergency care could affect the safety of out-of-hospital births. For example, there are stronger midwifery education and training requirements in some countries compared to the U.S., including Iceland (two-year Master of Midwifery after completion of a Bachelor of Science in Nursing), the Netherlands (four-year direct-entry baccalaureate program), and England (18-month postgraduate program after completion of Bachelor of Science in Nursing or three-year direct-entry baccalaureate program). In contrast, Oregon does not have any requirements for college completion for licensed or unlicensed direct-entry midwives (see Table 2 above). Midwives have hospital admitting privileges in some countries (Canada, New Zealand, Norway), and that is not always the case in the U.S. In Oregon, hospitals can grant CNMs admitting privileges. This ability is not granted to licensed or unlicensed direct-entry midwives. Requirements for midwives to carry emergency medical supplies varies across countries, and sometimes varies within a country. These contextual differences could limit the generalizability of findings from international settings to the U.S. (Comeau et al., 2018).

Oregon Public Health Data

Planned out-of-hospital births in Oregon have decreased from 1,903 births (4.6%) in 2012 to 1,636 (4.1%) in 2017 (OHA, 2018). By county, planned out-of-hospital births range from 0.7% (Lake) to 10.1% (Curry) of all births (OHA, 2018). Women planning out-of-hospital birth are more often older, white, married, college-educated, and self-paying for delivery (OHA, 2018). They are also more likely to have inadequate (8.0% vs. 5.1%) or no (1.9% vs. 0.4%) prenatal care (OHA, 2018).

Infants born to low-risk women planning an out-of-hospital birth (i.e., gestational age ≥ 37 weeks to < 42 weeks, singleton, no history of prior cesarean section) have a decreased risk of neonatal intensive care unit (NICU) admission consistently, most recently 17 per 1,000 compared to 31.2 per 1,000 births for planned in-hospital births (OHA 2018). Fetal and neonatal deaths through 6 days of life (i.e., perinatal deaths) remain a rare event for births planned to be in and or out of a hospital. From 2012 to 2017, Oregon perinatal mortality rates were 2.0 per 1,000 for planned out-of-hospital birth compared to 1.7 per 1,000 for planned hospital births (absolute risk difference [ARD 0.03], number needed to harm [NNH] 3,333) (OHA, 2018).

A previous investigation into Oregon perinatal death disparities for planned out-of-hospital births was conducted in 2012 after the Oregon birth certificate was changed to record information about the planned place of birth. In the 2012 analysis, the perinatal mortality rate was 4.0 per 1,000 deaths (compared to 2.1 per 1,000 for planned hospital birth). The analysis revealed that for the eight perinatal deaths in 2012 that occurred in out- of- hospital settings, two of the mothers had inadequate or no prenatal care, four declined ultrasound in pregnancy, five declined group B streptococcal (GBS) screening, and two declined intrapartum GBS prophylaxis for positive carrier status (OHA, 2013). Additionally, for six of the eight deaths, the mothers did not meet the criteria for having a low-risk pregnancy because of either multiple gestations, advanced gestational age (> 41 weeks), or morbid obesity (> 40 body mass index) (OHA, 2013).

Evidence Review

Comparative Studies

Studies reporting findings for each of the five outcomes selected for this coverage guidance are summarized below. A summary of identified comparative studies and methodological quality is reported, followed by a high-level summary of the findings. Greater detail is available in the subsequent paragraphs by U.S.-based or international setting or different birth location (home or birth center if available). Findings from subgroups are reported in a separate section.

Outcome: Mode of Delivery

Summary

Table F1 in Appendix F provides findings of the 18 comparative cohort studies reporting mode of delivery for planned home or birth center births compared to planned hospital births. The majority (14) of studies were of poor methodological quality (Davies-Tuck et al., 2018; Halfdansdottir et al., 2018; Halfdansdottir et al., 2015; Hutton et al., 2016; Hutton et al., 2009; Janssen et al., 2009; Katoaka et al., 2018; Kennare et al., 2010; Laws et al., 2014; Øian et al., 2018; Schroeder et al., 2017; Sprague et al., 2018; Thornton et al., 2017; Wiegerinck et al., 2015). One study was assessed as having fair methodological quality (Monk et al., 2014), and three of good methodological quality (Birthplace in England Collaborative, 2011; Snowden et al., 2015; van der Kooy et al., 2017). An additional six studies reporting findings only by parity, the most common subgroup reported across studies, are in Table F1 (Bailey, 2017; Bolten et al., 2016; Christensen & Overgaard, 2017; Hollowell et al., 2017 Li et al., 2015; van Haaren-ten Haken et al., 2015).

Planned home or birth center birth was consistently associated with a greater likelihood of vaginal birth and reduction in cesarean or operative vaginal delivery compared to planned hospital birth. Studies of higher methodological quality were more likely to account for planned home or birth center transfers to a hospital, thus eliminating differential misclassification bias that would have favored planned home or birth center birth.

Estimates of spontaneous vaginal birth from fair- or good-methodologic-l quality studies reported an absolute risk difference of 20 to 27% in favor of planned home or birth center birth (four to five women needed to treat with planned out-of-hospital birth compared to planned hospital birth to avoid one non-spontaneous vaginal birth). Estimates of operative vaginal or cesarean deliveries from good- or fair-methodological-quality studies observed an absolute risk difference in favor of planned home birth (3% to 17% or 5 to 33 women with planned delivery at home or birth center to avoid one operative vaginal or cesarean delivery). However, comparative evidence on delivery mode for U.S. women is limited. Notably, aside from a single Australian study with a 27% hospital cesarean rate (Kennare et al., 2010), all studies were conducted in sites with fewer hospital cesarean deliveries than typically observed in U.S. hospitals where the cesarean delivery rate was 31% in 2016 (CDC, 2017b).

U.S. Studies

Two studies reported mode of delivery for U.S.-based settings (Snowden et al., 2015; Thornton et al., 2017). In a good-quality study from Oregon, planned home or birth center births were associated with a reduced risk of cesarean delivery compared to planned hospital delivery (absolute risk difference -24%, 95% CI -26.6 to -21.4, $p < 0.001$) and operative vaginal delivery (absolute risk difference -4.7%, 95% CI -

5.8 to -3.5%, p < 0.001) with greater rates of spontaneous vaginal delivery (absolute risk difference 27.5%, 95% CI 24.9 to 30.2, p < 0.001) (Snowden et al., 2015). In a poor-quality separate analysis of planned home or birth center births in 43 states, cesarean deliveries were less common for planned home or birth center births compared to planned hospital births (aOR 0.63, 95% CI 0.50 to 0.79) (Thornton, et al., 2017).

Non-U.S. Studies

Fifteen studies reported comparative mode of delivery outcomes for women by intended place of birth in non-U.S. based settings (Birthplace, 2011; Davies-Tuck et al., 2018; Halfdansdottir et al., 2018; Halfdansdottir et al., 2015; Hutton et al., 2009; Hutton et al., 2016; Janssen et al., 2009; Katoaka et al., 2018; Kennare et al., 2010; Laws et al., 2014; Monk et al., 2014; Schroeder et al., 2017; Sprague et al., 2018; van der Kooy et al., 2017; Wiergerinck et al., 2015). Findings from the two good-quality studies demonstrated increased rates of spontaneous vaginal deliveries (aOR 3.61, 95% CI 2.97 to 4.38) (Birthplace, 2011) and decreased risk of operative or cesarean delivery (aOR 0.77, 95% CI 0.75 to 0.78) (van der Kooy et al., 2017).

Vaginal birth rates were consistently higher for planned home or planned birth center births (over 90% across studies) compared to hospital births in non-U.S. settings. Estimates ranged across studies comparing planned home to planned hospital births from a 30% to 60% reduced odds of cesarean delivery for planned home or birth center births compared to planned hospital birth. Rates of operative vaginal delivery (forceps, vacuum, or both) were reduced for planned home or birth center births compared to planned hospital deliveries. The magnitude of effect ranged across studies from 20% to 60% reduced odds of an operative delivery.

Outcome: Perinatal or Neonatal Mortality

Estimates of fetal or neonatal mortality were not consistently defined across identified studies, encompassing definitions that ranged from 20 weeks gestation through 27 days of life. As able, we provided specific timing of mortality to allow more direct comparisons across studies. If the study authors provided absolute numbers and used an unadjusted odds ratio as their estimate of effect, we provided a calculated unadjusted risk ratio (relative risk) estimate.

Summary

Table F2 provides findings of the 16 comparative studies reporting perinatal mortality outcomes for planned home or birth center births compared to planned hospital births. The majority of these studies were of poor methodological quality (Davies-Tuck et al., 2018; Grigg et al., 2017; Grunebaum, McCullough, Arabin et al., 2017; Hutton et al., 2016; Hutton et al., 2009; Janssen et al., 2009; Katoaka et al., 2018; Kennare et al., 2010; Thornton et al., 2017; Wiegerinck et al., 2015). We assessed four studies as having fair methodological quality (Grunebaum, McCullough, Sapra et al., 2017; Halfdansdottir et al., 2015; Homer et al., 2014; van der Kooy et al., 2011), and two as having good methodological quality (Birthplace, 2011; Snowden, et al., 2015). An additional three studies, reporting findings only by parity, the most common subgroup, are also in Table F2 (Bailey et al., 2017; de Jonge et al., 2013; van Haaren-ten Haken et al., 2015).

International studies consistently observe very low rates of intrauterine, intrapartum, and neonatal mortality that are similar for home, birth center, and hospital settings for all women. However, U.S.-based studies reported increased risks of neonatal death (from 0 to 27 days) for planned home births

compared to planned hospital births using national vital statistics data (Grunebaum, McCullough, Sapra et al., 2017; Snowden et al., 2015). Comparisons of U.S. studies to international settings are limited by differences in outcome definition, provider types, health system delivery, and the reliance on administrative vital statistics in the U.S. that limits ability of authors to adjust for confounding.

U.S. Studies

Three studies reported comparative mortality outcomes for births in U.S.-based settings (Grunebaum, McCullough, Sapra et al., 2017; Snowden, et al., 2015; Thornton et al., 2017). In the first study, a fair-quality study of national vital statistics data, neonatal death from 0 to 27 days was more common in planned home ~~birth (not limited by attendant type)~~ births attended by a midwife (provider type confirmed by personal communication, A. Grunebaum, June 4, 2019)~~-~~compared to planned hospital birth attended by a certified nurse midwife from 2009 to 2013 (0.12% vs. 0.03%, standardized mortality ratio 4.13, 95% CI 3.38 to 4.88) (Grunebaum, McCullough, Sapra et al., 2017). ~~- While this study is limited to intended home births, the birth attendants are not limited to direct entry midwives or certified nurse midwives and as a result outcomes may include intended home births that were unattended by a trained professional (Grunebaum, McCullough, Sapra et al., 2017).~~

The second study, a good-quality study conducted in Oregon, the risk of fetal death (≥ 20 weeks), intrapartum, or neonatal death (0 to 27 days) was higher for planned home and birth center births compared to planned hospital births from 2012 to 2013 (absolute difference 0.158 percentage points, 95% CI 0.055 to 0.261, p = 0.003) (Snowden et al., 2015). Overall, 634 women would need to have a planned hospital birth to avoid one fetal or neonatal death in the planned home or birth center setting.

In the third study, which we rated as poor quality, intrapartum or newborn death (days of life not reported) was similar for planned birth centers and planned hospital births in data from 43 states and 79 birth centers from 2006 to 2011 (OR 0.86, 95% CI 0.09 to 8.3, p = 0.99; RR calculated 0.96, 95% CI 0.54 to 1.70) (Thornton et al., 2017).

Non-U.S. Studies

Seven studies reported comparative mortality outcomes for births in settings outside the U.S. (Davies-Tuck et al., 2018; Grigg et al., 2017; Janssen et al., 2009; Katoaka et al., 208; Kennare et al., 2010; van der Kooy et al., 2011; Wiegerinck, et al., 2015). In a good quality study from the Netherlands, from 2000 to 2007 intrapartum or neonatal deaths (0 to 7 days) did not differ for planned home and planned hospital births attended by a midwife (aOR 1.05, 95% CI 0.91 to 1.21) (van der Kooy et al., 2011).

Estimates from poor-quality studies reported similar findings from the Netherlands (Wiegerinck et al., 2015), British Columbia (Janssen et al., 2009), Australia (Davies-Tuck et al., 2018; Kennare et al., 2010), New Zealand (Grigg et al., 2017), and Japan (Katoaka et al., 2018)..

A cohort of Dutch women from 2005 to 2008 observed similar intrapartum or neonatal deaths (OR 1.30, 95% CI 0.63 to 2.67) (Wiegerinck et al., 2015). Planned home births in British Columbia, Canada, had similar rates of fetal (≥ 20 weeks), intrapartum, or neonatal deaths (0 to 7 days) compared to planned hospital births attended by midwives and a cohort of births attended by physicians, matched for maternal demographics (RR 0.61, 95% CI 0.06 to 5.88; RR 0.55, 95% CI 0.06 to 5.25; respectively) (Janssen et al., 2009). Rates of intrauterine or neonatal death were not statistically different for planned home births compared to planned hospital births in two studies from two states in Australia (Victoria, South Australia) with over 10 years of registry data (Davies-Tuck et al., 2018; Kennare et al., 2010). In a

small study (n < 1,000) from New Zealand, there were no intrauterine, intrapartum, or neonatal deaths (0 to 27 days) for hospital births compared to 3 (0.74%) for planned birth center births (Grigg et al., 2017). No intrauterine or intrapartum deaths were observed for planned birth center births in Japan, compared to 11 (0.3%) for planned hospital births (Katoaka et al., 2018).

Outcome: Neonatal Morbidity

Summary

Neonatal morbidity encompasses a range of outcomes including but not limited to admission to a hospital, admission to a specialized neonatal unit or NICU, low Apgar score at birth, neonatal seizures, hypoxic ischemic encephalopathy, and sepsis. These outcomes were reported individually or as composites, depending on the study.

Table F3 provides findings of the 20 comparative studies reporting neonatal morbidity outcomes for planned home or birth center births compared to planned hospital births. The majority of studies were of poor methodological quality (Davies-Tuck et al., 2018; Grigg et al., 2017; Halfdansdottir et al., 2018; Halfdansdottir et al., 2015; Hitzert et al., 2016; Hutton et al., 2016; Hutton et al., 2009; Janssen et al., 2009; Katoaka et al., 2018; Kennare et al., 2010; Li et al., 2017; Øian et al., 2018; Schroeder et al., 2017; Sprague et al., 2018; Thornton et al., 2017; Wiegerinck et al., 2015).We rated two studies as fair methodological quality (Homer et al., 2014; Monk et al., 2014), and two of good methodological quality (Birthplace in England Collaborative, 2011; Snowden, et al., 2015). An additional five studies reporting findings only by parity, the most common subgroup, are in Table F3 (Bailey et al., 2017; Christensen & Overgaard, 2017; de Jonge et al., 2015; Hollowell et al., 2017; Li et al., 2015; van Haaren-ten Haken et al., 2015).

Three studies reported comparative neonatal morbidity outcomes for women in U.S. settings. Two reported single state findings from Oregon (Snowden et al., 2015) and South Carolina (Li et al., 2017). The third reported outcomes from freestanding birth centers in 43 states (Thornton et al., 2017). Findings from these U.S. studies demonstrated a small but increased risk of seizures and need for ventilator support in Oregon from 2012 to 2013 data (Snowden et al., 2015). Older data from South Carolina also demonstrated greater rates of neonatal morbidity for planned home or birth center births versus planned hospital births without formal statistical analysis, including neonatal seizures (0.15% vs. 0.0% vs. 0.02%) and convulsions (0.61% vs. 0.24% vs. 0.24%) (Li et al., 2017).

Generally, findings from international studies of planned home or birth center births compared to planned hospital births did not observe statistically significant differences across neonatal morbidity outcomes. However, in subgroup analyses, nulliparous women appeared to experience a greater likelihood of neonatal morbidity in the Birthplace study from England (i.e., Birthplace composite outcome) even after restricting to the lowest-risk group (Birthplace et al., 2011; Hollowell et al., 2017). However, that relationship was not consistent across a study from Australia (Homer et al., 2014).

U.S. Studies: Planned Home and Birth Center Settings

A study conducted in Oregon from 2012 to 2013 found that the risk of admission to an NICU was lower for planned home or birth center births compared to planned hospital births (absolute difference -0.85 percentage points, 95% CI -1.57 to -0.14, NNT = 117) (Snowden et al., 2015). The risk of all the following outcomes was higher for planned home or birth center births compared to planned hospital births:

- A lower Apgar score at five minutes of less than seven (unadjusted 2.3% vs. 1.8%, adjusted absolute difference 0.50, 95% CI 0.07 to 0.93, NNH = 200) and less than four (unadjusted 0.6% vs. 0.4%, adjusted absolute difference 0.18, 95% CI 0.00 to 0.37, NNH = 555)
- Neonatal seizures (unadjusted 0.13% vs. 0.04%, absolute difference, 0.07 percentage points, 95% CI 0.02 to 0.13, calculated NNH = 1,428)
- Ventilator support (unadjusted 3.8% vs. 3.3%, adjusted absolute difference, 1.05 percentage points, 95% CI 0.48 to 1.62, calculated NNH = 95) (Snowden et al., 2015)

In a study conducted in South Carolina from 2003 to 2013, the frequency of neonatal seizures and convulsions was higher for planned home births (0.15%, 0.61% respectively) compared to planned birth center (none, 0.24%) and hospital settings (0.02%, 0.24%); no formal statistical analysis was reported (Li et al., 2017).

U.S. Studies: Birth Center Setting

In a poor-quality study of birth centers in 43 states, women planning a birth center birth experienced similar odds of a lower Apgar score at five minutes (score 3 to 7; aOR 1.60, 95% CI 0.82 to 3.16), and short-term positive pressure ventilation (< 10 minutes; aOR 1.31, 95% CI 0.95 to 1.82) compared to those planning a hospital birth (Thornton et al., 2017). The odds of needing a newborn sepsis evaluation was reduced for planned birth center birth (aOR 0.51, 95% CI 0.32 to 0.81). The odds of a composite outcome consisting of mortality, hypoxic injury, low Apgar, seizure, respiration support, and meconium aspiration syndrome were also similar across settings (aOR 1.44, 95% CI 0.95 to 1.82).

Non-U.S. Studies: Home Birth Setting

The odds of a composite outcome encompassing death after the start of care in labor, early neonatal death, neonatal encephalopathy, meconium aspiration syndrome, brachial plexus injury, and fractured humerus or clavicle were similar across planned home and planned hospital births in a good-quality study from England (aOR 1.16, 95% CI 0.76 to 1.77) (Birthplace, 2011) and a fair-quality study from Australia (aOR 1.06, 95% CI 0.44 to 2.56) (Homer et al., 2014). The odds of a composite outcome of Apgar score less than four at five minutes and need for positive pressure ventilation or chest compressions were similar for planned home and planned hospital births in two poor-quality studies from Ontario, Canada (RR 0.95, 95% CI 0.6 to 1.48) (Hutton et al., 2016), which is consistent with findings from an earlier cohort (RR 0.82, 95% CI 0.66 to 1.01) (Hutton et al., 2009).

In a poor-quality study conducted in the Netherlands, planned home births were associated with decreased odds of NICU admission for over 24 hours (OR 0.64, 95% CI 0.43 to 0.95), and similar odds of an Apgar score less than seven at five minutes (OR 0.93, 95% CI 0.75 to 1.15) (Wiegerinck et al., 2015). In a poor-quality study from the state of South Australia conducted in a 14-year period, the odds of Apgar score less than seven at five minutes (aOR 1.43, 95% CI 0.66 to 3.07) and needs for specialized neonatal care (aOR 0.80, 95% CI 0.62 to 1.03) were not different for planned home and planned hospital births (Kennare et al., 2010). The odds of an Apgar score less than seven at five minutes (aOR 0.82, 95% CI 0.27 to 2.52), need for respiratory support (aOR 0.97, 95% CI 0.63 to 1.50), and admission to a neonatal nursery unit (aOR 1.44, 95% CI 0.70 to 2.96) were similar for planned midwifery birth center births and planned obstetric hospital births in a small, poor-quality study from New Zealand (n < 1,000) (Grigg et al., 2017).

Infants whose mothers had planned home births in British Columbia, Canada, experienced a decreased risk of birth weight < 2,500g (RR 0.44, 95% CI 0.25 to 0.78), a lower rate of need for resuscitation (RR 0.23, 95% CI 0.14 to 0.37), and birth trauma (RR 0.26, 95% CI 0.11 to 0.58) compared to midwife-attended hospital births. Relative risk of an Apgar score less than seven at five minutes (RR 0.92, 95% CI 0.58 to 1.47), asphyxia (RR 0.79, 95% CI 0.30 to 2.05), meconium aspiration (RR 0.83, 95% CI 0.38 to 1.81), seizures (RR 0.61, 95% CI 0.12 to 3.03), and assisted ventilation over 24 hours (RR 1.02, 95% CI 0.34 to 3.04) were not statistically different across settings in a poor-quality study (Janssen et al., 2009).

The frequency of Apgar scores < five at five minutes (0.9% vs. 1.2%, p = 0.08), hypoxic ischemic encephalopathy (0% vs. 0.2%, p = 0.44), and other perinatal morbidities were not statistically different in a poor-quality study conducted in the state of Victoria in Australia from 2000 to 2008; no formal statistical analysis was reported (Davies-Tuck et al., 2018). There were more admissions to an NICU (0.4% vs. 0.2%, p = 0.03) among planned home births. Admission to a special care nursery 1.8% vs. 8.3%, p < 0.001), birth trauma (1.4% vs. 6.6%, p < 0.001*),* intrauterine hypoxia (1.5% vs. 5.8%, p < 0.001), and composite morbidity (e.g., NICU admissions, birth trauma, hypoxia) (3.6% vs. 13.4%, p < 0.001) were less common in planned home births than planned hospital births.

Non-U.S. Studies: Birth Center Settings

In fair- to good-quality studies, the odds of a composite outcome encompassing stillbirth after the start of care in labor, early neonatal death, neonatal encephalopathy, meconium aspiration syndrome, brachial plexus injury, and fractured humerus or clavicle were similar across planned birth center and planned hospital births in England (aOR 0.92, 95% CI 0.58 to 1.46) (Birthplace, 2011) and Australia (aOR 0.87, 95% CI 0.69 to 1.10) (Homer et al., 2014).

In a poor-quality study, admission to an NICU was similar (aRR 1.3, 95% CI 0.9 to 2.0) for planned birth center births and planned midwife-attended hospital births in Ontario, Canada, in the first year after the introduction of the birth center (2014 to 2015) (Sprague et al., 2018).

Outcome: Maternal Harm

Summary

Outcomes related to maternal harm include but are not limited to third or fourth degree perineal injuries or obstetric anal sphincter injuries, immediate postpartum hemorrhage, blood transfusion, admission to a hospital or an intensive care unit (ICU), infection, uterine rupture, and manual removal of the placenta. Definitions for outcomes varied across studies, particularly for postpartum hemorrhage and blood transfusion; some studies only reported findings for large transfusion volume (i.e., over 4 units).

Table F4 provides findings of the 20 comparative studies reporting maternal harm outcomes for planned home or birth center births compared to planned hospital births. The methodological quality of the included studies was largely poor (Davies-Tuck et al., 2018; Grigg et al., 2017; Halfdansdottir et al., 2018; Halfdansdottir et al., 2015; Hutton et al., 2016; Hutton et al., 2009; Janssen et al., 2009; Katoaka et al., 2018; Kennare et al., 2010; Laws et al., 2014; Øian et al., 2018; Schroeder et al., 2017; Thornton et al., 2017; Wiegerinck et al., 2015). We assessed four studies as having fair methodological quality (de Jonge et al., 2013; Davis et al., 2012; Monk et al., 2014; Nove et al., 2012;) and two as good methodological quality (Birthplace in England Collaborative, 2011; Snowden et al., 2015). An additional five studies

reported findings only by parity and are also in Table F4 (Bailey, 2017; Bolten et al., 2016; Christensen & Overgaard, 2017; Hollowell et al., 2017; van Haaren-ten Haken et al., 2015).

Only two of the 20 included studies reported outcomes for U.S.-based settings (Snowden et al., 2015; Tilden et al., 2017). Overall, estimates of maternal harm for planned home or birth center births are limited in the U.S. because they rely on vital statistics data. In the two included studies, planned home or birth center births observed a decreased risk of third or fourth degree perineal tear with an increased risk of blood transfusion (Snowden et al., 2015; Tilden et al., 2017). In international studies, the authors observed mixed results in estimates of maternal harm, often with no statistical differences in harms or a reduced frequency in the home birth group.

U.S. Studies

In a good-quality study conducted in Oregon using data from 2012 to 2013, women planning a home or birth center birth experienced a decreased risk of severe perineal lacerations (adjusted risk difference 0.54 in favor of planned home or birth center, 95% CI −0.98 to −0.11, p = 0.02), but also had an increased risk of blood transfusion (adjusted risk difference 0.27 favoring planned hospital birth, 95% CI 0.08 to 0.46 p = 0.006) (Snowden et al., 2015). In a poor-quality study, postpartum hemorrhage frequency was not statistically different for planned birth center and planned hospital groups (aOR 1.25, 95% CI 0.99 to 1.58) (Thornton et al., 2017).

Non-U.S. Studies: Home Births

Estimates of third or fourth degree tears were similar in one good-quality study (1.9% vs. 3.2%, aOR 0.77, 95% CI 0.57 to 1.05)((Birthplace, 2011) and one poor-quality study (1.0% vs. 1.8%, aOR 0.77, 95% CI 0.34 to 1.74, p = 0.53 (Kennare et al., 2010) and decreased in three poor-quality studies (1.0% vs. 2.0%, p < 0.001; 1.3% vs. 2.3%, RR 0.57, 95% CI 0.47 to 0.69; 1.2% vs. 2.9%, RR 0.43, 95% CI 0.29 to 0.63) (Davies-Tuck et al., 2018; Hutton et al., 2016; Janssen et al., 2009) for women in planned home birth settings compared to planned hospital births. Obstetric anal sphincter injuries were less common in planned home birth groups in two poor-quality studies (2.5% vs. 3.1%, p = NR; 2.6% vs. 3.0%, aOR 0.97, 95% CI 0.41 to 2.27) (Halfdansdottir et al., 2018; Halfdansdottir et al., 2015).

In eight poor- to fair-quality studies conducted in multiple countries, women in the planned home birth group were less likely to have a documented postpartum hemorrhage (9.1% vs. 12.9%, p < 0.001; 29.2% vs. 39.9%, p = NR; 3.0% vs. 3.7%, aOR 0.64, 95% CI 0.24 to 1.67; 0.8% vs. 1.2%, RR 0.68, 95% CI 0.49 to 0.96; 2.5% vs. 3.0%, RR 0.82, 95 % CI 0.70 to 0.96; 3.8% vs. 6.0%, RR 0.43, 95% CI 0.29 to 0.63; 0.38% vs. 1.04%, aOR 0.4, 95% CI 0.3 to 0.6, p < 0.001; 4% vs. 5%, OR 0.68, 95% CI 0.62 to 0.74, p < 0.001)(Davies-Tuck et al., 2018; de Jonge et al., 2013; Halfdansdottir et al., 2015; Hutton et al., 2009; Hutton et al., 2016; Janssen et al., 2009; Nove et al., 2012; Wiegerinck et al., 2015). The frequency of estimated blood loss at time of delivery of ≥ 1000 mL was not statistically different in 2 poor to fair quality studies (1.0% vs. 1.1%, aRR 0.93, 95% CI 0.49 to 1.74, p = 0.97; 4.4% vs. 5.5%, aOR 0.72, 95% CI 0.47 to 1.11, p = 0.14)(Davis et al., 2012; Kennare et al., 2010).

Estimates of the need for blood transfusion were similar for planned home and hospital births (0.6% vs. 1.2%, aOR 0.72, 95% CI 0.47 to 1.12) in a good-quality study (Birthplace, 2011). The frequency of blood transfusion was less common in two poor- to fair-quality studies (de Jonge et al., 2013; no formal statistical analysis reported; Halfdansdottir et al., 2015). Manual removal of the placenta was less frequent for planned home birth groups; however, neither study reported statistical analysis (de Jonge et al., 2013; Janssen et al., 2009).

In 2 poor to fair quality studies, women in the planned home birth group were less likely to be admitted to a hospital or an ICU (0.2% vs. 0.6%, p = 0.002; 0.3% vs. 0.7%, p = NR) (Davies-Tuck et al., 2018; de Jonge et al., 2013). Frequency of maternal postpartum infection was similar for planned home and hospital births in a single poor-quality study without statistical analysis (Janssen et al., 2009).

Non-U.S. Studies: Birth Centers

Findings from birth centers related to third or fourth degree perineal lacerations observed similar rates (2.2% vs. 1.8%, aOR 1.43, 95% CI 0.46 to 4.42, p > 0.05) (Grigg et al., 2017) or lower rates compared to planned hospital births (2.5% vs. 3.0%, aOR 0.85, 95% CI 0.74 to 0.99) (Law et al., 2014). Overall, perineal laceration rates were lower in the birth center setting compared to planned hospital (40.9% vs. 66.1%, aOR 0.38, 95% CI 0.35 to 0.42; Katoaka et al., 2018).

Studies demonstrated conflicting outcomes for frequency of blood loss ≥ 1,000 ml for planned birth center births compared to planned hospital births: higher in one study (3.6% vs. 2.4%, aOR 1.77, 95% CI 1.35 to 2.32) (Katoaka et al., 2018), similar in two studies (5.9% vs. 4.6%, aOR 1.74, 95% CI 0.85 to 3.59, p > 0.05; 3.6% vs. 139 4.4%, aOR 0.88, 95% CI 0.52 to 1.47, p = 0.618) (Grigg et al., 2017; Monk et al., 2014), and lower in another study (8.6% vs. 10.6%, aOR 0.79, 95% CI 0.73 to 0.86) (Laws et al., 2014). Women planning birth center births were also less likely to have a uterine rupture (0.03% vs. 0.08%, aOR 0.17, 95% CI 0.04 to 0.73), postpartum infection (1.0% vs. 1.4%, aOR 0.74, 95% CI 0.59 to 0.92), and ICU admission (0.02% vs. 0.08%, aOR 0.12, 95% CI 0.02 to 0.89) (Laws et al., 2014).

Outcome: Breastfeeding

Summary

Table F5 provides findings of the nine comparative studies reporting breastfeeding outcomes for planned home or birth center births compared to planned hospital births. The majority of the identified studies are of poor methodological quality (de Cock et al., 2015; Grigg et al., 2017; Hutton et al., 2016; Hutton et al., 2009; Laws et al., 2014; MacDorman & Declercq, 2016; Thornton et al., 2017); two are of fair methodological quality (Monk et al., 2014; Quigley et al., 2016).

Two of the studies provided outcomes for U.S.-based settings (MacDorman & Declercq, 2016; Thornton et al., 2017). Across all studies, the timing of breastfeeding outcomes ranged from rates of initiation in the birth setting to exclusive breastfeeding at six months. Only two studies (Hutton et al., 2016; Hutton et al., 2009) provided outcomes for nulliparous and multiparous women separately, with the remaining studies reporting aggregate outcomes for all women.

Early rates of breastfeeding (initiation, at time of discharge, or within the first two weeks) were consistently higher for planned home or birth centers compared to hospital births. However, estimates that control for confounding and examine breastfeeding at a time point further from delivery did not observe differences between planned home birth, birth center, and planned hospital groups in international settings. There were no U.S.-based studies with comparative breastfeeding outcomes that reported data past discharge from the birth setting. A retrospective survey reported that rates of exclusive breastfeeding at six months were higher for individuals reporting a planned home birth, but the findings were well below World Health Organization (WHO) goals and based on two surveys with low participation rates (Quigley et al., 2016).

U.S. Studies

Two poor-quality studies reported comparative estimates of breastfeeding by place of birth in the U.S. (MacDorman & Declercq, 2016; Thornton et al., 2017). Breastfeeding initiation rates from birth certificate data from 2004 to 2014 were higher for planned home or birth center births, 97.9% and 98.1% respectively, compared to 80.8% for planned hospital births; no formal statistical analysis was provided (MacDorman & Declercq, 2016). Analysis of data from the American Association of Birth Centers from 2006 to 2011 observed that infants born in a planned birth center were more likely to be breastfed at the time of discharge compared to infants born in a planned hospital birth (94.5% vs. 72.2%, aOR 9.12, 95% CI 7.45 to 11.16, p = NR) (Thornton et al., 2017).

Non-U.S. Studies

Seven poor- to fair-quality studies reported comparative estimates of breastfeeding by place of birth in Australia, Canada, Ireland, the Netherlands, New Zealand, and the United Kingdom (de Cock et al., 2015; Grigg et al., 2017; Hutton et al., 2016; Hutton et al., 2009; Laws et al., 2014; Monk et al., 2014; Quigley et al., 2016). Largely, rates of breastfeeding were higher for planned home birth groups compared to planned hospital births across all time points. Exclusive breastfeeding at six months of life was reported by a single fair-quality study using retrospective data from Irish and UK national surveys (Quigley et al., 2016). In Ireland, 22% of infants from a planned home birth group compared to 9% of those with planned hospital births were exclusively breastfed at six months (aOR 2.77, 95% CI 1.78 to 4.33, p = 0.0073). In the United Kingdom, the proportion of infants with exclusive breastfeeding at six months declined, but was still higher for the planned home birth cohort compared to the planned hospital cohort (4% vs. 1%, aOR 2.24, 95% CI 1.14 to 4.03, p < 0.001).

Although the proportion of infants exclusively breastfed at a median of five weeks postpartum was lower for planned hospital births compared to planned home births in a small study from the Netherlands (n = 712), the difference was not statistically significant after adjusting for potential confounders of age, parity, education level, ethnicity, smoking, and birth weight (68.5% vs. 75%, aOR 0.79, 95% CI 0.53 to 1.18) (de Cock et al., 2015). Similarly, in New Zealand, rates of exclusive breastfeeding at six weeks were statistically similar for planned birth in primary midwifery units (i.e., birth centers) compared to tertiary maternity hospitals (i.e., hospital births) after adjusting for potential confounders of age, smoking, parity, term, and need for augmentation or induction (80.6% vs. 78.6%, aOR 1.14, 95% CI 0.76 to 1.70, p > 0.05) (Grigg et al., 2017).

A study from Canada found that breastfeeding rates were higher at 10 days for planned home compared to planned hospital births (87.8% vs. 78.9%, RR 1.11, 95% CI 1.10 to 1.13) (Hutton et al., 2016). The likelihood of breastfeeding at discharge was higher for planned home births in Australia in both the studies by Laws et al. (aOR 2.32, 95% CI 2.04 to 2.65, p = NR) and Monk et al. (aOR 1.59, 95% CI 1.14 to 2.24 p = 0.007), after adjusting for potential confounders.

Subgroup Findings

The following section outlines comparative findings across identified subpopulations or subgroups for all outcomes prioritized for this coverage guidance. Reported subgroups are parity, maternal age, other risk factors, history of cesarean section, breech position, gestational age, and race/ethnicity. Studies commonly reported outcomes for all participants, then separately reported outcomes for nulliparous

and multiparous women. Additionally, studies reported outcomes for a specific subpopulation (e.g. women with a prior cesarean delivery, high-risk pregnancy [based on differing definitions]).

A summary is provided for each subgroup, followed by specifics for each outcome. As above, findings are reported for U.S-based studies separately from non-U.S. studies. Findings from U.S-based studies by subgroup only report neonatal mortality or morbidity outcomes. Please see the tables in Appendix G for detailed findings.

Subgroup: Parity

Summary

Comparisons by parity were the most commonly reported subgroup and included mode of delivery, fetal or neonatal mortality, neonatal harm, maternal harm, and breastfeeding. Findings from U.S. settings were limited to neonatal mortality rates from two studies. Both studies observed higher rates of neonatal death for all women; nulliparous women were at the highest risk. International studies consistently observed more optimal delivery mode outcomes and similar intrapartum and early neonatal death rates across birth settings for nulliparous and multiparous women.

Rates of neonatal harm, specifically the Birthplace composite outcome, were higher for nulliparous women in the planned home but not planned birth center setting compared to planned hospital setting in the original Birthplace cohort study. This finding was not observed in a study of similar quality conducted in Australia.

Mode of Delivery

No U.S.-based study reported comparative mode of delivery outcomes by parity. In non-U.S. studies, nulliparous and multiparous women were likely to experience more optimal delivery mode outcomes (i.e., increased odds of vaginal delivery, lower odds of instrumental [forceps or vacuum assisted] or cesarean delivery) in the planned home or birth center groups compared to women in planned hospital births, based on good- or fair-methodological-quality studies.

Non-U.S. Studies: Home Birth Settings

Ten non-U.S.-based studies reported mode of delivery outcomes by parity (Bailey et al., 2017; Bolten et al., 2016; Christensen & Overgaard, 2017; Halfdansdottir et al., 2017; Hollowell et al., 2017; Hutton et al., 2009; Hutton et al., 2016; Janssen et al., 2009; Li et al., 2015; van Haaren-ten Haken et al., 2015).

Nulliparous and multiparous women planning a home birth were more likely to experience a straightforward vaginal birth (one without instrumentation, a third or fourth degree tear, or requiring blood transfusion) than similar women planning hospital birth in the good-quality Birthplace study conducted in England (aRR 1.63, 95% CI 1.47 to 1.81 for nulliparous women; aRR 1.20, 95% CI 1.16 to 1.23 for multiparous) (Li et al., 2015).

Across studies of poor quality, nulliparous and multiparous women experienced more optimal delivery mode outcomes in the planned home birth group (i.e., increased odds of vaginal delivery, lower odds of instrumental or cesarean delivery) compared to planned hospital birth; the magnitude of the benefit was greater for multiparous women across all modes for planned home birth compared to planned hospital birth; for example, a study conducted in the Netherlands found greater odds of spontaneous vaginal delivery for multiparous women (aOR 2.29, 95% CI 1.21 to 4.36 compared to aOR 1.38, 95% CI 1.08 to 1.76 for nulliparous women, no formal statistical comparison reported) (Bolten et al., 2016).

Similar benefits were observed in nulliparous and multiparous women in Ontario, Canada (Hutton et al., 2016). In studies only reporting comparative rates, with no formal statistical analysis, women who had planned home births experienced lower cesarean delivery rates in British Columbia (Janssen et al., 2009) and Iceland (Halfdansdottir et al., 2015), and in older data from Ontario, Canada (Hutton et al., 2009).

Non-U.S. Studies: Birth Center Settings

Three non-U.S. based studies reported outcomes from birth center settings: two studies were poor quality (Bailey et al., 2017; Christensen & Overgaard, 2017) and one was fair quality (Hollowell et al., 2017). Nulliparous and multiparous women planning to give birth at a freestanding birth center in the United Kingdom were more likely to have a spontaneous vaginal delivery and less likely to have an instrumental delivery, but had similar odds of cesarean delivery compared to planned hospital births after adjusting for maternal characteristics and complicating conditions at the start of labor (Hollowell et al., 2017).

Unadjusted estimates from Denmark demonstrated greater odds of uncomplicated birth, one "leaving both mother and infant in good condition" and lower odds of instrumental delivery for nulliparous and multiparous women planning a birth center birth compared to a matched hospital birth group. The odds of uncomplicated birth were greater for multiparous women than for nulliparous women (OR 2.9, 95% CI 2.0 to 4.2 compared to OR 2.2, 95% CI 1.4 to 3.3); nulliparous women experienced a greater reduction in the odds of cesarean delivery (OR 0.4, 95% CI 0.2 to 0.9 compared to OR 0.8, 95% CI 0.3 to 2.2). The reduction in instrumental delivery was similar for both groups (OR 0.4, 95% CI 0.2 to 0.7 nulliparous, OR 0.3, 95% CI 0.1 to 0.9 multiparous) (Christensen & Overgaard, 2017).

Nulliparous and multiparous women planning a birth center birth in New Zealand experienced similar reductions in odds of instrumental delivery, with a small reduction in the risk of cesarean delivery for multiparous women (aOR 0.34, 95% CI 0.26 to 0.46) compared to that for nulliparous women (aOR 0.51, 95% CI 0.44 to 0.59) (Bailey et al., 2017).

Fetal or Neonatal Mortality

Two studies of poor and fair quality reported comparative mortality outcomes by parity in the U.S. from 2008 to 2012 (Grunebaum, McCullough, Arabin et al., 2017) and 2009 to 2013 (Grunebaum, McCullough, Sapra et al., 2017). In the first study, neonatal death (0 to 27 days) was higher in the planned home birth group (attended by a certified nurse or other midwife) compared to hospital births attended by a certified nurse midwife for nulliparous (RR 5.34, 95% CI 3.9 to 7.4) and multiparous women (RR 3.1, 95% CI 2.4 to 4) (Grunebaum, McCullough, Arabin et al., 2017). The authors did not report adjusted estimates to account for possible confounding.

The findings were similar for the later time period (2009 to 2013) with a higher standardized mortality ratio (SMR) in planned home births for nulliparous (SMR 6.06, 95% CI 4.30 to 7.83) and multiparous women (SMR 3.49, 95% CI 2.68 to 4.30) (Grunebaum, McCullough, Sapra et al., 2017). The planned home birth cohort in this analysis was not limited by provider type to certified nurse or other midwife, as above, and included births that were purposely not attended by a trained professional. Estimates in this study were reported as standardized mortality ratios, attempting to account for parity and other maternal demographics in comparisons.

Seven non-U.S.-based studies reported comparative perinatal mortality outcomes by parity in Australia (Homer et al., 2014), Iceland (Halfdansdottir et al., 2015), New Zealand (Bailey et al., 2017), the

Netherlands (de Jonge et al., 2015; van Haaren-ten Haken et al., 2015) and Ontario, Canada (Hutton et al., 2016; Hutton et al., 2009). Of these, two fair-quality studies reported findings by parity (Homer et al., 2014; de Jonge et al., 2015). Nulliparous women in Australia did not experience statistically different rates of neonatal death across birth settings (home vs. hospital: aOR 2.48, 95% CI 0.34 to 18.02; birth center vs. hospital: aOR 0.99, 95% CI 0.52 to 1.88 (Homer et al., 2014). No cases of intrapartum or neonatal deaths (0 to 7 days) were observed for multiparous women in home or birth center settings. In the same eight-year time period, 96 events were observed in planned hospital births for multiparous women (0.103% of births; due to absence of deaths in the home and birth center groups, no further statistical analysis was performed).

In a study conducted in the Netherlands, the risk of intrapartum death was similar across settings for nulliparous (aOR 1.02, 95% CI 0.76 to 1.37) and multiparous women (aOR 1.31, 95% CI 0.89 to 1.94). Neonatal death, 0 to 7 days, was also similar across settings by parity (nulliparous: aOR 0.98, 95% CI 0.70 to 1.36; multiparous: aOR 1.07, 95% CI 0.70 to 1.65). Neonatal death, 0 to 27 days, also did not differ by setting for nulliparous and multiparous women (aOR 0.97, 95% CI 0.70 to 1.34; aOR 1.07, 95% CI 0.70 to 1.62, respectively) (de Jonge et al., 2015).

Additional findings from poor-quality studies either observed similar rates of neonatal death or no cases of death. Intrapartum and neonatal death from 0 to 27 days were similar for planned home and planned hospital births for nulliparous women (RR 1.17, 95% CI 0.39 to 3.47) and multiparous women (unadjusted RR 0.67, 95% CI 0.11 to 3.99) in Ontario, Canada (Hutton et al., 2016). Death from peripartum hypoxia was similar in planned birth center and planned hospital births for nulliparous women (unadjusted OR 1.30, 95% CI 0.46 to 3.23; calculated RR 1.27, 95% CI 0.65 to 2.49) and multiparous women in New Zealand (OR 1.70, 95% CI 0.47 to 5.90) (Bailey et al., 2017). Two small studies (n < 500) did not observe any deaths across birth settings for multiparous women in the Netherlands or Iceland (van Haaren-ten Haken et al., 2015; Halfdansdottir et al., 2015).

Neonatal Morbidity

No U.S. studies reported comparative neonatal morbidity outcomes by parity. Six non-U.S. studies provided comparative neonatal morbidity outcomes by parity (Bailey et al., 2017; Christensen & Overgaard, 2017; de Jonge et al., 2015; Hollowell et al., 2017; Li et al., 2015; van Haaren-ten Haken et al., 2015). Five studies provided overall estimates with separate analyses by parity (Birthplace, 2011; Homer et al., 2014; Halfdansdottir et al., 2015; Hutton et al., 2016; Hutton et al., 2009). Reported outcomes included the Birthplace composite outcome (stillbirth after the start of care in labor, early neonatal death, neonatal encephalopathy, meconium aspiration syndrome, brachial plexus injury, fractured humerus or clavicle), NICU admission, and Apgar scores.

Home Birth Setting

In the good-quality Birthplace study (Birthplace, 2011) the composite outcome did not differ by setting (see Outcome: Neonatal Morbidity section). When stratified by parity, for multiparous women, there was no difference across birth settings (aOR 0.72, 0.41 to 1.27) compared to all study participants (aOR 1.16, 95% CI 0.76 to 1.77). Infants of nulliparous women were at increased odds for the composite outcome in the planned home birth group compared to planned hospital group (9.3% vs. 5.3%, aOR 1.75, 1.07 to 2.86). In a fair-quality study conducted in Australia (2000 to 2008), the Birthplace composite for all births was not different in planned home compared to planned hospital births when

stratified by parity (nulliparous women: aOR 1.72, 95% CI 0.64 to 4.63 compared to aOR 0.47, 95% CI 0.07 to 3.38) (Homer et al., 2014).

In a good-quality secondary analysis of the Birthplace cohort, adding admission to an NICU for over 48 hours (beginning within 48 hours of birth) to the composite outcomes for nulliparous and multiparous women did not result in a difference across planned home and planned hospital settings for nulliparous women (aRR 0.60, 95% CI 0.25 to 1.43); multiparous women remained at lower risk (aRR 0.47, 95% CI 0.25 to 0.88) (Li et al., 2015).

In a fair-quality study conducted in the Netherlands, low Apgar scores and admission to NICU (within 28 days) did not differ across birth settings for nulliparous women (aOR 0.95, 95% CI 0.87 to 1.02; aOR 1.05, 95% CI 0.92 to 1.18 respectively). Multiparous women were at decreased odds of an Apgar score less than seven at five minutes (aOR 0.77, 95% CI 0.69 to 0.86), similar odds for an Apgar score less than four at five minutes (aOR 0.92, 95% CI 0.70 to 1.20), and decreased odds of admission to NICU within 28 days (aOR 0.79, 95% CI 0.66 to 0.93) (de Jonge et al., 2015).

In a poor-quality study from Ontario, Canada, the odds of a composite outcome consisting of intrapartum or neonatal mortality, Apgar score less than four at five, positive pressure ventilation, or chest compressions remained similar in subgroup analyses by parity (nulliparous: RR 1.04, 95% CI 0.61 to 1.78; multiparous: RR 0.79, 95% CI 0.36 to 1.73) (Hutton et al., 2016).

In a poor-quality study, the frequency of NICU admission, an Apgar score less than seven at five minutes, and need for resuscitation was quantitatively similar (no statistical analysis provided) in planned home and planned hospital settings in Iceland. When stratified by parity, nulliparous women experienced greater frequency of NICU admission (18.8% vs. 12%), an Apgar score less than seven at five minutes (6.3% vs. 3.1%), and need for neonatal resuscitation (6.3% vs. 1.6%); however, no formal statistical analysis was reported (Halfdansdottir et al., 2015).

Birth Center Setting

In the fair-quality Birthplace study, the composite outcome was similar for planned birth center and planned hospital births for nulliparous women (0.045% vs. 0.027%, aOR 0.96, 95% CI 0.51 to 1.82, p = 0.91) and multiparous women (0.047% vs. 0.024%, aOR 1.14, 95% CI 0.52 to 2.50, p = 0.745) (Hollowell et al., 2017).

In a fair-quality study from Australia analyzing data from 2000 to 2008, the Birthplace composite outcome) for all women (aOR 0.87, 95% CI 0.69 to 1.10) remained similar for nulliparous women in planned birth center births compared to planned hospital births (nulliparous women: aOR 1.04, 95% CI 0.81 to 1.34). Infants of multiparous women experienced a reduction in the odds of the composite outcome (aOR 0.45, 95% CI 0.26 to 0.81) (Homer et al., 2014).

Admissions to NICUs were lower for planned birth center births compared to planned hospital births in a poor-quality New Zealand study, but the difference was only statistically significant for nulliparous women (aOR 0.70, 0.58 to 0.86 compared to aOR 0.85, 95% CI 0.71 to 1.01 for multiparous women) (Bailey et al., 2017).

Maternal Harm

No U.S-based studies reported comparative maternal harm outcomes by parity. In one fair-quality non-U.S. study, a composite measure of severe acute maternal morbidity was lower for planned home birth

compared to planned hospital birth (1.5% vs. 2.7%, no statistical analysis reported). When analyzed by parity, there was no statistically significant difference for nulliparous women (aOR 0.77, 95% CI 0.56 to 1.06); reduced odds were observed for multiparous women (aOR 0.43, 95% CI 0.29 to 0.63, RRR 58.3%, 95% CI 33.2% to 87.5%) (de Jonge et al., 2013). Similarly, for the following outcomes, a statistically significant reduction in the odds was only observed in multiparous women in the planned home birth group compared to planned hospital birth:

- Need for a blood transfusion of four or more units (0.09% vs. 0.19%, aOR 0.45, 0.30 to 0.68, RRR 52.7, 95% CI 24.9 to 85.3)
- Postpartum hemorrhage (1.96% vs. 3.76%, aOR 0.50, 95% CI 0.46 to 0.55, RRR 47.9%, 95% CI 41.2% to 54.7%)
- Manual removal of the placenta (0.85% vs. 1.96%, aOR 0.41, 95% CI 0.36 to 0.47, RRR 56.9%, 95% CI 47.9% to 66.3%) (de Jonge et al., 2013).

In one poor-quality study, the need for blood transfusion was lower for planned birth center births compared to planned hospital births for nulliparous (0.9% vs. 2.4%, aOR 0.40, 95% CI 0.25 to 0.62) and multiparous women (0.4% vs. 1.0%, aOR 0.54, 95% CI 0.35 to 0.83) (Bailey et al., 2017).

Estimates of obstetric anal sphincter injury were inconsistent. Two poor-quality studies observed either an increased risk in planned home birth groups compared to planned hospital for nulliparous women (5.3% vs. 3.2%, aOR 1.75, 95% CI 1.01 to 3.03) (Bolten et al., 2016) or decreased risk (3.1% vs. 4.7%, RR 0.67, 95% CI 0.53 to 0.83) (Hutton et al., 2016). One poor-quality study observed similar rates of obstetric anal sphincter injury in the planned birth center group compared to planned hospital birth for nulliparous (OR 0.9, 95% CI 0.4 to 2.0) and multiparous women (OR 0.6, 95% CI 0.2 to 1.7) (Christensen & Overgaard, 2017). One poor-quality study observed similar rates for planned home birth group compared to planned hospital birth group in Iceland for nulliparous (6.3% vs. 6.3%, aOR 1.37, 95% CI 0.40 to 4.63) and multiparous women (1.6% vs. 2.2%, aOR 0.73, 95% CI 0.20 to 2.59) (Halfdansdottir et al., 2015).

Studies observed statistically similar rates of postpartum hemorrhage in planned home and planned hospital births for nulliparous and multiparous women (Bolten et al., 2016; van Haaren-ten Haken et al., 2015). Postpartum hemorrhage was similar in planned home births compared to planned hospital births for nulliparous (3.2% vs. 3.6%, RR 0.89, 95% CI 0.71 to 1.12) and reduced in multiparous women (2.1% vs. 2.7%, RR 0.77, 95% CI 0.63 to 0.95) in one poor-quality study (Hutton et al., 2016).

Breastfeeding

No U.S-based studies reported comparative breastfeeding outcomes by parity. Two poor-quality studies reported comparative breastfeeding outcomes for nulliparous women in Ontario, Canada (Hutton et al., 2009; Hutton et al., 2016). At day 10 of life, infants in the planned home birth group were more likely to be breastfed compared to infants in the planned hospital birth group (84.8% vs. 75.9%, RR 1.13, 95% CI 1.11 to 1.16) (Hutton, et al., 2016). Exclusive breastfeeding at six weeks of life was reported for 89.1% of planned home birth infants compared to 76.7% for planned hospital births; no formal statistical analysis was reported (Hutton et al., 2009). These two studies also reported comparative breastfeeding outcomes for multiparous women (Hutton et al., 2009; Hutton et al., 2016). At day 10 of life, infants in the planned home birth group were more likely to be breastfed compared to infants in the planned hospital birth group (89.6% vs. 81.2%, RR 1.10, 95% CI 1.09 to 1.12) (Hutton, et al., 2016). Exclusive breastfeeding at six weeks of life was reported for 91.1% of infants in the planned home birth group

compared to 82.2% for infants in the planned hospital birth group; no formal statistical analysis was reported (Hutton et al., 2009).

Subgroup: Maternal Age

Summary

Findings from U.S.-based studies reporting outcomes by maternal age are limited to neonatal mortality. Neonatal mortality in U.S. studies was higher for all women; women 35 years and older had higher risk than younger women.

International studies reported mode of delivery, neonatal harm, and maternal harm findings by maternal age. Overall, increasing maternal age was associated with a slightly increased risk in operative or cesarean delivery across birth settings, but actual rates of operative or cesarean delivery were lower across age groups. Similarly, risk of neonatal harm increased for every five-year increase in age; nulliparous women over 40 were at the highest risk of neonatal harm (including death or NICU admission).

Mode of Delivery

No U.S. based study reported comparative mode of birth outcomes by maternal age. A single good-quality study from England (Birthplace) reported mode of delivery outcomes for women by age and parity (Li, et al., 2014). The risk of instrumental and cesarean delivery increased with every five-year increment in age for nulliparous and multiparous women after controlling for maternal characteristics and intended birth setting (aRR ranged from 1.15 to 1.27, 95% CI ranged 1.05 to 1.32). The risk of a maternal composite outcome, incorporating delivery mode and maternal harms, increased with every five-year increase in age from 16 to 40 years, and was greater for planned out-of-hospital births (all non-hospital planned settings: aRR 1.21, 95% CI 1.18 to 1.25) compared to planned hospital births (aRR 1.12, 95% CI 1.10 to 1.15) (Li et al., 2014). The composite included augmentation, instrument delivery, intrapartum cesarean delivery, general anesthesia, blood transfusion, third or fourth degree tear, and admission to a higher level of care. However, the absolute rates of the maternal composite outcome were lower for nulliparous and multiparous women in the planned out-of-hospital group than the planned hospital group. The magnitude of the benefit decreased with increasing age (nulliparous women age 16 to 19: aRR 0.49, 95% 0.42 to 0.58 and women 40 and older: aRR 0.70, 95% CI 0.53 to 0.93).

Fetal or Neonatal Mortality

Two studies of poor to fair quality reported comparative U.S. estimates of neonatal death (0 to 27 days) by maternal age, from 2008 to 2012 (Grunebaum, McCullough, Arabin et al., 2017) and 2009 to 2013 (Grunebaum, McCullough, Sapra et al., 2017). Across both time periods, the risk of neonatal death was higher in planned home births compared to planned hospital births. When stratified by age, older women (≥ 35 years) experienced greater neonatal mortality than younger women. The two studies used different effect estimates (unadjusted relative risk and standardized mortality ratios (SMR), respectively) (≥ 35 years: RR 4.1, 95% CI 2.6 to 6.5; <35 years: RR 3.9, 95% CI 2.8 to 4.4) (Grunebaum, McCullough, Arabin et al., 2017); (≥ 35 years: SMR 5.11, 95% CI 3.19 to 7.03; < 35 years: SMR 3.72, 95% CI 2.95 to 4.50) (Grunebaum, McCullough, Sapra et al., 2017).

Neonatal Harm

We identified no studies that reported neonatal morbidity by maternal age in a U.S. setting. In a good-quality non-U.S. study, the risk of a composite outcome consisting of NICU admission over 48 hours (within 48 hours or birth) and the Birthplace composite (i.e., stillbirth after the start of care in labor, early neonatal death, neonatal encephalopathy, meconium aspiration syndrome, brachial plexus injury, fractured humerus or clavicle) was increased for nulliparous women over 40 compared to women aged 25 to 29 (aRR 2.29, 95% CI 1.28 to 4.09). For every 5 year increase in age, the adjusted relative risk was not statistically significant for nulliparous (aRR 1.06, 95% CI 0.95 to 1.17) and multiparous women (aRR 0.98, 95% CI 0.84 to 1.15) (Li et al., 2014).

Maternal Harm

No studies reported maternal harm by maternal age in U.S. settings. In a single good-quality study from England, controlling for birth setting, nulliparous women experienced a small, but statistically significant, increased risk of third or fourth degree tear for every five-year increase in age (aRR 1.12, 95% CI 1.02 to 1.23) (Li et al., 2014). The need for blood transfusion, controlling for place of birth, was not increased for nulliparous or multiparous women with higher maternal age.

Breastfeeding

No studies from U.S. or non-U.S. settings reported breastfeeding by maternal age.

Subgroup: Prior Cesarean Delivery

Summary

Findings from two U.S.-based studies observed conflicting estimates of effect: one study showed increased risk of neonatal death in planned home or birth center settings and the other did not observe a statistically significant difference. International studies observed greater frequency of neonatal harms in planned home or birth center settings, but the findings were not statistically significantly different. International studies observed that women with a history of cesarean delivery had higher rates of vaginal delivery in planned home or birth center settings.

Mode of Delivery

No U.S.-based study reported comparative mode of delivery outcomes for women with a prior cesarean delivery. A single good-quality, non-U.S.-based study reported comparative delivery mode outcomes for women with a prior cesarean section in England (Rowe et al., 2016). Compared to planned hospital birth, women with a history of cesarean delivery planning home birth were more likely to have a vaginal birth, including spontaneous vertex or breech vaginal births, or vaginal births assisted by forceps or vacuum (aRR 1.19, 95% CI 1.06 to 1.24).

Fetal or Neonatal Mortality

A single fair-quality study reported comparative mortality outcomes for women planning home birth with a prior cesarean delivery in U.S. settings (Grunebaum, McCullough, Sapra et al., 2017). The standardized perinatal mortality ratio (birth to day 27) for women with a prior cesarean delivery (SMR 8.33, 95% CI 2.59 to 14.07) was higher compared to women without a prior cesarean delivery (SMR 3.72, 95% CI 3.01 to 4.43).

A single fair-quality study reported comparative mortality outcomes for women planning home or birth center birth with a prior cesarean delivery (Tilden et al., 2017). Women planning home or birth center births experienced a greater frequency of neonatal death (0.13% vs. 0.08%), but the difference was not statistically significant (aOR 2.10, 95% CI 0.73 to 6.05, p > 0.05). No non-U.S. based studies reported comparative fetal or neonatal mortality outcomes for women with a prior cesarean delivery.

No non-U.S. based studies reported comparative fetal or neonatal mortality outcomes for women with a prior cesarean delivery.

Neonatal Harm

A single fair-quality study conducted in the U.S. reported comparative neonatal morbidity outcomes for women with a prior cesarean section (Tilden et al., 2017). Poor neonatal outcomes were more common for home or birth center births compared to planned hospital births for the following outcomes: Apgar scores less than four (0.73% vs. 0.40%, aOR 1.77, 95% CI 1.12 to 2.79, p = 0.016), Apgar scores less than seven (4.42% vs. 2.68%, aOR 1.62, 95% CI 1.35 to 1.96, p < 0.001), and neonatal seizures (0.19% vs. 0.02%, aOR 8.53, 95% CI 2.87 to 25.4, p = 0.003). Rates of NICU admission were lower for planned home or birth center births compared to planned hospital births (1.11% vs. 3.10%, aOR 0.40, 95% CI 0.29 to 0.57, p < 0.001). There were no statistically significant differences across groups in the need for ventilator support (0.38% vs. 0.29%, aOR 1.36, 95% CI 0.75 to 2.46, p = 0.31).

A single good-quality study reported comparative neonatal morbidity outcomes for women with a prior cesarean section in England (Rowe et al., 2016). Comparing planned home versus planned hospital births, the risk of a composite of intrapartum death or an Apgar score less than seven at five minutes (1.87% vs. 1.57%, RR 1.19, 95% CI 0.41 to 3.44) and admission to a neonatal unit (3.71% vs. 3.04%, RR 1.22, 95% CI 0.57 to 2.59) did not differ among women with a history of cesarean delivery in the planned home birth group compared to planned hospital birth

Subgroup: Breech Position of Fetus

Summary

Outcomes for breech position are limited to fetal or neonatal mortality. Breech position was associated with an increased risk of neonatal death in a single U.S. study.

Fetal or Neonatal Mortality

A single poor-quality study conducted in the U.S. observed higher standardized mortality ratios for cephalic and breech infants in planned home birth groups compared to planned hospital births attended by midwives (Grunebaum, McCullough, Sapra et al., 2017). The point estimate for breech presentation was over a twofold increase (SMR 8.14, 95% 2.17 to 14.11) compared to cephalic (SMR 3.61, 95% CI 2.92 to 4.31).

Subgroup: Other Factors

Summary

This section includes outcomes for several combinations of risk factors for low- and high-risk groups. Studies attempting to examine the most low-risk group, women without complicating conditions at the start of labor, excluded women with meconium-stained fluids, preeclampsia, non-cephalic position,

abnormal fetal heartrate, or prolonged rupture of membranes. Other definitions of risk were not consistent across settings, which limited comparisons across studies.

Findings for U.S.-based studies were limited to fetal or neonatal mortality outcomes and observed higher risk for several combinations of factors, particularly for nulliparous women of older age, or advanced gestational age. International studies reported delivery mode, fetal or neonatal mortality, and neonatal harm outcomes by risk factor groupings. Nulliparous women without complicating conditions at the start of labor experienced a small but statistically significant increased odds of neonatal harm in planned home birth groups that was similar to that observed for all nulliparous women; from international studies.

Mode of Delivery

No U.S.-based study reported comparative delivery mode outcomes for women by other risk factor groupings. Three studies conducted outside of the U.S. reported delivery mode outcomes for women with or without an array of risk factors: we rated one as good quality (Birthplace, 2011) and two as poor quality (Halfdansdottir et al., 2018; Davies-Tuck et al., 2018)..

Women without a complicating condition at the start of labor (e.g., meconium-stained amniotic fluid) were more likely to experience a birth without induction, epidural or spinal analgesia, general anesthesia, or assisted or cesarean delivery in planned home or planned birth center settings than in planned hospital settings (aOR 4.12, 95% CI 3.37 to 5.04 for home births, aOR 3.42, 95% CI 2.74 to 4.27 for birth centers, both compared to hospital birth) (Birthplace, 2011). However, as the authors noted, the use of an odds ratio for this common outcome likely overstated the actual magnitude of the effect.

Women with a known contraindication to home birth (e.g., BMI > 35, after 42 weeks completed gestation, chronic diseases, prematurity, previous cesarean delivery) were no more likely to have an operative delivery compared to women planning home birth without a contraindication in a small study of 1,228 women in Iceland (OR 5.42, 95% CI 0.60 to 48.99) (Halfdansdottir et al., 2018).

In a study conducted in Australia, high-risk women also experienced beneficial delivery mode outcomes more often in planned home birth settings compared to a planned hospital setting (i.e., lower rates of cesarean delivery, instrumental deliveries, and higher rates of spontaneous vaginal deliveries; no formal statistical analysis reported) (Davies-Tuck et al., 2018). Although there were higher NICU admission rates for the infants (1.6% vs. 0.4%, $p < 0.001$) and intrauterine hypoxia (3.2% vs. 6.6%, $p < 0.001$), rates of other maternal and neonatal outcomes were not statistically significantly different (i.e., perinatal morbidity (meconium aspiration syndrome, pneumonia, or respiratory distress syndrome), Apgar score less than seven at five minutes, composite morbidity). Rates of birth trauma (brachial plexus injury, fractured clavicle or humerus) were reduced for high-risk planned home births compared to planned hospital births (3.1% vs. 7.6%, $p < 0.001$).

Fetal or Neonatal Mortality

A single fair-quality study from the U.S. observed increased risk of neonatal mortality (0 to 27 days) for several combinations of risk factors for planned home births (all providers) compared to planned hospital births attended by a midwife (Grunebaum, McCullough, Sapra et al., 2017). The greatest risk was seen in nulliparous women, 35 years and older (SMR 12.41, 95% CI 4.33 to 20.49) and nulliparous women at 41 weeks of pregnancy or later (SMR 9.57, 95% CI 5.84 to 13.30); other groups experienced increased risk.

A single fair-quality Australian study limited to women without complicating conditions at the start of labor (i.e., prolonged rupture of membranes, preeclampsia, gestational hypertension, antepartum hemorrhage, eclampsia, gestational diabetes or pre-pregnancy diabetes; 8.9% of entire study sample), observed no cases of intrapartum or early neonatal death (0 to 7 days) for planned home births from 2000 to 2008. Estimates after adjusting for negative values (by adding 0.5 to all counts) were not statistically significantly different for all home, birth center, and planned hospital births (Homer et al., 2014).

Neonatal Harm

No U.S. based study reported comparative neonatal harm outcomes for women by other risk factor groupings. In a subgroup comparison from the good-quality Birthplace study limited to nulliparous women without complicating conditions at the start of labor (e.g., meconium-stained fluids) experienced increased odds of the Birthplace composite outcome (stillbirth after start of care in labor, early neonatal death, neonatal encephalopathy, meconium aspiration syndrome, brachial plexus injury, fractured humerus or clavicle) in planned home birth (unadjusted aOR 2.80, 95% CI 1.59 to 4.92 compared to aOR 1.75, 95% CI 1.07 to 2.86 for all nulliparous women planned home compared to planned hospital). Although the effect estimate was higher, the incidence was similar (3.5 per 1,000 vs. 9.5 per 1,000; the wider confidence interval is likely a result of the smaller sample in the analysis of women without complicating conditions.. Risk the Birthplace composite was similar in planned birth center settings compared to planned hospital (aOR 1.40, 95% CI 0.74 to 2.65) (Birthplace, 2011).

In a fair-quality Australian study of women without complications at the start of labor, there were no statistically significant differences in the composite outcome comparing planned home to planned hospital births (aOR 0.87, 95% CI 0.33 to 2.35) or comparing planned birth center to planned hospital births (aOR 0.82, 95% CI 0.64 to 1.05) (Homer et al., 2014).

For women at higher risk at the start of labor (e.g., gestational diabetes, BMI > 35, 42 to 44 weeks gestation, known high-risk medical conditions), but without complicating conditions at the start of labor (e.g., meconium-stained fluids), in the Birthplace cohort, the small number of nulliparous women (n = 288) fared similarly in home and hospital settings (aRR 0.43, 95% CI 0.16 to 1.16); multiparous women (n = 1,201) were at a lower risk of adverse perinatal outcomes (i.e., Birthplace composite) (aRR 0.41, 95% CI 0.18 to 0.89) (Li et al., 2015).

In a poor-quality study conducted in Australia, high-risk women (e.g., obese, with chronic medical conditions, non-cephalic presentation, prior cesarean delivery) in the planned home birth group more commonly experienced NICU admissions for their infants (1.6% vs. 0.4%, $p < 0.001$). Rates of other outcomes were not statistically significantly different or favored home birth for reduced composite morbidity (7.8% vs. 16.9%, $p < 0.001$), intrauterine hypoxia (3.2% vs. 6.6%, $p < 0.001$), and birth trauma (3.1% vs. 7.6%, $p < 0.001$) (Davies-Tuck, et al., 2018).

In a poor-quality study conducted in Iceland, women with a known contraindication to home birth, but who elected to proceed with home birth, experienced similar odds of NICU admission (OR 1.88, 95% CI 0.41 to 8.64), Apgar score of less than seven at five minutes (OR 8.37, 95% CI 0.37 to 189.36), neonatal resuscitation (OR 1.89, 95% CI 0.14 to 9.68), and overall morbidity (OR 1.16, 95% CI 0.65 to 5.51) compared to women without a contraindication, but the results were all imprecise (i.e., had wide confidence intervals) (Halfdansdottir et al., 2018)

Subgroup: Gestational Age

Summary

Outcomes by gestational age were limited to fetal or neonatal mortality from a single U.S. study.

Fetal or Neonatal Mortality

Estimates of neonatal mortality by gestational age in U.S. settings were reported by two studies of poor to fair quality that had overlapping time periods (Grunebaum, McCullough, Arabin et al., 2017; Grunebaum, McCullough, Sapra et al., 2017). Neonatal mortality (0 to 27 days) was higher for planned home births across both gestational age groups (≥ 37 to < 41 weeks, and ≥41 weeks) in both studies. In the 2009 to 2013 dataset, both groups experienced increased rates of neonatal mortality at ≥ 37 to < 41 weeks (SMR 3.37, 95% CI 2.95 to 4.50) and ≥41 weeks (SMR 4.78, 95% CI 3.43 to 6.12) (Grunebaum, McCullough, Sapra et al., 2017). The 2008 to 2012 dataset also demonstrated higher risk of neonatal mortality for home birth attended by a CNM or other midwife compared to hospital birth attended by a midwife at ≥ 37 to < 41 weeks (RR 3.25, 95% CI 2.6 to 4.2) and ≥41 weeks (RR 4.43, 95% CI 3.1 to 6.3) (Grunebaum, McCullough, Arabin, et al., 2017).

Subgroup: Race or Ethnicity

Summary

Outcomes by race or ethnicity were limited to fetal or neonatal mortality from a single U.S. study.

Fetal or Neonatal Mortality

A single poor-quality study reported standardized mortality ratios for white, non-Hispanic women and women of all other races or ethnicities combined. Both groups experienced an increased risk of neonatal death (0 to 27 days) compared to planned hospital births attended by a midwife, but the estimates overlapped (RR 3.71, 95% CI 3 to 4.6 for white women; RR 2.65, 95% CI 1.4 to 5 for all other race/ethnicities combined) (Grunebaum, McCullough, Arabin et al., 2017).

Noncomparative Studies

We identified 14 noncomparative studies that reported on relevant outcomes from planned home or birth center births. Seven of the studies analyzed U.S. data (Bachilova et al., 2018; Bovbjerg et al., 2017; Cheyney et al., 2014; Cox et al., 2015; Nethery et al., 2017; Stapleton et al., 2013; Stephenson-Famy et al., 2017), and four of these studies relied on data from the Midwives Alliance of North America Statistics Project (MANA Stats), which combines outcome data from planned home and birth center births (Bovbjerg et al., 2017; Cheyney et al., 2014; Cox et al., 2015; Nethery et al., 2017). One study used a combination of Canadian and U.S. data (Johnson & Daviss, 2005), and the remaining six studies were based in Australia (Catling-Paull et al., 2013), Japan (Eto et al., 2017; Suto et al., 2015), the Netherlands (Schuit et al., 2016), and Nordic countries (Blix et al., 2015; Edqvist et al., 2016). Sample sizes across the studies ranged from 1,521 (Suto et al., 2015) to 746,642 (Schuit et al., 2016). There were high levels of heterogeneity in the outcomes reported across studies. At least six of the 14 noncomparative studies reported on delivery mode, maternal genital tract trauma, perinatal mortality, and neonatal morbidity.

The noncomparative studies demonstrated favorable delivery mode outcomes (i.e., high rates of vaginal deliveries, low rates of assisted or cesarean deliveries). In general, the studies reported greater risks of maternal and neonatal harms for nulliparous women and women with a previous history of cesarean or

instrument-assisted vaginal delivery. In addition, breech presentation, multiple gestation, and high-risk maternal conditions (e.g., hypertension) were associated with higher risks of adverse neonatal events. Many of the noncomparative studies excluded high-risk populations, and thus these findings might not be directly applicable to typical populations of planned home and birth center births. Appendix H provides additional details on the study characteristics of the included noncomparative observational studies.

Evidence Summary

Planned out-of-hospital birth is associated with favorable outcomes for women, but with increased risk of harm to neonates in U.S. studies. Rates of vaginal births for women having planned home or birth center births were consistently greater than for women having planned hospital births, as reported across U.S. and international studies of fair to good methodological quality. Maternal harms were also more favorable in planned out-of-hospital settings. Estimates of breastfeeding by planned place of birth tended to favor out-of-hospital settings, but the quality of evidence is very low.

Although overall rates of infant harm were similar from fair- to good-methodological-quality international studies, there were estimates of increased harm, particularly higher rates of death, for infants in planned out-of-hospital births compared to planned hospital births as observed in U.S.-based studies of similar methodological quality.

The risk of neonatal morbidity or death within subgroups was higher for nulliparous women in U.S-studies, whereas non-U.S.-based studies observed higher or similar risks. In U.S. studies, higher maternal age, later gestational stage, breech position, and prior cesarean delivery were associated with increased risk of neonatal death. In the U.S., rates of death for newborns also increased for combinations of risk, notably for nulliparous older women or at advanced gestational age. The magnitude of the neonatal risk difference was greater in U.S.-based studies than international studies because neonatal death was less common across international studies.

Policy Landscape

Guidelines from Others

A search of MEDLINE, Center core sources, and professional societies relevant to planned out-of-hospital birth identified documents from the American Academy of Pediatrics (AAP) (2016), American Association of Birth Centers (AABC) (2017), American College of Nurse Midwives (ACNM) (2015), American College of Obstetricians and Gynecologists (ACOG) (2017), the National Institute for Health and Care Excellence (NICE) (2017), and the Society of Obstetricians and Gynecologists of Canada (SOGC) (2019). In-person public comment from the June 2019 EBGS meeting identified guidance from the Oregon Midwifery Council (OMC) (2019). The Midwives Alliance of North America (2005) and the National Association of Certified Professional Midwives (2004) had no updated guidance in the last 15 years.

The 2015 HERC Coverage Guidance used guidance from NICE (2014), the College of Midwives of British Columbia (CMBC) (2014), the College of Midwives of Ontario (2015), and the Obstetric Working Group of the National Insurance Board of the Netherlands (n.d.). Updated documents were only identified from the College of Midwives of British Columbia (2018) and NICE (2017). The College of Midwives of Ontario published *Professional Standards for Midwives* in 2018, but this document does not make

specific recommendations about clinical care, eligibility, or transfers (College of Midwives of Ontario, 2018). The most current standards for consultation and transfers from the College of Midwives of Ontario remain the 2015 guidance, included in the prior HERC coverage guidance (College of Midwives of Ontario, 2015).

Only the NICE guideline included information on evidence review methods for the guideline *Intrapartum Care for Healthy Women and Babies*, which was updated in 2017 and is available publicly at: https://www.nice.org.uk/guidance/cg190 (NICE, 2017). This guideline was assessed as having good methodological quality. No other identified documents included the methods of development. These documents should be considered expert opinion and of poor methodological quality.

The information contained within the identified documents is vast in scope. Specific guidance on system-level practices, emergency planning, and life support training requirements for birth attendants is summarized in this section; specific risk assessment levels are abstracted in Appendix I for maternal indications and Appendix J for newborn indications.

Regulatory Guidance

An additional source is included in this Coverage Guidance because it is relevant to the Oregon regulatory environment. The proposed administrative rules (as of May 2019) from the Oregon Health Authority's State Board of Direct Entry Midwifery (OR DEM) are also included for reference in Appendices I and J (OR DEM, 2019).

Guidelines and Regulatory Guidance Summary

Table 3 lists all included guidelines and regulatory guidance, along with a billing guide from the state of Washington's Medicaid program (WA) identified in the policy search (see below). The Washington guide is included in this section because it provides specific guidance on risk assessment, consultation, and referrals criteria for planned home or birth center births.

Table 3. Included Guidelines, Regulations, and Professional Society Guidance

Organization	Year	Specific Risk Assessment Protocols
American Academy of Pediatrics	2013 (reaffirmed 2016)	Yes
American Association of Birth Centers	2017	Yes
American College of Nurse-Midwives	2015	Yes
American College of Obstetricians and Gynecologists	2017	Yes
College of Midwives of British Columbia	2018	Yes
College of Midwives of Ontario	2018	No
National Institute for Health and Care Excellence	2014, updated 2017	Yes
Oregon Midwifery Council	2019	No
Society of Obstetricians and Gynecologists of Canada	2019	No
State Board of Direct Entry Midwifery, Oregon	2019, proposed	Yes
Washington Medicaid Billing Guide	2017	Yes

System-Level Recommendations

This section summarizes recommendations on health system-level practices to improve outcomes for planned out-of-hospital births. Canada's "systems-based approach," supporting safety for home birth within its integrated health system, is posited as the reason for improved perinatal and obstetric outcomes observed in Canada compared to the United States (SOGC, 2019).

Regarding transfer, multiple organizations recommend that a relationship with a medical facility should be in place in the event of transfer, and the attendant should have readily available consultation (AAP, 2016; ACNM, 2015; ACOG, 2017). The AABC standards include recommendations for an established system for consultation, collaboration, or referral for emergency and non-emergency events (AABC, 2017). Transfers should occur in a timely and safe fashion (AAP, 2016; ACNM, 215; ACOG, 2017).

The AAP and the ACOG both recommend hospitals or birth centers as the safest place of birth in the U.S (AAP, 2016; ACOG, 2017). Acknowledging that women may, after participating in an informed risk and benefit discussion, elect to pursue a home birth, the AAP and ACOG recommend that to reduce perinatal mortality, the birth should be within an integrated and regulated health system attended by a certified nurse midwife, certified midwife, or midwife meeting International Confederation of Midwives' Global Standards for Midwifery Education (AAP, 2016; ACOG, 2017).

According to the AAP, care of the newborn immediately after birth should adhere to the *Guidelines for Perinatal Care* published by the ACOG and AAP, including but not limited to transitional care after birth, monitoring for group B streptococcal disease, glucose screening, eye gonococcal prophylaxis, vaccination for hepatitis B, provision of vitamin K prophylaxis, assessment of feeding, screening for hyperbilirubinemia, and newborn screening (AAP, 2016). Additionally, all infants should receive an evaluation by a "health care professional who is knowledgeable and experienced in pediatrics within 24 hours of birth and subsequently within 48 hours of that first evaluation" (AAP pg. 1019, 2016). This evaluation should also include an assessment for congenital heart disease in addition to but not limited to hydration, jaundice, integration of clinical laboratory testing, and breastfeeding (AAP, 2016).

Emergency Planning and Life Support Training

The AAP recommends that each delivery, regardless of location, be attended by 2 individuals, 1 with training in infant resuscitation (e.g., Neonatal Resuscitation Program) whose sole responsibility is the newborn, allowing the other to attend to the mother (AAP, 2016). This is similar to guidance from the SOCG, which notes that a second care provider is required to accompany a registered midwife for a home birth (SOCG, 2019). The SOGC also notes that registered midwives attending homebirths are required to maintain hospital privileges, bring emergency equipment and supplies, and have emergency transportation protocols (SOGC, 2019, pg. 224). Similarly, NICE recommends that protocols be in place for patient transfer with development oversight by a multidisciplinary regulatory body with midwifery, obstetric, anesthesia, and neonatal experts (NICE, 2017).

Specifically in the case of the presence of meconium, NICE recommends transfer to hospital setting, with providers trained in fetal blood sampling and neonatal life support present at the delivery (NICE, 2017).

Eligibility and Risk Assessment, Transfer or Consultation Criteria

The majority of ~~All~~ identified guideline documents concur~~affirm~~ that women planning an out-of-hospital birth should be at low risk and have uncomplicated pregnancies, but vary in the level of detail with which they describe low-risk candidates (AABC 2017; AAP 2016; ACNM 2015; ACOG 2017; CMBC 2017;

NICE 2017; SOGC 2019;). Ongoing risk assessment over the course of pregnancy is recommended (AABC 2017; ACNM 2015; CMBC 2017; NICE 2017; OR DEM 2019; OMC 2019; SOGC 2019). Specific instructive language on what to do in the event of a risk factor varies across documents. For example, a consultation in the Washington guidance may include telephone, written, or electronic mail with an MD/DO, co-management, referral for exam or treatment, or transfer (WA, 2017). In the guidance from CMBC, a consultation is an in-person evaluation by a consultant resulting in recommendations for continuing care with a registered midwife, co-management, or transfer (CMBC, 2018). This recommendation language would be a "referral" in the Washington guidance. For the purposes of this document, conditions are categorized as high-risk historical conditions or complications of current pregnancy requiring hospital birth (3), conditions requiring consultation (2), or eligible for planned out-of-hospital birth provided there are no other complications (1).

Specific risk criteria for consultation, transfer, or contraindications/exclusions vary in level of detail across documents. When language aligned, similar recommendations are summarized together on the same line within Appendices I and J. In an attempt to ease comparisons across guidance documents, recommendations were color and number coded as described in Appendices I and J. When no formal recommendation for a condition was identified (--) was placed in the cell. At times, a recommendation for one condition may be superseded by another, which is denoted by the abbreviation for non-applicable, NA. For example, a recommendation for consultation with rupture of membranes at 35 weeks by one guideline (i.e., category 2), might not be applicable to a different organization that lists gestational age under 36 weeks as high-risk exclusion (i.e., category 3). When it was possible, we attempted to clarify whether a listed condition referred to a history of the condition or as a new condition arising in the current pregnancy. Risk criteria recommendations also reflect variation in the integration of out-of-hospital birth and the scope of midwife practice. For example, within the National Health Service of the United Kingdom when risk factors are identified that suggest birth in a hospital setting is safer than out of hospital, the midwife is compelled to inform the woman and engage in an informed consent process but not required to transfer. Ensuring women are informed of the risk is required, balanced by personal autonomy of the woman to make the decision to transfer (NICE, 2017).

Appendix I catalogues maternal risk factor recommendations from the 2015 Coverage Guidance, additional guidance published in the interim, and relevant documents from Washington State (2017) and the Oregon Health Authority, OR DEM Board proposed rules (2019). Appendix J provides the same details for neonatal conditions.

Fetal malpresentation, multiple gestation, and prior cesarean are high-risk contraindications to planned out-of-hospital birth by the AAP, AABC, ACNM, ACOG, CMBC, NICE, and the Washington guidance, which concurs with the 2015 HERC Coverage Guidance (AAP 2016; AABC 2017; ACOG 2017; CMBC 2017; NICE 2017; ~~SOGC 2019;~~ WA 2017). The OR DEM Board (2019) considers frank or complete breech and/or ~~fetal malpresentation or~~ prior cesarean delivery to be acceptable risk factors for out-of-hospital birth (OR DEM, 2019). The OMC lists out-of-hospital birth past 42 completed weeks of gestation (i.e., 43 weeks 0 days) as "outside of our community standard of care" and recommends starting fetal surveillance testing at 41 weeks and 3 days gestation (OMC 2019, pg. 11).

Across most guidelines are statements regarding the general medical health of the women attempting a planned out-of-hospital birth, specifically that they be free of chronic medical conditions or conditions that would be expected to worsen during pregnancy, or require treatment with pharmacotherapy (AABC 2017; ACNM 2015; CMBC 2018; NICE 2017).

Payer Coverage Policies

Medicaid

The policy for the Washington Medicaid Program (effective 1/1/2019) covers planned home births and births in agency-approved, licensed birthing centers attended by a qualified licensed midwife, a certified nurse midwife, or a physician. For coverage, the pregnancy must be low risk (see criteria below) and the woman must be expected to deliver the child vaginally and without complication.

Planned home birth providers and birthing center providers must:

- Have evidence of current cardiopulmonary resuscitation (CPR) training for adult CPR and neonatal resuscitation
- Have written, appropriate plans for consultation, emergency transfer, and transport of client and newborn to a hospital
- Obtain from the client a signed informed consent form

Home birth providers must also provide documentation of:

- Names and national provider identifier (NPI) number of back-up midwives that are current Washington Apple Health providers and will provide 24 hour-per-day coverage
- Local emergency medical services and emergency response capability in the area
- Professional consultation plan and referral
- Midwife's informed consent that includes newborn screening, prophylactic eye ointment, and vitamin K injection
- Participation in a formal, state sanctioned, quality assurance/improvement program or professional liability review process
- Midwife's or birthing center's professional liability policy

Washington Medicaid does not cover planned home births or births in birthing centers for women with a history of or identified with any of these factors:

- Cesarean section delivery
- Known multiple gestation
- Known breech presentation in labor with delivery not imminent
- Significant hematological disorders/coagulopathies
- Deep venous thrombosis or pulmonary embolism
- Cardiovascular disease causing functional impairment
- Chronic hypertension
- Significant endocrine disorders including pre-existing diabetes
- Hepatic disorders including uncontrolled intrahepatic cholestasis of pregnancy or abnormal liver function tests
- Isoimmunization, including evidence of Rh sensitization/platelet sensitization
- Neurologic disorders or active seizure disorders
- Pulmonary disease
- Renal disease

- Collagen-vascular diseases
- Cancer affecting site of delivery
- Other significant deviations from normal as assessed by the provider

In addition, coverage is not provided to women with current alcohol/drug addiction or abuse or current severe psychiatric illness.

Washington Medicaid requires consultation with a physician (MD/DO) and may require referral to a physician when any of the following conditions arise during the pregnancy:

- Breech at 37 weeks
- Polyhydramnios/Oligohydramnios
- Significant vaginal bleeding
- Persistent nausea and vomiting causing a weight loss of > 15 lbs.
- Post-dates pregnancy (> 42 completed weeks)
- Fetal demise after 12 completed weeks gestation
- Significant size/dates discrepancies
- Abnormal fetal non-stress test (NST)
- Abnormal ultrasound findings
- Acute pyelonephritis
- Infections whose treatment is beyond the scope of the provider
- Evidence of large uterine fibroid that may obstruct delivery or significant structural uterine abnormality
- No prenatal care prior to the third trimester
- Other significant deviations from normal, as assessed by the provider

Referral to a physician is required when any of the following conditions arise during pregnancy:

- Evidence of pregnancy-induced hypertension (BP > 140/90 for more than six hours with client at rest)
- Hydatidiform mole (molar pregnancy)
- Gestational diabetes not controlled by diet
- Severe anemia unresponsive to treatment (Hgb < 10, Hct (hematocrit)< 28)
- Known fetal anomalies or conditions affected by site of birth
- Documented placental abnormalities, significant abruption past the first trimester, or any evidence of previa in the third trimester
- Rupture of membranes before the completion of 37 weeks gestation
- Positive HIV antibody test
- Documented intrauterine growth retardation (IUGR)
- Primary genital herpes past the first trimester
- Noncompliance with the plan of care (e.g., frequent missed prenatal visits)
- Development of any of the high-risk conditions that result in non-coverage of planned home birth or birthing center births

Washington Medicaid requires consultation with a physician and may require referral to a physician when any of the following conditions arise intrapartum:

- Prolonged rupture of membranes, >24 hours and not in active labor
- Other significant deviations from normal as assessed by the provider

Referral to a physician or hospital is required when any of the following emergency conditions arise intrapartum:

- Labor before the completion of 37 weeks gestation, with known dates
- Abnormal presentation or lie at time of delivery, including breech
- Persistent non-reassuring fetal heart rate (requires emergency transport)
- Active genital herpes at the onset of labor
- Thick meconium-stained fluid with delivery not imminent
- Prolapse of the umbilical cord (requires emergency transport)
- Sustained maternal fever
- Maternal seizure (requires emergency transport)
- Abnormal bleeding (hemorrhage requires emergent transfer)
- Hypertension with or without additional signs or symptoms of pre-eclampsia
- Prolonged failure to progress in active labor
- Sustained maternal vital sign instability or shock (requires emergency transport)
- Maternal desire for pain medication, consultation, or referral

Washington Medicaid requires consultation with a physician and may require referral to a physician when any of the following conditions arise postpartum in the first 24 hours after delivery of the placenta:

- Development of any of the applicable conditions listed for prenatal or intrapartum referral
- Significant maternal confusion or disorientation
- Other significant deviations from normal as assessed by the provider

Referral to a physician is required when any of the following conditions arise postpartum:

- Anaphylaxis or shock (requires emergency transport)
- Undelivered adhered or retained placenta with or without bleeding
- Significant hemorrhage not responsive to treatment (requires emergency transport)
- Maternal seizure (requires emergency transport)
- Third or fourth degree lacerations, if repair is beyond provider's level of expertise
- Sustained maternal vital sign instability and/or shock (requires emergency transport)
- Development of maternal fever, signs/symptoms of infection or sepsis
- Acute respiratory distress (requires emergency transport)
- Uterine prolapse or inversion (requires emergency transport)

Washington Medicaid requires consultation with a pediatric physician and may require referral to a pediatric physician when any of the following conditions arise in a neonate:

- Apgar score ≤ 6 at five minutes of age
- Birth weight < 2,500 grams
- Abnormal jaundice

- Other significant deviations from normal as assessed by the provider

Referral to a pediatric physician is required when any of the following conditions arise in a neonate:

- Birth weight < 2,000 grams
- Persistent respiratory distress (requires emergency transport)
- Persistent cardiac abnormalities or irregularities (requires emergency transport)
- Persistent central cyanosis or pallor (requires emergency transport)
- Prolonged temperature instability when intervention has failed
- Prolonged glycemic instability (requires emergency transport)
- Neonatal seizure (requires emergency transport)
- Clinical evidence of prematurity (gestational age < 35 weeks)
- Loss of > 10% of birth weight/failure to thrive
- Birth injury requiring medical attention
- Major apparent congenital anomalies
- Jaundice prior to 24 hours

Medicare

No National Coverage Determinations or Local Coverage Determinations were identified for out-of-hospital births.

Private Payers

Coverage policies for out-of-hospital births were assessed for four private payers: Aetna, Cigna, Moda, and Regence. All four payers cover deliveries in birthing centers. The policy for Aetna (last review 3/28/2019) considers planned home births not medically appropriate. The policies for Cigna (effective 1/15/2019), Moda (last review 4/3/2018), and Regence (webpage dated 2019) cover planned home births attend by certified nurse midwives. None of these private payers include coverage criteria regarding low-risk pregnancies, other than requiring that attending midwifes need to be performing duties within the scope of their licensure.

Cigna

Midwife Services

Coverage of professional fees for midwife services is subject to the terms, conditions, and limitations of the applicable benefit plan and may be limited based on health care professional certification/licensure requirements. In addition, coverage of midwife services may be governed by state mandates; please note that licensure and regulations related to midwifery practice and prescriptive authority vary among states.

In addition, midwife services and/or birthing centers are excluded from network adequacy/network exception or transition of care provisions.

Services provided by a Licensed/Certified Nurse Midwife are eligible for coverage. Services provided by non-nurse midwives (e.g., Certified Midwife [CM], Certified Professional Midwife [CPM], Direct-Entry Midwife, Lay Midwife), may be covered depending on state requirements.

Licensed/Certified Nurse Midwife

Cigna covers services provided by a Licensed/Certified Nurse Midwife acting within the scope of license or certification under the applicable state law

Non-Nurse Midwife

Cigna ONLY covers services provided by a non-nurse midwife (e.g., Certified Midwife [CM)] Certified Professional Midwife [CPM], Direct-Entry Midwife, Lay Midwife) when acting within the scope of license or certification under the applicable state law.

Not Covered

Cigna does not cover ANY of the following:

- Services provided by an out-of-network midwife (e.g., Licensed/Certified Nurse Midwife, Certified Midwife) when out-of-network benefits are not available.
- Services at the in-network benefit level, for services provided by an out-of-network health care provider (i.e., network exception) when a qualified in-network health care professional who provides obstetrical services is available, unless required by state regulations or mandates.
- Services provided by a midwife (e.g., Licensed Certified Midwife, Certified Midwife) acting outside the scope of license or certification under the applicable state law.
- Doula services (e.g., childbirth education and support services during pregnancy by a trained non-clinician), absent state mandates.

Home Birth Services

Coverage of a planned home birth may be governed by state mandates.

A planned home birth is an elective alternative to delivery in a birthing center or hospital setting. Coverage of professional fees for a home birth (i.e., elective, planned delivery in the home setting) is subject to the terms, conditions, and limitations of the applicable benefit plan and may be limited based on health care professional certification/licensure requirements.

Cigna covers the professional fee for services provided to a mother eligible for coverage under a Cigna health benefit plan for a home birth, including delivery and immediate medically necessary postpartum care, when services are provided by a health care provider who is acting within the scope of his/her license or certification under the applicable state law.

Cigna does not cover any of the following services associated with a home birth:

- Services provided by an out-of-network provider when out-of-network benefits are not available
- Services at the in-network benefit level, for services provided by an out-of-network health care provider (i.e., network exception) when a qualified in-network health care professional who provides obstetrical services is available, unless required by state regulations
- Services that are not considered eligible for reimbursement (e.g., other than a health care provider who is acting within the scope of that provider's license or certification under the applicable state law)
- Duplication of services (e.g., services provided by a licensed physician and licensed certified nurse-midwife simultaneously [i.e., at the same time])

- Services considered not medically necessary (e.g., non-routine maternity services, additional prenatal counseling sessions, prenatal evaluation and management services specifically related to home birth)
- Items that are excluded or otherwise not covered under the benefit plan (e.g., equipment, supplies [e.g., emergency kits], supplies specifically related to home birth, modifications to the home, standby services [e.g., support personnel])
- Facility charges for the home setting

Moda

Home Births

Eligible professional fees by the Certified Nurse Midwife or Nurse Practitioner Midwife are eligible for coverage. Other home birth expenses are not eligible for reimbursement and are generally excluded by the member's contract. This includes but is not limited to travel, portable hot tubs, supplies, and transportation of equipment, etc.

Regence

Home/birthing center deliveries and postpartum services are subject to this reimbursement policy in the same manner as services performed by physicians and other health care professionals who deliver in the hospital setting.

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Appendix A. GRADE Table Element Descriptions

Element	Description
Balance of benefits and harms	The larger the difference between the desirable and undesirable effects, the higher the likelihood that a strong recommendation is warranted. An estimate that is not statistically significant or has a confidence interval crossing a predetermined clinical decision threshold will be downgraded.
Quality of evidence	The higher the quality of evidence, the higher the likelihood that a strong recommendation is warranted
Resource allocation	The higher the costs of an intervention—that is, the greater the resources consumed in the absence of likely cost offsets—the lower the likelihood that a strong recommendation is warranted
Values and preferences	The more values and preferences vary, or the greater the uncertainty in values and preferences, the higher the likelihood that a weak recommendation is warranted
Other considerations	Other considerations include issues about the implementation and operationalization of the technology or intervention in health systems and practices within Oregon.

Strong recommendation

In Favor: The subcommittee concludes that the desirable effects of adherence to a recommendation outweigh the undesirable effects, considering the balance of benefits and harms, resource allocation, values and preferences and other factors.

Against: The subcommittee concludes that the undesirable effects of adherence to a recommendation outweigh the desirable effects, considering the balance of benefits and harms, resource allocation, values and preferences and other factors.

Weak recommendation

In Favor: The subcommittee concludes that the desirable effects of adherence to a recommendation probably outweigh the undesirable effects, considering the balance of benefits and harms, resource allocation, values and preferences and other factors., but further research or additional information could lead to a different conclusion.

Against: The subcommittee concludes that the undesirable effects of adherence to a recommendation probably outweigh the desirable effects, considering the balance of benefits and harms, cost and resource allocation, and values and preferences, but further research or additional information could lead to a different conclusion.

Confidence in estimate rating across studies for the intervention/outcome

Assessment of confidence in estimate includes factors such as risk of bias, precision, directness, consistency and publication bias.

High: The subcommittee is very confident that the true effect lies close to that of the estimate of the effect. Typical sets of studies are RCTs with few or no limitations and the estimate of effect is likely stable.

Moderate: The subcommittee is moderately confident in the estimate of effect: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Typical sets of studies are RCTs with some limitations or well-performed nonrandomized studies with additional strengths that guard against potential bias and have large estimates of effects.

Low: The subcommittee's confidence in the estimate of effect is limited: The true effect may be substantially different from the estimate of the effect. Typical sets of studies are RCTs with serious limitations or nonrandomized studies without special strengths.

Very low: The subcommittee has very little confidence in the estimate of effect: The true effect is likely to be substantially different from the estimate of effect. Typical sets of studies are nonrandomized studies with serious limitations or inconsistent results across studies.

Appendix B. GRADE Evidence Profile

Quality Assessment (Confidence in Estimate of Effect)							
No. of Studies	**Study Design(s)**	**Risk of Bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other Factors**	**Quality**
Mode of Delivery							
18	Observational	Not serious	Not serious	Serious	Not Serious		Low ●●○○
Perinatal or Neonatal Mortality							
16	Observational	Not serious	Serious	Serious	Serious		Very Low ●○○○
Neonatal Morbidity							
20	Observational	Not serious	Serious	Serious	Not serious		Very Low ●○○○
Maternal Harm							
20	Observational	Not serious	Serious	Serious	Not serious		Very Low ●○○○
Breastfeeding							
9	Observational	Serious	Serious	Serious	Not serious		Very Low ●○○○

Appendix C. Methods

Scope Statement

Populations

Pregnant women

Population scoping notes: None

Interventions

Planned out-of-hospital birth (home or birth center)

Intervention exclusions: None

Comparators

Planned birth in a hospital

Outcomes

Critical: Delivery mode (cesarean, operative vaginal delivery, spontaneous vaginal delivery), perinatal mortality, serious neonatal morbidity (e.g., seizures, NICU admission, low Apgar's, hypoxic ischemic encephalopathy, sepsis), serious maternal harm (e.g., postpartum hemorrhage, serious infection, mortality)

Important: Breastfeeding

Considered but not selected for the GRADE table: None

Key Questions

KQ1: What is the comparative effectiveness of planned out-of-hospital birth compared to hospital birth?

KQ2: Does the comparative effectiveness of planned out-of-hospital birth vary by:

a. Patient characteristics (demographics)
b. Risk factors (pregnancy or pre-pregnancy) and comorbidities
c. Setting (including home, out-of-hospital birth center)
d. Location (U.S. vs. non-U.S.)

KQ3: What are the harms of planned out-of-hospital birth compared to hospital birth?

KQ4: Do the harms of planned out-of-hospital birth vary by:

a. Patient characteristics (demographics)
b. Risk factors (pregnancy or pre-pregnancy) and comorbidities
c. Setting (including home, out-of-hospital birth center)
d. Location (U.S. vs. non-U.S.)
e. Provider characteristics

Contextual Questions

CQ1: What do applicable guidelines recommend as standards for consultation and referral or transfer of patients planning out-of-hospital birth?

a. What conditions require consultation?
b. What conditions require transfer?

CQ2: What systems factors (e.g., coordination with consultants, hospitals, and emergency transportation) are associated with differential outcomes in out-of-hospital birth?

CQ3: What is the rate of expected transfer to a hospital setting with a planned out-of-hospital birth?

CQ4: What are example coverage criteria from other public and private payers?

Search Strategy

Sources from the previous Coverage Guidance: Planned Out-of-Hospital Birth (2015) were included in this evidence review. Then, a full search of the core sources was conducted to identify systematic reviews, meta-analyses, and technology assessments that met the criteria for the scope described above. Searches of core sources were limited to citations published since 2015.

The following core sources were searched:

- Agency for Healthcare Research and Quality (AHRQ)
- Canadian Agency for Drugs and Technologies in Health (CADTH)
- Cochrane Library (Wiley Online Library)
- Institute for Clinical and Economic Review (ICER)
- Medicaid Evidence-based Decisions Project (MED)
- National Institute for Health and Care Excellence (NICE)
- Tufts Cost-effectiveness Analysis Registry
- Veterans Administration Evidence-based Synthesis Program (ESP)
- Washington State Health Technology Assessment Program

A MEDLINE® search was also conducted to identify systematic reviews, meta-analyses, and technology assessments, randomized controlled trials, and comparative and noncomparative observational studies using the search terms for home births, birth centers, and out-of-hospital births. The search was limited to publications in English published since 2015.

Searches for clinical practice guidelines were limited to those published since 2013. A search for relevant clinical practice guidelines was also conducted using MEDLINE® and the following sources:

- Australian Government National Health and Medical Research Council (NHMRC)
- Canadian Agency for Drugs and Technologies in Health (CADTH)
- Centers for Disease Control and Prevention (CDC), Community Preventive Services
- National Institute for Health and Care Excellence (NICE)
- Scottish Intercollegiate Guidelines Network (SIGN)
- United States Preventive Services Task Force (USPSTF)
- Veterans Administration/Department of Defense (VA/DoD) Clinical Practice Guidelines

Inclusion/Exclusion Criteria

Studies were excluded if they were not published in English, did not address the scope statement, or were study designs other than systematic reviews, meta-analyses, technology assessments, randomized controlled trials, comparative or noncomparative observational studies, or clinical practice guidelines.

Appendix D. Applicable Codes

CODES	DESCRIPTION
CPT Codes	
59400	Routine obstetric care including antepartum care, vaginal delivery (with or without episiotomy, and/or forceps) and postpartum care
59409	Vaginal delivery only (with or without episiotomy and/or forceps);
59410	Vaginal delivery only (with or without episiotomy and/or forceps); including postpartum care
59412	External cephalic version, with or without tocolysis
59414	Delivery of placenta (separate procedure)
59425	Antepartum care only; 4-6 visits
59426	Antepartum care only; 7 or more visits
59430	Postpartum care only (separate procedure)
59510	Routine obstetric care including antepartum care, cesarean delivery, and postpartum care
59514	Cesarean delivery only;
59515	Cesarean delivery only; including postpartum care
59525	Subtotal or total hysterectomy after cesarean delivery (List separately in addition to code for primary procedure)
59610	Routine obstetric care including antepartum care, vaginal delivery (with or without episiotomy, and/or forceps) and postpartum care, after previous cesarean delivery
59612	Vaginal delivery only, after previous cesarean delivery (with or without episiotomy and/or forceps);
59614	Vaginal delivery only, after previous cesarean delivery (with or without episiotomy and/or forceps); including postpartum care
59618	Routine obstetric care including antepartum care, cesarean delivery, and postpartum care, following attempted vaginal delivery after previous cesarean delivery
59620	Cesarean delivery only, following attempted vaginal delivery after previous cesarean delivery;
59622	Cesarean delivery only, following attempted vaginal delivery after previous cesarean delivery; including postpartum care
HCPCS Codes	
H1000-5	Prenatal care, at risk assessment

Note: Inclusion on this list does not guarantee coverage.

Appendix E. ~~Study~~ Characteristics of Comparative Observational Studies

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
Bailey, 2017 New Zealand Routinely collected maternity outcome data compiled from Counties-Manukau District Health Board (CMDHB) maternity facilities 2003 to 2010 Poor quality	N = 47,381 Planned Birth Center n = 10,448 Planned Hospital n = 36,933	Inclusion criteria: Single pregnancy, cephalic presentation, labored spontaneously at ≥37 weeks gestation Exclusion criteria: Previous cesarean delivery, specific indications for a cesarean delivery, pregestational or gestational diabetes, malpresentation, lethal congenital abnormality, multiple pregnancy, intrauterine fetal death before onset of labor, preterm labor, induction of labor	Planned Birth Center (n = 10,448) vs. Planned Hospital (n = 36,933) Parity Nulliparous: 3,438 (32.9%) vs. 11,915 (32.3%) Parity ≥5: 363 (3.5%) vs. 2,149 (5.8%) Maternal age Age <20 years: 1,100 (10.5%) vs. 3,777 (10.2%) Age ≥35 years: 1,436 (13.7%) vs. 4,868 (13.2%) Ethnicity European: 5,086 (48.7%) vs. 4,868 (22.5%) Maori: 3,258 (31.2%) vs. 8,884 (24.1%) Pacific Island: ,1363 (13.0%) vs. 14,029 (38.0%) Other: 926 (7.1%) vs. 5,714 (15.4%) Deprivation score Decile 1-4: 2,510 (24.3%) vs. 4,427 (12.3%) Decile 5-8: 3,230 (31.2%) vs. 7,538 (20.9%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Decile 9-10: 4,603 (44.5%) vs. 24,110 (66.8%) New Zealand Deprivation index based on domicile, using socioeconomic measures from census data, then stratified into deciles
Birthplace in England Collaborative, 2011 United Kingdom Birthplace April 2008 to April 2010 Good quality	N = 64,538 Planned Home n = 16,840 Planned Freestanding Midwifery Unit n = 11,282 Planned Obstetric Unit n = 19,706 Planned Alongside Midwifery Unit n = 16,710	Inclusion criteria: Any NHS midwife attendance in part or all of labor, at 37 or more weeks in spontaneous labor Exclusion criteria: Elective cesarean delivery, prior cesarean delivery, preterm labor, multiple gestations, no prenatal care, fetal demise before onset of labor (i.e., stillbirth), presence of any medical or obstetric risk factor listed in the NICE intrapartum care guideline	Planned Home vs. Planned Freestanding Midwifery Unit vs. Planned Alongside Midwifery Unit vs. Planned Obstetric Unit Maternal age (years) <20: 218 (1.3%) vs. 677 (6.0%) vs. 1,069 (6.4%) vs. 1,506 (7.7%) 20–24: 1,706 (10.2%) vs. 2,132 (18.9%) vs. 3,489 (20.9%) vs. 4,251 (21.6%) 25–29: 4,346 (25.9%) vs. 3,267 (29.0%) vs. 5,001 (30.0%) vs. 5,701 (29.0%) 30–34: 5,848 (34.8%) vs. 3,248 (28.8%) vs. 4,582 (27.5%) vs. 5063 (25.7%) 35–39: 4,017 (23.9%) vs. 1,690 (15.0%) vs. 2,232 (13.4%) vs. 2,640 (13.4%) ≥40: 671 (4.0%) vs. 254 (2.3%) vs. 299 (1.8%) vs. 520 (2.6%) Ethnic group White: 15,937 (94.8%) vs. 10,329 (91.6%) vs. 13485 (80.9%) vs. 16068 (81.7%) Indian: 67 (0.4%) vs. 87 (0.8%) vs. 509 (3.1%) vs. 477 (2.4%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Pakistani: 41 (0.2%) vs. 164 (1.5%) vs. 545 (3.3%) vs. 636 (3.2%) Bangladeshi: 14 (0.1%) vs. 147 (1.3%) vs. 130 (0.8%) vs. 297 (1.5%) Black Caribbean: 127 (0.8%) vs. 48 (0.4%) vs. 198 (1.2%) vs. 265 (1.3%) Black African: 112 (0.7%) vs. 94 (0.8%) vs. 520 (3.1%) vs. 670 (3.4%) Mixed: 280 (1.7%) vs. 124 (1.1%) vs. 293 (1.8%) vs. 328 (1.7%) Other: 241 (1.4%) vs. 284 (2.5%) vs. 993 (6.0%) vs. 938 (4.8%) Understanding of English Fluent: 16,724 (99.5%) vs. 10,927 (97.1%) vs. 15,196 (91.3%) vs. 18,044 (92.3%) Some: 75 (0.4%) vs. 273 (2.4%) vs. 1176 (7.1%) vs. 1,130 (5.8%) None: 15 (0.1%) vs. 55 (0.5%) vs. 274 (1.6%) vs. 380 (1.9%) Marital or partner status Married or living with partner: 16,056 (96.0%) vs. 10,444 (93.6%) vs. 15,014 (91.2%) vs. 17,097 (88.2%) Single or unsupported by partner: 673 (4.0%) vs. 718 (6.4%) vs. 1,453 (8.8%) vs. 2,289 (11.8%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Mean BMI in pregnancy: 24.0 ± 3.7 vs. 24.1 ± 3.7 vs. 24.0 ± 3.8 vs. 24.4 ± 4.0 Mean gestation (completed weeks: 39.8 ± 1.0 vs. 39.8 ± 1.0 vs. 39.7 ± 1.0 vs. 39.8 ± 1.1) Complications per woman 0: 15 757 (94.6%) vs. 10,643 (94.5%) vs. 15,512 (93.1%) vs. 15,794 (80.5%) 1: 847 (5.1%) vs. 572 (5.1%) vs. 1,078 (6.5%) vs. 3345 (17.0%) ≥2: 51 (0.3%) vs. 50 (0.4%) vs. 78 (0.5%) vs. 490 (2.5%)
Bolten et al., 2016 The Netherlands DELIVER (Data EersteLIjns VERloskunde) Study 2009 to 2010 Poor quality	N = 3,495 Planned Home n = 2,050 Planned Hospital n = 1,445	Inclusion criteria: Low-risk women who were in midwife-led care at the onset of labor Exclusion criteria: Women who were transferred to obstetrician-led care during pregnancy, and who received midwife-led care but had a 'medium risk' indication (according to VIL), including a history of postpartum hemorrhage or manual removal of the placenta, and who had prolonged rupture of membranes without contractions	Nulliparous, Planned Home (n = 868) vs. Planned Hospital (n = 717) Maternal age <25: 145 (16.7%) vs. 131 (18.3%) 25 to 35: 651 (75.0%) vs. 490 (68.3%) ≥35: 72 (8.3%) vs. 96 (13.4%) Ethnic background Dutch: 785 (90.4%) vs. 540 (75.3%) Non-Dutch Western: 37 (4.3%) vs. 82 (11.4%) Non-Western: 43 (5.0%) vs. 92 (12.8%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Prepregnancy BMI <25: 654 (75.3%) vs. 511 (71.3%) ≥25: 182 (21.0%) vs. 170 (23.7%) Socioeconomic status High: 187 (21.5%) vs. 180 (25.1%) Middle: 389 (44.8%) vs. 319 (44.5%) Low: 288 (33.2%) vs. 215 (30.0%) Parous, Home (n = 1,182) vs. Hospital (n = 728) Maternal age <25: 48 (4.1%) vs. 36 (4.9%) 25 to 35: 870 (73.6%) vs. 506 (69.5%) ≥35: 264 (22.3%) vs. 186 (25.5%) Ethnic background Dutch: 1,030 (87.1%) vs. 532 (73.1%) Non-Dutch Western: 82 (6.9%) vs. 69 (9.5%) Non-Western: 65 (5.5%) vs. 125 (17.2%) Prepregnancy BMI <25: 842 (71.2%) vs. 481 (66.1%) ≥25: 292 (24.7%) vs. 216 (29.7%) Socioeconomic status High: 321 (27.2%) vs. 205 (28.2%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Middle: 581 (49.2%) vs. 325 (44.6%) Low: 277 (23.4%) vs. 194 (26.6%)
Christensen & Overgaard, 2017 Denmark Data collected on sociodemographic characteristics, present and previous pregnancies and births, neonatal outcomes and transfers March 2004 to October 2008 Poor quality	N = 1,678 Planned Birth Center n = 839 Planned Obstetric Unit n = 839	Inclusion criteria: Freestanding Midwifery Unit - considered low obstetric risk, presented with spontaneous onset of labor between 37 + 0 and 41 + 6 weeks of gestation following an uncomplicated pregnancy Obstetric Unit- included in the control group only if they represented a strict match on all nine criteria at the start of care in labor (e.g., BMI, age, parity) Exclusion criteria: NR	Planned Birth Center (n = 839) vs. Planned Obstetric Unit (n = 839) Parity Primiparous: 215 (25.6%) vs. 215 (25.6%) Multiparous: 624 (74.4%) vs. 624 (74.4%) Ethnicity Nordic or Western European: 805 (96%) vs. 809 (96.4%) Other ethnicity: 34 (4.0%) vs. 30 (3.6%) Education level No postsecondary education 230 (27.4%) vs. 230 (27.4%) Postsecondary education 609 (72.6%) vs. 609 (72.6%) Occupation level Low level of employment: 535 (63.8%) vs. 535 (63.8%) High level of employment 304 (36.2%) vs. 304 (36.2%) Mean BMI: 24.2 ± 3.9 vs. 24.0 ± 3.9

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Mean age: 29.4 ± 4.6 vs. 30.2 ± 4.5
Davies-Tuck et al., 2018 Australia Victorian Perinatal Data Collection 2000 to 2015 Poor quality	N = 833,231 Planned Home n = 3,945 Planned Hospital n = 829,286 High Risk N = 128,971 Planned Home n = 743 Planned Hospital n = 128,228 Low Risk N = 704,260 Planned Home n = 3,202 Planned Hospital n = 701,058 High risk defined as any of the following: multiple pregnancy, post-term (> 41 and 6 weeks), non-cephalic presentation in labor, obesity (BMI Class 2 or	Inclusion criteria: Women who gave birth from 2000 to 2015 who had planned before the onset of labor to give birth either at home with a midwife or in a hospital, who delivered at or past 37 weeks gestation. Pregnancies were classified as high or low risk: high risk pregnancy was defined as: a multiple pregnancy, a post-term (> 41 + 6 weeks of gestation) pregnancy, a non-cephalic presentation in labor, obesity, a prior cesarean delivery, previous uterine surgery, grand multiparity (≥5 previous births), any significant maternal medical condition such as preexisting diabetes, hypertension, renal, cardiac, liver, respiratory, endocrine, immunological, renal, or gastrointestinal disease	Low risk, Planned Home (n = 3,202) vs. Planned Hospital (n = 701,058) Maternal Age <20: 19 (0.6%) vs. 21,845 (3.1%) 20 to 30: 870 (27.2%) vs. 292,891 (41.8%) ≥30: 2,269 (70.9%) vs. 385,833 (55%) BMI < 18.5: 74 (2.3%) vs. 9,642 (1.4%) 18.5 to 24.9: 902 (28.2%) vs. 155,936 (22.2%) 25 to 29.9: 284 (8.9%) vs. 74,788 (10.7%) ≥30: 98 (3.1%) vs. 30,515 (4.4%) Country of Birth Australian/NZ: 2,515 (78.5%) vs. 500,945 (71.5%) Non-Australian: 481 (15.0%) vs. 175,420 (25.0%) Parity Nulliparous: 1,103 (34.5%) vs. 347,079 (49.5%) Second birth: 1,187 (37.1%) vs. 218,790 (31.2%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
	greater), a prior cesarean, previous uterine surgery, grand multiparity (≥5 previous births), any significant maternal medical condition such as preexisting diabetes, hypertension, renal, cardiac, liver, respiratory, endocrine, immunological, renal, or gastrointestinal disease as determined by individual ICD-10 codes. Low risk defined as absence of any high risk condition.		3rd or subsequent birth: 912 (82.5%) vs. 135,181 (19.3%) Index of Relative Social Disadvantage quintile 1 Most Disadvantaged: 365 (11.4%) vs. 130,638 (18.6%) 2: 544 (17.0%) vs. 130,782 (18.7%) 3: 567 (17.7%) vs. 135,146 (19.3%) 4: 740 (21.1%) vs. 132,770 (18.9%) 5 Least Disadvantaged: 846 (26.4%) vs. 132,991 (19.0%) High risk, Planned Home (n = 743) vs. Planned Hospital (n = 128,228) Maternal Age <20: 2 (0.3%) vs. 2,051 (1.6%) 20 to 30: 162 (21.8%) vs. 44,543 (34.7%) ≥30: 573 (77.1%) vs. 81,605 (63.6%) BMI < 18.5: 15 (2.0%) vs. 1,310 (1.0%) 18.5 to 24.9: 196 (26.4%) vs. 25,437 (19.8%) 25 to 29.9: 85 (11.4%) vs. 16,288 (12.7%) ≥30: 73 (9.8%) vs. 32,406 (25.3%) Country of Birth

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Australian/NZ: 606 (81.6%) vs. 87,369 (68.1%) Non-Australian: 91 (12.3%) vs. 35,301 (27.5%) Parity Nulliparous: 142 (19.1%) vs. 41,499 (32.4%) Second birth: 294 (39.6%) vs. 48,341 (37.7%) 3rd or subsequent birth: 306 (41.2%) vs. 36,829 (28.7%) Index of Relative Social Disadvantage quintile 1 Most Disadvantaged: 84 (11.3%) vs. 29,013 (22.6%) 2: 110 (14.8%) vs. 26,024 (10.3%) 3: 134 (18.0%) vs. 23,966 (18.7%) 4: 177 (23.8%) vs. 21,320 (16.6%) 5 Least Disadvantaged: 176 (23.7%) vs. 19,244 (15.0%)
Davis et al., 2012 New Zealand New Zealand College of Midwives research database, managed by the Midwifery Maternity Provider Organisation	N = 16,210 Planned Home n = 1,830 Planned Primary Unit n = 2,877	Inclusion criteria: Low risk - see exclusion criteria Exclusion criteria:	Planned Home (n = 1,830) vs. Planned Primary Unit (n = 2,877) vs. Planned Secondary Hospital (n = 7,380) vs. Planned Tertiary Hospital (n = 4,123) Mean age: 30.4 ± 5.4 vs. 27.9 ± 6.0 vs. 27.7 ± 6.0 vs. 29.3 ± 5.9, p < 0.001

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
2006 to 2007 Fair quality	Planned Secondary Hospital n = 7,380 Planned Tertiary Hospital n = 4,123	Previous cesarean delivery, stillbirth, fetal death before commencement of labor, multiple birth, labor on or before 36 weeks + 6 days or after 41 weeks + 6 days, induced labor, breech or shoulder presentation, transverse lie, and elective cesarean delivery, previous postpartum hemorrhage (>1,000 mL), severe pregnancy-induced hypertension, gestational diabetes, Rh sensitization, ABO incompatibility, essential hypertension, diabetes, thyroid disease, drug or alcohol abuse, heart disease, pulmonary disease/asthma, hematological disorder, neurological disorder, renal/urinary tract disorder, muscular skeletal disorder, consultation with or transfer of care to another practitioner during antenatal period	Mean parity: 1.4 ± 1.4 vs. 1.1 ± 1.2 vs. 0.9 ± 1.2 vs. 0.7 ± 1.0, p < 0.001 Mean length of labor: 5.1 ± 4.8 vs. 6.1 ± 4.8 vs. 6.39 ± 4.6 vs. 7.4 ± 5.3, p < 0.001 Proportion of unassisted vaginal births: 95.4% vs. 94.7% vs. 84.5% vs. 72.7%, p < 0.001 Proportion of emergency cesarean deliveries: 2.6% vs. 3.2% vs. 8.5% vs. 14.9%, p < 0.001 Proportion of active management: 25.9% vs. 47.1% vs. 73.2% vs. 77.8%, p < 0.001
de Cock et al., 2015 The Netherlands Survey data, DELIVER study September 2009 to April 2011 Poor quality	N = 712 Home: n = 547 Planned hospital-Midwife: n = 165	Inclusion criteria: Singleton pregnancy, fetus in cephalic presentation, low-risk and in primary care at the onset of labor, started labor spontaneously between 37 and 42 weeks, stated intention to breastfeed prior to birth Exclusion criteria:	Planned Home (n = 547) vs. Planned Hospital-Midwife (n = 165) Ethnic background (p = 0.15) Dutch/other western: 529 (96.9%) vs. 154 (94.5%) Non-western: 17 (3.1%) vs. 9 (5.5%) Education level woman (p = 0.34)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
		Previous cesarean delivery, medical or obstetric risk factors that are an indication for secondary care, women who gave birth in hospital under the supervision of an obstetrician, place of birth unknown, child had congenital anomaly, completed questionnaire in the first week postpartum or after six months postpartum	Low/medium 203 (37.1%) vs. 68 (41.2%) High 344 (62.9%) vs. 97 58.8%) Education level partner (p = 0.42) Low/medium: 263 (48.5%) vs. 85 (52.1%) High: 279 (51.5%) vs. 78 (47.9%) Age (p = 0.35) ≤24 years: 32 (5.9%) vs. 8 (4.8%) 25–34 years: 422 (77.1%) vs. 121 (73.3%) ≥35 years: 93 (17.0%) vs. 36 (21.8%) Smoking before or during pregnancy (p = 0.31) Yes: 80 (14.6%) vs. 19 (11.5%) No: 467 (85.4%) vs. 146 (88.5%) Parity (p = 0.24) Nulliparous: 172 (31.4%) vs. 60 (36.4%) Parous: 375 (68.6%) vs. 105 (63.6%)
de Jonge et al., 2015 The Netherlands Netherlands Perinatal Registry 2000 to 2009 Fair quality	N = 743,070 Planned Home n = 466,112 Planned Hospital-Midwife n = 276,958	Inclusion criteria: Low-risk women in midwife-led care at the onset of labor, single pregnancy, spontaneous labor at ≥37 weeks gestation, no medical indication for hospital birth Exclusion criteria:	Planned Home (n = 466,112) vs. Planned Hospital-Midwife (n = 276,958) Parity Nulliparous: 198,515 (42.5%) vs. 137,168 (49.5%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
		Medium-risk women, women who had not received prenatal care, missing national perinatal database-1 form, unknown planned place of birth, prolonged ruptured membranes for more than 24 hours without contractions, an intrauterine death before labor began, a child with a congenital abnormality, gestational age <37 or >42 weeks	Parous: 267,526 (57.5%) vs. 139,740 (50.5%) Maternal age <25 years: 44,621 (9.6%) vs. 48,083 (17.4%) 25 to 34 years: 341,617 (73.3%) vs. 181,763 (65.6%) ≥35 years: 79,700 (17.1%) vs. 47,006 (17.0%) Ethnicity Dutch: 423,853 (90.9%) vs. 184,433 (66.6%) Non-Dutch: 38,999 (8.3%) vs. 90,276 (32.6%) Socioeconomic status Low: 113,091 (24.3%) vs. 103,230 (37.3%) Medium: 230,767 (49.5%) vs. 106,461 (38.4%) High: 116,641 (25.0%) vs. 62,635 (22.6%) Missing: 5,542 (1.2%) vs. 4,582 (1.7%)
de Jonge, et al., 2013 The Netherlands LEMMoN study merged with Netherlands Perinatal Registry August 2004 to August 2006 Fair quality	N = 146,752 Planned Home n = 92,333 Planned Hospital n = 54,419	Inclusion criteria: Singleton, cephalic, without medical or obstetric risk factors (e.g., history of prior cesarean delivery), spontaneous onset of labor between 37 and 42 weeks	Planned Home (n = 92,333) vs. Planned Hospital (n = 54,419) Parity 0: 38,728 (41.9%) vs. 26,499 (48.7%) 1+: 53,602 (58.1%) vs. 27,919 (51.3%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
		Exclusion criteria: ROM > 24 hours without contractions, "medium risk" history: prior postpartum hemorrhage or retained placenta, unknown planned place of birth	Gestational age 37+0 to 37+6: 3,404 (3.7%) vs. 2,296 (4.2%) 38+0 to 40+6: 67,507 (73.1%) vs. 40,256 (74.0%) 41+0 to 41+6: 21,422 (23.2%) vs. 11,867 (21.8%) Maternal age (years) <25: 9,142 (9.9%) vs. 9,407 (17.3%) 25-34: 66,554 (72.1%) vs. 35,137 (64.6%) ≥35: 16,630 (18.0%) vs. 9,868 (18.1%) Ethnicity Dutch: 83,629 (90.9%) vs. 36,126 (66.9%) Non-Dutch: 8,385 (9.1%) vs. 17,904 (33.1%) Socioeconomic position High: 23,243 (25.5%) vs. 12,324 (23.0%) Medium: 45,320 (49.7%) vs. 21,099 (39.4%) Low: 22,671 (24.8%) vs. 20,190 (37.7%)
Grigg et al., 2017 New Zealand Maternity and Midwifery Provider Organization data 2010 to 2011 Poor quality	N = 692 PMUs n = 407 TMH n = 285 Freestanding Primary Level Midwife-led Maternity Units	Inclusion criteria: All women booked to give birth at birthing centers near Christchurch, New Zealand between March 2010 and August 2011 Exclusion criteria:	Planned Birthing Center (n = 407) vs. Planned Hospital (n = 285) Mean age: 30.8 vs. 32.1 <25: 56 (13.8%) vs. 26 (9.2%) 25 to 29: 127 (31.2%) vs. 67 (23.6%) 30 to 34: 142 (34.9%) vs. 120 (42.3%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
	(PMUs) vs. Tertiary-level Obstetric-led Maternity Hospital (TMH)	Previous cesarean delivery, expecting twins, BMI > 40, neurological disorder	≥35: 83 (20.2%) vs. 71 (25.0%) Median parity: 1 (0.9) vs. 0 (0.5) Nulliparous: 167 (41.0%) vs. 157 (54.1%) Ethnicity NZ European: 308 (75.7%) vs. 226 (79.3%) Māori: 30 (7.4%) vs. 6 (2.1%) Other: 69 (17.0%) vs. 53 (18.6%) Smoker: 31 (7.6%) vs. 15 (5.3%) Residence City or semirural: 308 (75.7%) vs. 248 (87.0%) Rural or remote rural: 99 (25.3%) vs. 37 (13.0%) Has a partner: 377 (92.4%) vs. 260 (91.6%) BMI <25: 233 (58.7%) vs. 196 (69.3%) 25 to 35: 149 (37.5%) vs. 79 (27.9%) >35: 15 (3.8%) vs. 8 (2.8%) Income <$25,000 per annum before tax: 20/326 (6.1%) vs. 14/226 (6.2%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			$25,000 to $50,000: 95/326 (29.1%) vs. 34/226 (15.0%) $50,000 to $75,000: 99/326 (30.4%) vs. 70/226 (31.0%) >NZ$75,000: 112/326 (34.4%) vs. 108/226 (47.8%) Education No post school completed: 67/331 (20.2%) vs. 36/230 (15.7%) Apprenticeship, certificate: 55/331 (16.6%) vs. 32/230 (13.9%) Diploma: 56/331 (16.9%) vs. 41/230 (17.8%) Degree: 153/331 (46.2%) vs. 121/230 (52.6%)
Grunebaum, McCullough, Arabin et al., 2017 U.S. CDC-linked birth-infant death data set 2008 to 2012 Poor quality	N = 15,906,211 Planned Home n = 95,657 Planned Hospital-CNM n = 1,363,199 Planned Hospital-Physician n = 14,447,355	Inclusion criteria Liveborn, singleton, term (≥ 37 weeks), birth weight ≥ 2500g, delivered by physician, CNM, or other midwife. Exclusion criteria Preterm, low birthweight (<2,500g), other deliverer, other location than home or hospital	Planned Home (n = 95,657) vs. Planned Hospital-CNM (n = 1,363, 199) vs. Planned Hospital-Physician (n = 14,447,355) Unmarried: 8685 (9.1%) vs. 587,688 (43.1%) vs. 5,721,977 (39.6%) White non-Hispanic: 84,759 (88.6%) vs. 728,918 (53.5%) vs. 7,779,467 (53.8%) Nulliparous: 22,773 (23.8%) vs. 540,582 (39.7%) vs. 5,896,748 (40.8%) 41+ weeks: 27,825 (29.1%) vs. 297,534 (20.5%) vs. 2,252,777 (15.6%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Maternal age ≥35: 20,807 (21.8%) vs. 146,339 (10.7%) vs. 2,087,544 (14.4%)
Grunebaum, McCullough, Sapra et al., 2017 U.S. CDC-linked birth-infant death files 2009 to 2013 Fair quality	N = 12,953,671 Planned Home n = 96,815 Planned Hospital-CNM n = 1,077,197 Planned Hospital-Physician n = 11,779,659	Inclusion criteria Term (≥37 weeks), weight ≥2,500 g, singleton, nonanomalous, states using the 2003 revised birth certificate Exclusion criteria Birthplace outside hospital or home, unintended home birth, multiple gestations, residents of a foreign country	Planned Home Birth (n = 96, 815) vs. Planned Hospital-CNM (n = 1,077,197) vs. Planned Hospital-Physician (n = 11,779,659) Maternal ethnicity Non-Hispanic white: 87,253 (90.1%) vs. 577,665 (53.6%) vs. 6,276,662 (53.3%) Black: 1,890 (2.0%) vs. 137,484 (12.8%) vs. 1,539,889 (13.1%) Hispanic: 4,643 (4.8%) vs. 283,687 (26.3%) vs. 3,042,950 (25.8%) Other: 1,614 (1.7%) vs. 71,335 (6.6%) vs. 828,184 (7.0%) Unknown: 1,415 (1.5%) vs. 7,026 (0.7%) vs. 91,974 (0.8%) Maternal age, years <25: 15,294 (15.8%) vs. 390,660 (36.3%) vs. 3,745,494 (31.8%) 25 to 34: 61,409 (63.4%) vs. 567,481 (52.7%) vs. 6,336,325 (53.8%) ≥35: 20,106 (20.8%) vs. 119,030 (11.0%) vs. 1,697,022 (14.4%) Maternal education, years

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			<13: 38,443 (39.7%) vs. 496,538 (46.1%) vs. 4,998,057 (42.4%) ≥13: 57,729 (59.6%) vs. 566,134 (52.6%) vs. 6,642,060 (56.4%) Prenatal visits, n 0: 2,652 (2.7%) vs. 8,839 (0.8%) vs. 145,689 (1.2%) 1-5: 13,255 (13.7%) vs. 49,372 (5.6%) vs. 519,504 (4.4%) ≥6: 79,765 (82.4%) vs. 973,834 (90.4%) vs. 10,679,376 (90.7%) Insurance Private: 12,174 (12.6%) vs. 294,262 (27.3%) vs. 3,464,544 (29.4%) Government: 6,145 (6.3%) vs. 319,590 (29.7%) vs. 3,337,667 (28.3%) Self-pay/other: 42,808 (44.2%) vs. 47,071 (4.4%) vs. 423,746 (3.6%) Unknown: 3,055 (3.2%) vs. 12,945 (1.2%) vs. 89,663 (0.8%) Not reported: 32,633 (33.7%) vs. 89,663 (0.8%) vs. 4,464,039 (37.9%) Parity Nulliparous: 20,125 (20.8%) vs. 424,060 (39.4%) vs. 4,756,609 (40.4%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Parous: 75,809 (78.3%) vs. 641,625 (59.6%) vs. 6,952,531 (59.0%) Unknown: 881 (0.9%) vs. 11,512 (1.1%) vs. 70,519 (0.6%) Previous cesarean delivery No: 92,199 (95.2%) vs. 1,048,436 (97.3%) vs. 9,961,948 (84.6%) Yes: 4,273 (4.4%) vs. 22,176 (2.1%) vs. 1,782,055 (15.1%) Unknown: 343 (0.4%) vs. 6,585 (0.6%) vs. 35,656 (0.3%) Newborn weight, g 2,500 to 3,900: 76,428 (78.9%) vs. 982,994 (91.3%) vs. 10,744,142 (92.2%) ≥ 4,000: 20,387 (21.1%) vs. 94,203 (8.7%) vs. 1,035,517 (8.8%) Gestational age (week) 37-38: 14,205 (14.7%) vs. 256,151 (23.8%) vs. 3,341,327 (28.4%) 39-40: 54,232 (56.0%) vs. 606,165 (56.3%) vs. 6,645,173 (56.4%) ≥41: 28,378 (29.3%) vs. 214,881 (19.9%) vs. 1,793,159 (15.2%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Presentation Cephalic: 93,462 (96.5%) vs. 1,036,683 (96.2%) vs. 10,977,624 (93.2%) Breech: 553 (0.6%) vs. 1,921 (0.2%) vs. 300,204 (2.5%) Other: 470 (0.5%) vs. 11,189 (1.0%) vs. 259,162 (2.2%) Unknown: 2,330 (2.4%) vs. 27,404 (2.5%) vs. 242,669 (2.1%) Risk composite No risk present: 37,286 (38.5%) vs. 414,744 (38.5%) vs. 3,464,701 (29.4%) Any risk present: 57,831 (59.7%) vs.637,530 (59.2%) vs. 8,124,803 (69.0%) Unknown: 1,698 (1.8%) vs. 24,923 (2.3%) vs. 190,155 (1.6%)
Halfdansdottir et al., 2018 Iceland Maternity notes review 2005 to 2009 Poor quality	N = 1,228 Low Risk N = 1,129 Planned Home n = 278 Planned Hospital n = 851 High Risk	Inclusion criteria: Women who intended to give birth at a home under the care of a midwife in Iceland before the onset of labor in 2005 to 2009, and hospital births matched on parity, maternal age, residence, known risks, and year of birth to similar hospital births Exclusion criteria:	Overall Mean age: 30.3 ± 4.7 < 25: 136 (11.1%) 25 to 34: 857 (69.8%) ≥35: 235 (19.1%) Residence Capital (all ≤ 20 min): 931 (75.8%) Rural ≤ 20 min: 196 (16.0%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
	N = 99 Planned Home n = 29 Planned Hospital n = 70	Hospital births that did not meet the criteria for home birth, unless matched on specific risk to a contraindicated home birth	Rural > 20 min: 101 (8.2%) Marital status Married: 505 (41.2%) Cohabiting: 650 (53.0%) Single: 72 (5.9%) Occupation Specialist: 569 (56.1%) Semi-specialist: 304 (30.0%) Non-specialist: 142 (14.0%) Citizenship Non-Icelandic: 105 (8.8%) Parity Primiparous: 256 (20.8%) Multiparous: 972 (79.2%) Previous home births: 70 (5.7%) Previous instrumental births: 137 (11.2%) BMI <25: 676 (56.9%) 25 to 29.99: 356 (30.0%) ≥30: 156 (13.1%) Maternal smoking: 35 (2.9%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Place of birth Hospital: 921 (75.0%) Home: 307 (25.0%) Mean gestation: 2,81.4 ± 7.4 Mean birthweight: 3,764 ± 475 Congenital anomalies: 57 (4.6%)
Halfdansdottir et al., 2015 Iceland Review of midwives' and doctors' original hand-written maternity notes 2005 to 2009 Poor quality	N = 1,228 Planned Home n = 307 Planned Hospital n = 921	Inclusion criteria: All planned home births accepted for midwifery care in Iceland at the onset of labor in 2005–2009, and births in a hospital or alongside midwifery unit matched on matched on parity (primipara vs. multipara); contraindications (if present in the home birth); residence (capital vs. rural, by transfer time to hospital); maternal age (±2 years); and year of birth (next in chronological order) Exclusion criteria: Unplanned and unattended home births, births in a hospital or midwifery unit that were not matched to the include home birth cases, women with any of 67 predefined contraindications (supporting information), based on the Directorate of	Planned Home (n = 307) vs. Planned Hospital or Midwifery Alongside Unit (n = 921) Mean age: 30.6 ± 4.9 vs. 30.2 ± 4.7, p = 0.120 <25: 33 (10.7%) vs. 103 (11.2%) 25 to 34: 202 (65.8%) vs. 655 (71.1%) ≥35: 72 (23.5%) vs. 163 (17.7%), p = 0.084 Marital status Married: 143 (46.6%) vs. 362 (39.3%) Cohabiting: 156 (50.8%) vs. 494 (53.7%) Single: 8 (2.6%) vs. 64 (7.0%) Occupation Specialist: 170 (59.4%) vs. 399 (54.7%) Semispecialist: 89 (31.1%) vs. 215 (29.5%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
		Health's guidelines for home births, were excluded when matching low-risk home births without contraindications	Nonspecialist: 27 (9.4%) 115 vs. (15.8%) Citizenship Icelandic: 286 (93.8%) vs. 799 (90.3%) Non-Icelandic: 19 (6.2%) vs. 86 (9.7%) Parity Primipara: 64 (20.8%) vs. 192 (20.8%) Multipara: 243 (79.2%) vs. 729 (79.2%) Previous home births No: 235 (77.0%) vs. 920 (100.0%) Yes: 70 (23.0%) vs. 0 (0.0%) Previous instrumental births No: 275 (90.2%) vs. 813 (88.4%) Yes: 30 (9.8%) vs. 107 (11.6%) BMI <25: 171 (59.2%) vs. 505 (56.2%) 25 to 29.99: 88 (30.4%) vs. 268 (29.8%) ≥30: 30 (10.4%) vs. 126 (14.0%) Smoking No: 294 (97.0%) vs. 895 (97.2%) Little: 9 (3.0%) vs. 26 (2.8%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Mental health problems No: 290 (94.5%) vs. 885 (96.1%) Yes: 17 (5.5%) vs. 36 (3.9%) Contraindications No: 278 (90.6%) vs. 851 (92.4%) Yes: 29 (9.4%) vs. 70 (7.6%) Contraindications: hypertensive disorders; previous cesarean delivery; isoimmunization; prolonged pregnancy; hyperthyroidism; bipolar affective disorder; abnormal findings on antenatal screening; macrosomia or anticipated maternal–fetal disproportion; BMI >35 or <18
Hitzert et al., 2016 The Netherlands Dutch Birth Centre Study August to December 2013 Poor quality	N = 990 Planned Home n = 350 Planned Birth Center n = 263 Planned Hospital-Midwife n = 262 Planned Hospital-Obstetrician n = 115	Inclusion criteria: Postpartum women under the care of community midwives in 82 randomly recruited midwifery practices between August 1 and December 31, 2013	Planned Home (n = 350) vs. Planned Birth Center (n = 263) vs. Planned Hospital-Midwife (n = 262) vs. Hospital-Obstetrician (n = 115) Age ≤25: 21 (6.5%) vs. 12 (4.6%) vs. 14 (5.8%) vs. 3 (2.7%) 26 to 35: 238 (73.2%) vs. 195 (75.0%) vs. 174 (72.5%) vs. 76 (69.1%) ≥36: 66 (20.3%) vs. 53 (20.4%) vs. 52 (21.7%) vs. 31 (28.2%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Primiparous: 126 (38.0%) vs. 154 (58.8%) vs. 113 (46.5%) vs. 47 (42.3%) Multiparous: 206 (62.0%) vs. 108 (41.2%) vs. 130 (53.5%) vs. 64 (57.7%) Education Low: 26 (8.0%) vs. 16 (6.1%) vs. 14 (6.0%) vs. 10 (9.4%) Middle: 120 (36.9%) vs. 64 (24.4%) vs. 72 (30.9%) vs. 35 (33.0%) High: 179 (55.1%) vs. 182 (69.5%) vs. 147 (63.1%) vs. 61 (57.5%) Ethnicity Dutch: 312 (96.3%) vs. 247 (93.9%) vs. 203 (84.6%) vs. 93 (85.3%) Non-Dutch: 12 (3.7%) vs. 16 (6.1%) vs. 37 (15.4%) vs. 16 (14.7%)
Hollowell et al., 2017 England Birthplace in England national prospective cohort study April 2008 to April 2010 Fair quality	N = 27,938 Planned Birthing Center n = 11,265 Planned Hospital n = 16,673	Inclusion criteria: Low-risk single pregnancy, received prenatal care from an NHS midwife, not known to have any medical or obstetric risk factors Exclusion criteria: Presented with labor <37 weeks, no prenatal care, experienced stillbirth prior to onset of labor	Planned Birthing Center (n = 11,265) vs. Planned Hospital (n = 16,673) Parity Nulliparous: 5,187 (46.0%) vs. 8,350 (50.1%) Multiparous: 6,078 (54.0%) vs. 8,323 (49.9%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Maternal age < 20 years: 676 (6%) vs. 1,054 (6%) 20 to 24 years: 2,129 (19%) vs. 3,208 (19%) 25-29 years: 3,258 (29%) vs. 4,994 (30%) 30-34 years: 3,244 (29%) vs. 4,574 (27%) 35 to 39 years: 1,690 (15%) vs. 2,227 (13%) 40+: 254 (2%) vs. 298 (2%) BMI 10 to 18.4: 234 (2.1%) vs. 437 (2.6%) 18.5 to 24.9: 5,596 (50%) vs. 8,202 (49.2%) 25.0 to 29.9: 2,648 (23.5%) vs. 3,784 (22.7%) 30.0 to 35.0: 911 (8.1%) vs. 1,269 (7.6%) Not Recorded: 1,861 (16.5%) vs. 2,915 (17.5%)
Homer et al., 2014 Australia Perinatal Data Collection, Admitted Patient Data Collection, Register of Congenital Conditions, Registry of Birth Deaths and Marriages, and the Australian Bureau of Statistics 2000 to 2008 Fair quality	N = 258,161 Planned Home n = 742 Planned Birth Center n = 14,483 Planned Hospital n = 242,936	Inclusion criteria: Women who gave birth to a singleton baby in a cephalic presentation following spontaneous labor at >37 weeks gestation from July 1, 2000, up to and including June 30, 2008 Exclusion criteria: Women who had an elective cesarean delivery, the baby was born before arrival to hospital, the birth occurred before 37	Planned Home (n = 742) vs. Planned Birth Center (n = 14,483) vs. Planned Hospital (n = 242,936) Age <20: 7 (0.9%) vs. 513 (3.5%) vs. 15,280 (6.3%) 20 to 24: 54 (7.3%) vs. 2,122 (14.7%) vs. 42,544 (17.5%) 25 to 29: 159 (21.4%) vs. 4,529 (31.3%) vs. 73,440 (30.2%), p < 0.001

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
		completed weeks gestation, had received no antenatal care, were attempting a vaginal birth after previous cesarean delivery (VBAC) for this birth, the baby was diagnosed with a congenital abnormality (that is, registered on the NSW Register of Congenital Conditions), had labor induced for any reason, or had a baby who had received a diagnosis (as recorded on the birth and subsequent admission data on the Admitted Patient Data Collection) of a congenital condition and who died within the first week of life resulted in that woman and baby pair being excluded from the cohort	30 to 34: 249 (33.6%) vs. 4,788 (33.1%) vs. 73,404 (30.2%) 35 to 39: 185 (24.9%) vs. 2,181 (15.1%) vs. 32,058 (13.2%) ≥40: 49 (6.6%) vs. 349 (2.4%) vs. 6,134 (2.5%) Previous pregnancies (≥20 weeks) 0: 313 (42.2%) vs. 9,145 (63.1%) vs. 149,459 (61.5%) 1: 219 (29.5%) vs. 3,328 (23.0%) vs. 54,445 (22.4%), p < 0.001 2: 143 (19.3%) vs. 1,453 (10.0%) vs. 24,627 (10.1%) ≥3: 59 (8.0%) vs. 552 (3.8%) vs. 14,259 (5.9%)
Hutton et al., 2016 Ontario, Canada Chart review March 2016 to April 2009 Poor quality	N = 22,986 Planned Home n = 11,493 Planned Hospital n = 11,493	Inclusion criteria: Term (≥ 37 weeks), single prior cesarean delivery Exclusion criteria: Alcohol or drug dependency, chronic hypertension, diabetes, heart condition, hepatitis B, HIV, isoimmunization, anemia unresponsive to treatment, antepartum bleeding, eclampsia, gestational diabetes, IUGR, SGA, oligohydramnios, pregnancy-induced hypertension, preterm delivery	Planned Home (n = 11,493) vs. Planned Hospital (n = 11,493) Age < 25: 1,512 (13.2%) vs. 1,821 (15.8%) 25–34: 7,802 (67.9%) vs. 8,015 (69.7%) ≥ 35: 2,177 (18.9%) vs. 1,656 (14.4%) Parity 0: 4,027 (35.0%) vs. 4,027 (35.0%) 1–4: 7,084 (61.6%) vs. 7,311 (63.6%) > 4: 382 (3.3%) vs. 155 (1.3%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
		(<37 weeks), breech presentation, multiple gestations, medical induction (oxytocin or prostaglandin), lethal congenital anomaly	Previous cesarean deliveries 0: 11,206 (97.5%) vs. 11,206 (97.5%) 1: 271 (2.4%) vs. 287 (2.5%) > 1: 16 (0.1%) vs. 0 (0.0%) Maternal smoking: 477 (4.3%) vs. 647 (5.8%) Multiple birth: 2 (0.02%) vs. 0 (0.0%) Breech presentation: 35 (0.3%) vs. 0 (0.0%) Gestational age < 37 weeks: 101 (0.9%) vs. 0 (0.0%) 37 to 41 weeks, 6 days: 11,210 (97.5%) vs. 11,414 (99.3%) > 41 weeks, 6 days: 182 (1.6%) vs. 79 (0.7%)
Hutton et al., 2009 Canada Ontario Ministry of Health database 2003 to 2006 Poor quality	N = 13,384 Planned Home n = 6,692 Planned Hospital n = 6,692	Inclusion criteria: Midwife-attended births that occurred between April 1, 2003, and March 31, 2006 who planned a home birth at the outset of labor, and a comparable low-risk group of women who planned a hospital birth at the outset of labor, and groups were matched with respect to parity and previous lower segment cesarean delivery	Planned Home (n = 6,692) vs. Planned Hospital-Midwife (n = 6,692) Age <25: 729 (10.9%) vs. 844 (12.6%) 25 to 34: 4,428 (66.1%) vs. 4,630 (69.2%) ≥35: 1,503 (22.5%) vs. 1,199 (17.9%) Parity 0: 2,293 (34.3%) vs. 2,298 (34.3%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			1 to 4: 4,172 (62.3%) vs. 4,289 (64.1%) >4: 221 (3.3%) vs. 105 (1.6%) Previous cesarean delivery 0: 6,479 (96.8%) vs. 6,485 (96.9%) 1: 200 (3.0%) vs. 207 (3.1%) >1: 6 (0.1%) vs. 0 (0%)
Janssen et al., 2009 British Columbia, Canada Perinatal Database Registry and vital statistics 2000 to 2004 Poor quality	N = 12,982 Planned Home n = 2,889 Planned Hospital-Midwife n = 4,752 Matched Sample of Physician-attended Hospital Births n = 5,331	Inclusion criteria: Planned home birth - Singleton fetus, cephalic presentation, gestational age greater than 36 and less than 41 completed weeks, no more than 1 previous cesarean delivery, labor is spontaneous or induced on an outpatient basis, absence of significant preexisting disease (including heart disease, hypertensive chronic renal disease or type 1 diabetes), absence of significant disease arising during pregnancy (including pregnancy-induced hypertension with proteinuria, antepartum hemorrhage after 20 weeks' gestation, gestational diabetes requiring insulin, active genital herpes, placenta previa or placental abruption), mother has not been transferred to the delivery hospital from a referring hospital Hospital attended by registered midwife - Met eligibility criteria for home birth, midwife was in attendance during labor,	Planned Home (n = 2,889) vs. Planned Hospital-Midwife (n = 4,752) vs. Matched Sample of Physician-attended Hospital Births (n = 5,331) Age 15 to 19: 48 (1.7%%) vs. 116 (2.4%) vs. 92 (1.7%) 20 to 24: 336 (11.6%) vs. 584 (12.3%) vs. 629 (11.8%) 25 to 29: 892 (30.8%) vs. 1,371 (28.9%) vs. 1,644 (30.8%) 30 to 34: 1,025 (35.4%) vs. 1,682 (35.4%) vs. 1,883 (35.3%) ≥ 35: 598 (20.6%) vs. 999 (21.0%) vs. 1,083 (20.3%) Nulliparous: 1,215 (41.9%) vs. 2,428 (51.1%) vs. 2,204 (41.3%) Mean gestational age at first prenatal contact: 12.2 ± 7.0 vs. 12.2 ± 6.8 vs. 11.8 ± 5.9

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
		rosters of the College of Midwives indicated that birth was planned to be in hospital Hospital attending by physician - Matched births that met eligibility criteria for home birth to each home birth on a 2:1 ratio - parameters were year of birth, parity, single parent, maternal age and hospital where the midwife conducting the index home birth had hospital privileges; women did not require oxytocin for induction of labor Exclusion criteria: NR	Mean number of antenatal visits: 11.8 ± 3.3 vs. 11.2 ± 3.6 vs. 9.3 ± 2.7 Mean BMI: 22.8 ± 4.0 vs. 23.3 ± 4.3 vs. 23.2 ± 4.3 Single parent 91 (3.1%) vs. 252 (5.3%) vs. 163 (3.1%) Use of illicit drugs during pregnancy: 39 (1.3%) vs. 57 (1.2%) vs. 71 (1.3%) Use of alcohol during pregnancy: 10 (0.3%) vs. 25 (0.5%) vs. 35 (0.7%) Smoking status Current: 166 (5.7%) vs. 375 (7.9%) vs. 487 (9.1%) Former: 256 (8.8%) vs. 417 (8.8%) vs. 211 (4.0%) Never: 2,477 (85.4%) vs. 3,960 (83.3%) vs. 4,633 (86.9%) Income quintile 1 (lowest): 650 (23.4%) vs. 906 (19.8%) vs. 1,088 (21.1%) 2: 593 (21.3%) vs. 910 (19.9%) vs. 1,163 (22.6%) 3: 525 (18.9%) vs. 913 (20.0%) vs. 1,006 (19.5%) 4: 543 (19.5%) vs. 984 (21.5%) vs. 1,020 (19.8%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			5 (highest): 460 (16.5%) vs. 862 (18.8%) vs. 875 (17.0%)
Katoaka et al., 2018 Japan Review of medical records Birth centers: 2001 to 2006, one hospital: 2004 to 2006, other hospital: 2008 Poor quality	N = 9,588 Planned Birth Center n = 5,379 Planned Hospital n = 4,209	Inclusion criteria: Vaginal delivery, gestation at ≥22 weeks, singleton, and cephalic presentation Exclusion criteria: Transportation to other facilities, cesarean delivery, and twin pregnancies	Planned Birth center (n = 5,379) vs. Planned Hospital (n = 4,209) Age <20: 20 (0.4%) vs. 20 (0.5%) 20 to 29: 1,537 (28.7%) vs. 1,273 (30.3%) 30 to 39: 3,669 (68.6%) vs. 2,762 (65.7%) ≥40: 122 (2.3%) vs. 147 (3.5%) Parity 0: 1,579 (29.4%) vs. 2,675 (63.6%) 1: 2,345 (43.6%) vs. 1,235 (29.3%) 2: 1,132 (21.0%) vs. 252 (6.0%) 3: 246 (4.6%) vs. 42 (1.0%) ≥4: 77 (1.4%) vs. 5 (0.1%)
Kennare et al., 2010 Australia Pregnancy Outcome Unit of South Australia Health perinatal data for all births and data on perinatal deaths 1991 to 2006 Poor quality	N = 298,333 Planned Home n = 1,141 Planned Hospital n = 297,192	Inclusion criteria: Live births and stillbirths of at least 400 g birthweight or 20 weeks' gestation Exclusion criteria: No antenatal care, termination of pregnancy	Planned Home (n = 1,141) vs. Planned Hospital (n = 297,192) Mean age: 31.3 ± 5.5 vs. 29.2 ± 5.5 Nulliparous: NR (31.2%) vs. NR (41.0%), p < 0.001) Indigenous: NR (1.0%) vs. NR (2.2%), p = 0.003 Live in the metropolitan area: NR (79.8%) vs. NR (76.0%), p = 0.003)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Post-term pregnancies (42 weeks' gestation): NR (3.8%) vs. NR (1.2%), p < 0.001
Laws et al., 2014 Australia Registry of Births, Deaths, and Marriages, Midwives Data Collection, Admitted Patient Data Collection 2001 to 2009 Poor quality	N = 81,932 Planned Birth Center n = 15,742 Planned Hospital n = 66,190	Inclusion criteria: All women intending to give birth in birth centers, to singleton babies at 37 or more weeks' gestation, with a spontaneous onset of labor, born between January 1, 2001, and December 31, 2009, plus 66,190 women intending to give birth in the co-located hospitals during the same period	Planned Birth Center (n = 15,742) vs. Planned Hospital (n = 66,190) Maternal age <20: 508 (3.2%) vs. 3,267 (4.9%) 20 to 24: 2,256 (14.3%) vs. 10,154 (15.3%) 25 to 29: 4,873 (31.0%) vs. 19,264 (29.1%) 30 to 34: 5,222 (33.2%) vs. 20,985 (31.7%) ≥35: 2,883 (18.3%) vs. 12,519 (18.9%) Country of birth Australia: 8,795 (55.9%) vs. 28,787 (43.5%) Overseas: 3,828 (24.3%) vs. 24,936 (37.7%) SEIFA Index of Disadvantage 1 (least): 3,496 (22.2%) vs. 15,074 (22.9%) 2: 4,690 (29.8%) vs. 18,640 (28.3%) 3: 4,085 (26.0%) vs. 14,011 (21.3%) 4: 2,156 (13.7%) vs. 9,316 (14.2%) 5 (most): 1,286 (8.2%) vs. 8,715 (13.3%) Parity Primiparous: 9,694 (61.6%) vs. 40,669 (61.4%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Multiparous: 6,048 (38.4%) vs. 25,428 (38.4%) Smoke during pregnancy: 1,440 (9.1%) vs. 8,959 (13.5%)
Li et al., 2017 South Carolina Birth certificates 1996 to 2013 Poor quality	N = 948,343 2004 to 2013 n = 550,239 1996 to 2003 n = 398,104 Planned Home n = 2,562 Planned Birth Center n = 1,274 Planned Clinic n = 22 Planned Hospital n = 944,299	Inclusion criteria: Live births born from 1996 to 2013 (of at least 20 weeks of gestation and 500 g birthweight) with linked datasets, including birth certificates and death certificates, statewide hospital discharge abstracts for inpatient and emergency room visits, and Medicaid claims data for both inpatient and outpatient visits and physician office visits in South Carolina Exclusion criteria: NR	NR
Li et al., 2015 United Kingdom Birthplace national prospective cohort study April 2008 to April 2010 Good quality	N = 8,180 higher risk Planned Home n = 1,489 Planned Hospital (i.e., obstetric unit) n = 6,691	Inclusion criteria: Birthplace cohort limited to "those with specified medical or obstetric risk factors known prior to the onset of labor or with post-term pregnancies (gestational age 42+1 weeks or more)" Exclusion criteria:	Patient characteristics stratified by nulliparous and parous women, then by planned home and planned obstetric unit. See table 1 in original study for details. Medical and obstetrics risk factors known prior to onset of labor

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
	n = 16,619 "low risk" women	Planned induction of labor	Nulliparous- Planned Home (n = 288) vs. Planned Hospital (n = 2,524) Confirmed cardiac disease: 5 (1.54%) vs. 49 (2.00%) Hypertensive disorders: 7 (2.17%) vs. 225 (8.59%) Asthma: 9 (3.55%) vs. 64 (2.40%) Group B strep: 22 (7.43%) vs. 337 (13.07%) Hyperthyroidism: 12 (4.14%) vs. 45 (1.72%) Diabetes: 1 (0.27%) vs. 89 (3.62%) Epilepsy: 3 (0.67%) vs. 60 (2.27%) 'Other' medical: 20 (7.84%) vs. 78 (3.10%) Any medical: 108 (37.93%) vs. 1102 (43.29%) Current pregnancy Pre-eclampsia or pregnancy-induced hypertension: 6 (2.37%) vs. 369 (14.60%) Gestational diabetes: 8 (2.63%) vs. 119 (4.68%) BMI at booking >35 kg/m2: 70 (24.60%) vs. 557 (22.24%) Post-term (42+1–44 weeks): 78 (26.80%) vs. 198 (8.20%) Small for gestational age: 5 (1.67%) vs. 107 (4.11%) 'Other' obstetric/fetal: 15 (4.62%) vs. 120 (4.84%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Any obstetric/fetal 187 (64.36%) vs. 1570 (62.64%) Medical and obstetric/fetal risk factors per women 1: 272 (95.05%) vs. 2,222 (88.20%) 2+: 6 (4.95%) vs. 302 (11.80%) Parous- Planned Home (n = 1,201) vs. Planned Hospital (n = 4,167) Confirmed cardiac disease: 10 (0.75) vs. 44 (1.05%) Hypertensive disorders: 16 (1.26%) vs. 150 (3.50%) Asthma: 6 (2.40%) vs. 50 (1.19%) Group B strep: 81 (6.17%) vs. 495 (11.95%) Hyperthyroidism: 35 (2.87% vs. 69 (1.63%) Diabetes: 4 (0.32%) vs. 95 (2.19%) Epilepsy: 24 (1.96%) vs. 81 (1.80%) 'Other' medical: 55 (4.30%) vs. 76 (1.73%) Any medical: 310 (24.81%) vs. 1273 (30.21%) Complications in previous pregnancies postpartum hemorrhage with

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			treatment/transfusion: 61 (4.86%) vs. 179 (4.43%) Retained placenta: 66 (5.87%) vs. 123 (3.14%) Caesarean delivery 209 (18.21%) vs. 1,227 (30.35%) Current pregnancy Pre-eclampsia or pregnancy-induced hypertension: 16 (1.20%) vs. 176 (4.13%) Gestational diabetes: 175 (4.33%) vs. 33 (3.14%) BMI at booking >35 kg/m2: 828 (19.48%) vs. 314 (26.23%) Post-term (42+1–44 weeks): 132 (3.11%) vs. 114 (8.92%) Small for gestational age: 136 (2.96%) vs. 18 (1.58%) 'Other' obstetric/fetal: 143 (3.55%) vs. 78 (6.56%) Any obstetric/fetal: 3213 (77.44%) vs. 936 (78.93%) Medical and obstetric/fetal risk factors per women 1: 1,079 (90.23%) vs. 3,415 (82.00%) 2+: 122 (9.77%) vs. 752 (18.00%)
Li et al., 2014 United Kingdom	N = 63,371 16 to 19 n = 3354	Inclusion criteria:	Previously described in Birthplace, 2011

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
Birthplace April 2008 to April 2010 Good quality	20 to 24 n = 11,395 25 to 29 n = 18,091 30 to 34 n = 18,453 35 to 39 n = 10,397 40 and over n =1,681	Age 16 year and older, 37 and 0 weeks to 42 and 0 weeks gestation, parity less than 6, "low-risk" Exclusion criteria: elective cesarean delivery or cesarean delivery before onset of labor, presented in preterm labor (<37 weeks' gestation), multiple pregnancy, unplanned home birth, received no antenatal care	
MacDorman & Declercq, 2016 U.S. Birth certificates in 47 states and DC 2004 to 2014 Poor quality	Planned Home n = 29,021 Planned Birthing Center n = 18,047 Planned Hospital n = 3,773,115	Inclusion criteria: Births in states that had implemented the revised birth certificate Exclusion criteria: NR	Planned Home (n = 29,021) vs. Planned Birthing Center (n = 18,047) vs. Planned Hospital (n = 3,773,115) Not all states report on every population characteristic Pre-pregnancy BMI < 18.5: 4.3% vs. 4.4% vs. 3.8% 18.5 to 24.9: 62.9% vs. 61.9% vs. 45.6% 25.0 to 29.9: 21.2% vs. 21.9% vs. 25.6% 30+: 11.6% vs. 11.8% vs. 25.0% Smoked during pregnancy: 0.9% vs. 1.3% vs. 8.5% First live birth: 20.5% vs. 36.1% vs. 39.2%

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Percent VBAC: 4.6% vs. 1.6% vs. 1.6% Maternal education Less than high school diploma: 22.8% vs. 13.8 vs. 15.1% High school diploma: 13.0% vs. 11.9% vs. 25.3% Some college: 26.5% vs. 27.8% vs. 29.6% Bachelor's degree: 26.4% vs. 31.2% vs. 19.0% Master's degree or higher: 11.2% vs. 15.3% vs. 11.0% Prenatal care: Began during first trimester: 54.3% vs. 66.9% vs. 76.9% Began during second trimester: 34.4% vs. 27.0% vs. 17.2% Late or no prenatal care: 11.4% vs. 6.0% vs. 5.9% Receipt of WIC food: 8.2% vs. 11.8% vs. 44.2% Method of payment for this delivery Medicaid: 8.5% vs. 18.4% vs. 44.2% Private insurance: 19.7% vs. 47.0% vs. 48.0% Self-pay: 67.1% vs. 31.9% vs. 3.4%

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Other: 4.7% vs. 2.6% vs. 4.4% Attendant at birth Physician: 0.9% vs. 3.1% vs. 91.5% CNM/CM: 28.1% vs. 53.6% vs. 8.0% Other midwife: 49.6% vs. 39.0% vs. 0.2% Other: 21.5% vs. 4.3% vs. 0.4%
Monk et al., 2014 Australia ObstetriX surveillance system of point-of-care maternity data collection across the antenatal, intrapartum, and immediate postnatal periods 2005 to 2006 Fair quality	N = 3,651 Planned Birth Center n = 494 Planned Tertiary Maternity Unit n = 3,157	Inclusion criteria: All women booked to give birth at the freestanding midwifery units were considered low risk and were included in the study, regardless of their specific ACM risk classification Exclusion criteria: NR	Planned Birth Center (n = 494) vs. Planned Tertiary Maternity Unit (n = 3,157) Mean age: 29.6 vs. 28.5 Median parity: 1 (0.9) vs. 1 (1.0) Nulliparous: 208 (42.1%) vs. 1,364 (43.2%) Ethnicity African: 5 (1.0%) vs. 40 (1.3%) Asian: 100 (20.2%) vs. 140 (4.4%) European: 27 (5.5%) vs. 92 (2.9%) Oceania: 350 (70.9%) vs. 2,856 (90.5%) Aboriginal/Torres Strait Islander: 12 (3.4%) vs. 165 (5.8%) South American: 4 (0.8%) vs. 5 (0.2%) North American: 7 (1.4%) vs. 20 (0.6%) Smoker: 27 (5.5%) vs. 546 (17.3%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Risk level at booking B/C or C: 27 (5.5) vs. 0 (0%) Risk level at labor B/C or C: 65 (13.2%) vs. 598 (18.9%) Previous cesarean delivery: 2 (0.4%) vs. 430 (13.6%)
Nove et al., 2012 United Kingdom St Mary's Maternity Information System 1988 to 2000 Fair quality	N = 273,872 Planned Home n = 5,998 Planned Hospital n = 267,874	Inclusion criteria: Pregnancy ended in live birth or stillbirth Exclusion criteria: Elective Cesarean delivery, medical induction, gestation < 37 weeks, high-risk pregnancy, unplanned home birth, unattended in labor, baby of indeterminate sex	Combined N = 273,872 Pregnancy risk status Medium: 73,862 (27%) Low: 200,010 (73%) Parity Primipara: 125,963 (46%) Multipara: 147,909 (54%) Mother's age at delivery <20: 13,881 (5%) 20 to 24: 51,640 (20%) 25 to 29: 93,757 (34%) 30 to 34: 81,332 (30%) 35 to 39: 29,031 (11%) 40+: 4,231 (2%) Mother's ethnic group Black African: 7,516 (3%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Black Caribbean: 6,587 (2%) Mediterranean: 6,808 (3%) Asian: 39,024 (14%) White European: 195,498 (71%) Other: 11,064 (4%) Pregnancy risk status based on a 2007 clinical guideline from the National Institute for Health and Clinical Excellence
Øian et al., 2018 Norway Medical Birth Registry with supplementary data collection January 2008 to December 2010 Poor quality	N = 107,876 Births in Midwife-led Birth Units, Planned n = 2,298 Births Planned for Midwife-led Birth Unit, Took Place Elsewhere n = 220 Births in Hospital, Low Risk n = 105,358	Inclusion Criteria: Planned Birth Center Births - Planned births in midwife-led birth units between 2008 and 2010 Planned Low-Risk Hospital Births - Infants born after 36 weeks gestation Exclusion Criteria: Planned Birth Center Births - NR Planned Low-Risk Hospital Births - planned cesarean deliveries, deliveries that were induced, women with chronic diseases such as hypertension, kidney disease, rheumatoid arthritis or heart disease; had suffered pregnancy complications such as gestational diabetes and hypertensive complaints	Births in Midwife-Led Birth Centers, Planned (n = 2,298) vs. Births Planned for a Midwife-led Birth Unit, Took Place Elsewhere (n = 220) vs. Births in Hospital, Low Risk (n = 105,358) Parity Nulliparous: 225 (14.5%) vs. 90 (50.6%) vs. 45,700 (43.4%) Multiparous: 1,332 (85.5%) vs. 88 (49.4%) vs. 59,658 (56.6%) Presentation Normal, Vertex: 1,470 (94.4%) vs. 150 (84.3%) vs. 98,182 (93.2%) Breech: 19 (1.2%) vs. 6 (3.4%) vs. 1,929 (1.8%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Other: 67 (4.3%) vs. 22 (12.4%) vs. 5,229 (5.0%) Missing Data: 1 (.0%) vs. 0 vs. 18 (0%)
Quigley et al., 2016 Ireland and United Kingdom Growing Up in Ireland study, 2008 to 2009 United Kingdom Millennium Cohort Study, 2001 to 2002 Fair quality	N = 28,125 Ireland: n = 10,604, Planned Home (n = 157), Planned Hospital (n = 10,447) United Kingdom: n = 17,521, Planned Home (n = 340), Planned Hospital (n = 17,181)	Inclusion criteria: Ireland: Mother-infant pairs, born between December 2007 and May 2008 United Kingdom: Mother-infant pairs, born between 2000 and 2001 Exclusion criteria: NR	Ireland (n = 10,604) vs. United Kingdom (n = 17,521) Place of birth Home: 157 (1.0%) vs. 340 (2.0%) Hospital: 10,447 (99%) vs. 17,181 (98%) Parity: Primiparous: 4,312 (41%) vs. 8,596 (49%) Multiparous: 6,292 (59%) vs. 8,975 (51%) Maternal age < 30 years: 3,453 (33%) vs. 9,762 (56%) 30 to 35 years: 3,662 (35%) vs. 5,042 (27%) ≥ 35 years: 3,489 (33%) vs. 2,764 (16%) Socioeconomic status Never worked: 1,193 (11%) vs. 2,114 (12%) Manager/Professional: 5,172 (49%) vs. 4,556 (26%) BMI < 25: 5,496 (52%) vs. 9,303 (53%) 25 to 30: 2,967 (28%) vs. 3,920 (22%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			≥30: 1,634 (15%) vs. 1,982 (11%) Missing: 534 (5.0%) vs. 2,316 (13%)
Rowe et al., 2016 England Birthplace in England national prospective cohort study April 2008 to April 2010 Good quality	N = 1,436 Planned Home n = 209 Planned Obstetric Unit n = 1,227	Inclusion criteria: Women planning vaginal birth after cesarean delivery Exclusion criteria: Elective cesarean delivery before the onset of labor, presented in preterm labor (<37 weeks' gestation), multiple pregnancy, unplanned home birth, received no antenatal care	Planned Home (n = 209) vs. Planned Obstetric Unit (n = 1,227) Parity Para 1: 87 (6.1%) vs. 787 (55%) Para 2+: 122 (8.5%) vs. 440 (30.6%) Maternal age < 20 years: 0 vs. 10 (0.8%) 20 to 24 years: 12 (5.4%) vs. 140 (11.1%) 25 to 29 years: 27 (13.6%) vs. 340 (27%) 30 to 34 years: 72 (36%) vs. 382 (31.1%) 35 to 39 years: 74 (34%) vs. 296 (25%) 40+ years: 24 (11%) vs. 58 (5.1%) Ethnicity White: 191 (92.4%) vs. 877 (68.6%) Non-white: 18 (7.6%) vs. 347 (31.4%) BMI Not recorded: 45 (20.4%) vs. 191 (16.6%) < 18.5: 4 (1.7%) vs. 24 (2.0%) 18.5 to 24.9: 81 (42.1%) vs. 431 (34.3%) 25.0 to 29.9: 56 (25.7%) vs. 326 (26.6%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			30.0 to 34.9: 17 (7.4%) vs. 165 (13.6%) 35.0 to 39.9: 1 (0.5%) vs. 54 (4.3%) 40.0+: 5 (2.2%) vs. 33 (2.7%) IMD quintiles 1st least deprived: 43 (21.4%) vs. 206 (15.6%) 2nd: 45 (20.8%) vs. 206 (15.9%) 3rd: 39 (18.5%) vs. 216 (17%) 4th: 38 (19%) vs. 222 (18.5%) 5th most deprived: 44 (20.3%) vs. 365 (33%)
Schroeder et al., 2017 England Interviews and medical records from Barkantine Birth Centre and Royal London Hospital's obstetric unit in Tower Hamlets, a low-income borough in east London 2008 to 2009 Poor quality	N = 333 Planned Birth Center n = 167 Planned Hospital n = 166	Inclusion criteria: Resident of Tower Hamlets, low risk of obstetric complications, satisfied criteria to use the birth center Exclusion criteria: NR	Planned Birth Center vs. Planned Hospital Marital status Living with partner/married: 123/141 (87.2%) vs. 90/104 (86.5%) Partner living away from home: 8/141 (5.7%) vs. 7/104 (6.7%) Single/no partner: 1/141 (0.7%) vs. 0/104 (0.0%) Other marital statuses: 9/141 (6.4%) vs. 7/104 (6.7%) Mother's ethnic group White British: 72/215 (33.5%) vs. 10 (5.7%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			All white non-British ethnic groups: 21/215 (9.8%) vs. (10 5.7%) White European: 18/215 (8.4%) vs. 6 (3.4%) White other: 3/215 (1.4%) vs. 4 (2.3%) Black: 10/215 (4.7%) vs. 5 (2.9%) South Asian (Indian/Pakistani/Bangladeshi): 33/215 (15.3%) vs. 127 (73.0%) All other ethnic groups: 29/215 (13.5%) vs. 6 (3.4%) Interpreter needed: Yes: 5/160 (3.1%) vs. 43/104 (41.3%)
Snowden, et al., 2015 Oregon, U.S. State vital statistics January 2012 to December 2013 Good quality	N = 79,727 Planned Out-of-Hospital Birth n = 3,804 Planned Hospital Birth n = 75,923	Inclusion criteria: Cephalic, singleton, term, non-anomalous deliveries Exclusion criteria: Unplanned home births, unknown intended place of birth, other location of birth (e.g., clinic or doctor's office)	Planned Out-of-Hospital birth (n = 3,804) vs. Planned Hospital Birth (n = 75,923) Race or ethnic group White: 3,317 (87.2%) vs. 51,238 (67.5%) Black: 34 (0.9%) vs. 1,945 (2.6%) Hispanic: 192 (5%) vs. 14,882 (19.6%) Asian: 97 (2.5%) vs. 4,896 (6.4%) American Indian or Alaskan native: 87 (2.3%) vs. 1,940 (2.6%) Other: 77 (2.0%) vs. 1,022 (1.3%) Parity 0: 1,514 (39.8%) vs. 30,758 (40.5%) 1: 1,219 (32.0) vs. 24,739 (32.6%) 2: 548 (14.4% vs. 12,136 (16.0%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			≥3: 523 (13.7%) vs. 8,290 (10.9%) Insurance status (n = 3,710 vs. n = 75,523) Public: 872 (23.5%) vs. 35,243 (46.7%) Private: 1,718 (46.3%) vs. 39,507 (52.3%) Self-pay: 1,120 (30.2%) of vs. 773 (1.0%) Maternal age <20: 47 (1.2%) vs. 4,887 (6.4) 20 to 34: 2,932 (77.1%) vs. 59,383 (78.2) ≥35: 825 (21.7%) vs. 11,653 (15.3)
Sprague et al., 2018 Ontario, Canada Better Outcomes Registry & Network, Canadian Institute of Health Information Discharge Abstracts Database, Statistics Canada census data, birth center records January 2014 to February 2015 Poor quality	N = 2,475 Planned Birth Center: n = 495 Planned Hospital: n = 1,980	All birth center births matched on 1:4 basis to singleton pregnancies in spontaneous labor in hospital midwifery care, additional matching based on gestational age at birth (within 2 weeks), parity and maternal age (<30, 30 to 34, 35+), location of residence, and pregnancy complications (gestational diabetes and hypertension)	Planned Birthing Center (n = 495) vs. Planned Hospital (n = 1,980) Age (years) <20: 10 (2.0%) vs. 25 (1.3%) 20 to 24: 38 (7.7%) vs. 151 (7.6%) 25 to 29: 113 (22.8%) vs. 468 (23.6%) 30 to 34: 209 (42.2%) vs. 836 (42.0%) 35 to39: 115 (23.2%) vs. 452 (22.8%) ≥40: 10 (2.0%) vs. 48 (2.4%) Parity Nulliparous: 292 (59.0%) vs. 1,168 (59.0%) Multiparous: 201 (41.0%) vs. 812 (41.0%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Previous cesarean delivery: 8 (1.6%) vs. 108 (5.5%) BMI category <21: 192 (38.8%) vs. 533 (26.9%) 21 to 25: 217 (43.8%) vs. 928 (46.9%) 26 to 30: 64 (12.9%) vs. 337 (17.0%) 31 to 35: 14 (2.8%) vs. 110 (5.6%) 36 to 40: 4 (0.8%) vs. 44 (2.2%) ≥41: 4 (0.8%) vs. 28 (1.4%) Spontaneous labor: 486 (98.2%) vs. 1,973 (99.6%) Women giving birth in the birth center: 373 (75.4%) vs. 0 (0.0%) Intermittent Auscultation Use: 487 (98.4%) vs. 839 (42.4%)
Thornton et al., 2017 U.S. Uniform Data Set from American Association of Birth Centers at 79 U.S. birth centers in 43 states 2006 to 2011 Poor quality	N = 11,303 Planned Birth Center n = 8,776 Planned Hospital n = 2,527	Inclusion criteria: Received prenatal care in birth center, reached 37 weeks' gestation, admitted in spontaneous labor to birth center or affiliated hospital Exclusion criteria: Twin gestation, labor was pharmacologically induced, nonvertex presentations, history	Planned Birth Center (n = 8,776) vs. Planned Hospital (n = 2,527) Parous: 4,698 (53.53%) vs. 1,521 (60.19%), p < 0.001 Mean age: 28.96 ± 5.17 vs. 26.81 ± 5.89, p < 0.001

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
		of cesarean delivery, anomalous fetuses, neonates weighing < 2500 grams or > 6000 grams at birth, BMI less than 20 or greater than 27, hypertension, diabetes, renal disease, asthma, seizure history, treated psychiatric disorders including depression, tobacco or other substance abuse, sexual or other physical victimization, gestational diabetes or hypertension, preeclampsia, anemia (hematocrit 30), infection, preterm labor or rupture of membranes, placental abruption or previa, nonreassuring antepartum fetal testing	Payment, p < 0.001 Private: 4,685 (53.38%) vs. 953 (37.71%) Medicaid: 2,192 (24.98%) vs. 1,174 (46.46%) Military: 240 (2.73%) vs. 25 (0.99%) Self-pay: 1,337 (15.23%) vs. 282 (11.16%) Race, p < 0.001 White: 7,490 (85.35%) vs. 1,871 (74.04%) Black: 428 (4.88%) vs. 275 (10.88%) Asian Pacific Islander: 220 (2.51%) vs. 131 (5.18%) Native American: 48 (0.55%) vs. 14 (0.55%) Lives with partner: 7,907 (90.10%) vs. 1,888 (74.71%); p < 0.001 Mean gestational age at birth: 39.90 ± 1.05 vs. 39.73 ± 1.09, p < 0.001 Trimester care began, p < 0.001 First trimester: (1 to 13 weeks): 6,581 (74.99%) vs. 1,674 (66.24%) Second trimester: (14 to27 weeks) 1,643 (18.72%) vs. 637 (25.21%) Third trimester: (28+ weeks) 163 (1.86%) vs. 69 (2.73%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Missing: 389 (4.43%) vs. 147 (5.82%)
Tilden et al., 2017 U.S. Birth and death certificates 2007 to 2010 Fair quality	N = 109,970 Planned Home n = 2,352 Planned Birth Center n = 795 Planned Hospital n = 106,823	Inclusion criteria: Women with singleton, term, vertex, nonanomolous, liveborn neonates who were delivered by VBAC in or out-of-hospital between 2007 and 2010 in the U.S. Exclusion criteria: No prior cesarean delivery, delivered by repeat cesarean delivery, multiple gestation, delivered preterm (<37 weeks) or extremely postterm (>43 weeks), breech fetus, fetus with congenital anomalies, stillbirth, obvious data miscoding	Planned Home and Birth Center (n = 3,147) vs. Planned Hospital (n = 106,823) Race/ethnicity White: 2,728 (86.69%) vs. 53,226 (49.83%) Black: 94 (2.99%) vs. 15,396 (14.41%) Hispanic: 273 (8.67%) vs. 31,030 (29.05%) Asian: 42 (1.33%) vs. 6,106 (5.72%) American Indian/Alaska Native: 10 (0.32%) vs. 1,065 (1.00%) Parity 1: 648 (20.59%) vs. 33,813 (31.65%) 2: 660 (20.97%) vs. 28,423 (26.61%) ≥3: 1785 (56.72%) vs. 43,237 (40.48%) Tobacco use: 25 (0.79%) vs. 7,842 (7.34%) Maternal age ≤20: 5 (0.16%) vs. 2,302 (2.15%) 21 to 34: 2,192 (69.65%) vs. 81,386 (76.19%) ≥35: 950 (30.19%) vs. 23,135 (21.66%) Education

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Not completed high school: 673 (21.39%) vs. 9,044 (8.47%) High school: 585 (18.59%) vs. 41,668 (39.01%) College: 1,587 (50.43%) vs. 45,093 (42.21%) Graduate school: 283 (8.99%) vs. 9,744 (9.12%) Previous cesarean deliveries 1: 2,791 (88.69%) vs. 94,478 (88.44%) 2: 232 (7.37%) vs. 7,916 (7.41%) ≥3: 42 (1.33%) vs. 1,676 (1.57%) History of vaginal birth: 2,392 (76.01%) vs. 67,217 (62.92%) Prenatal care initiation after 1st trimester: 1,584 (50.33%) vs. 31,415 (29.41%) Kotelchuck Index Adequate Plus: 208 (6.61%) vs. 21,011 (19.67%) Adequate: 998 (31.71%) vs. 35,629 (33.35%) Intermediate: 722 (22.94%) vs. 20,748 (19.42%) Inadequate: 1,131 (35.94%) vs. 22,486 (21.05%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Weight gain >40 pounds: 569 (18.08%) vs. 20,477 (19.17%)
van der Kooy et al., 2017 The Netherlands Netherlands Perinatal Registry 2000 to 2007 Good quality	N = 622,017 Planned Home n = 402,912 Planned Hospital n = 219,105	Inclusion criteria: Low-risk women in midwife-led care at the onset of labor, single pregnancy, spontaneous labor Exclusion criteria: Medium-risk women, defined by Dutch guidelines (e.g., women with a history of postpartum hemorrhage or obesity)	Planned Home (n = 402,912) vs. Planned Hospital (n = 219,105) Parity Primiparous: 171,986 (42.7%) vs. 104,249 (47.6%) Multiparous: 230,926 (57.3%) vs. 114,856 (52.4%) Maternal age < 19 years: 4,036 (1.0%) vs. 6,713 (3.1%) 20 to 25 years: 34,661 (8.6%) vs. 32,617 (14.9%) 25 to 34 years: 296,128 (73.5%) vs. 142,597 (65.1%) > 35 years: 68,087 (16.9%) vs. 37,178 (17.0%) Ethnicity Dutch: 370,647 (96.3%) vs. 196,659 (89.8%) Non-Dutch: 32,265 (8.0%) vs. 65,533 (29.9%) Socioeconomic status

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Privileged neighborhood: 388,089 (96.3%) vs. 196,659 (89.8%) Underprivileged neighborhood: 14,823 (3.7%) vs. 22,446 (10.2%)
van der Kooy et al., 2011 The Netherlands Netherlands Perinatal Registry 2000 to 2007 Fair quality	N = 622,017 Planned Home n = 402,912 Planned Hospital-Midwife n = 219,105	Inclusion criteria: Singleton pregnancy, under the supervision of a community midwife at the onset of labor Exclusion criteria: Medium-risk women (e.g., a history of postpartum hemorrhage, BMI > 30)	Planned Home (n = 402,912) vs. Planned Hospital-Midwife (n = 219,105) Parity Primiparous: 171,986 (42.69%) vs. 104,249 (47.58%) Multiparous: 230,926 (57.31%) vs. 114,856 (52.42%) Maternal age Younger than 19: 4,036 (1.00%) vs. 6,713 (3.06%) 20 to 25: 34,661 (8.60%) vs. 32,617 (14.89%) 25 to 34: 296,128 (73.50%) 267 vs. 142,597 (65.08%) Older than 35: 68,087 (16.90%) vs. 37,178 (16.97%) Ethnic background Western: 364,796 (90.54%) vs. 143,677 (65.57%) Non-Western: 38,116 (9.46%) vs. 75,428 (34.43%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Neighborhood Privileged neighborhood: 388,089 (96.32%) vs. 196,659 (89.76%) Underprivileged neighborhood: 14,823 (3.68%) vs. 22,446 (10.24%) Gestational age (weeks): Less than 34: 2,409 (0.60%) vs. 1,702 (0.78%) 35 to 36: 6,510 (1.62%) vs. 4,064 (1.85%) 37: 15,203 (3.77%) vs. 9,603 (4.38%) 38 to 41: 368,926 (91.56%) vs. 193,816 (88.46%) More than 41: 9,864 (2.45%) vs. 9,920 (4.53%)
van Haaren-ten Haken et al., 2015 The Netherlands Self-reported questionnaires, medical records, and birth registration forms 2007 to 2011 Poor quality	N = 576 Planned Home n = 226 Planned Hospital-Midwife n = 168 Planned Hospital-Obstetrician n = 182	Inclusion criteria: Low-risk nulliparous women who started their pregnancy in midwife-led care or in obstetrician-led care by 8 to 12 weeks gestation who indicated a preferred place of birth during pregnancy at that time Exclusion criteria: Women with an obstetric or medical indication according to the List of Obstetric Indications (high risk), women who had previously given birth, women who miscarried, women who began prenatal	Planned Home (n = 226) vs. Planned Hospital-Midwife (n = 168) vs. Planned Hospital-Obstetrician (n = 182) Mean age: 28.8 (3.9) vs. 29.1 (3.8) vs. 30.9 (4.8), p < 0.01 BMI <18.5: 10 (4.5%) vs. 5 (3.1%) vs. 7 (3.9%) 18.5 to 24.99: 139 (63.2%) vs. 115 (71.4%) vs. 121 (68.0%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
		care at 20 weeks gestation or later, women who did not report a preferred place of birth, women whose deliveries did not result in a birth registration form	25.00 to 29.99: 55 (25.0%) vs. 33 (20.5%) vs. 40 (22.5%) ≥30.0: 16 (7.3%) vs. 8 (5.0%) vs. 10 (5.6%) Ethnic background Dutch: 225 (99.6%) vs. 160 (95.2%) vs. 174 (95.6%) Non-Dutch: 1 (0.4%) vs. 8 (4.8%) vs. 8 (4.4%) Highest completed level of education Low: 19 (8.4%) vs. 18 (10.7%) vs. 19 (10.4%) Middle: 86 (38.1%) vs. 56 (33.3%) vs. 71 (39.0%) High: 121 (53.5%) vs. 94 (56.0%) vs. 92 (50.5%) Distance to hospital 0 to 15 minutes: 170 (75.6%) vs. 135 (80.8%) vs. 135 (74.6%) >15 minutes: 55 (24.4%) vs. 32 (19.2%) vs. 46 (25.4%) First pregnancy Yes: 181 (80.1%) vs. 142 (84.5%) vs. 112 (61.9%), p < 0.01 No: 45 (19.9%) vs. 26 (15.5%) vs. 69 (38.1%) Mean gestation (days) at birth: 278 (15) vs. 278 (13) vs. 274 (15), p < 0.01

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
Wiegerinck et al., 2018 The Netherlands National Perinatal Register 2005 to 2008 Poor quality	N = 57,396 Midwife-led care n = 46,764 Obstetrician-led care n = 10,632	Inclusion criteria: Women who gave birth after 37 weeks gestation and before 42 weeks gestation between January 1, 2005 and December 31, 2007 in the Amsterdam region Exclusion criteria: Planned cesarean delivery, induced labor, congenital anomalies, antepartum fetal death, non-vertex position of the fetus, a previous cesarean delivery, hypertension, gestational diabetes, prolonged rupture of membranes, vaginal bleeding in the second half of pregnancy	Midwife-led care (n = 46,764) vs. Obstetrician-led care (n = 10,632) Maternal age <25: 6,060 (13.0%) vs. 1,305 (12.3%) 25 to 29: 12,995 (27.8%) vs. 2,361 (22.2%) 30 to 34: 17,562 (37.5%) vs. 3,719 (35.0%) ≥35: 10,147 (21.7%) vs. 3,247 (30.5%) Parity Nulliparous: 21,074 (45.1%) vs. 4,376 (41.2%) Multiparous: 25,690 (54.9%) vs. 6,256 (58.8%) Ethnicity Western: 35,358 (75.6%) vs. 7,406 (69.7%) Non-Western: 11,406 (24.4%) vs. 3,226 (30.3%) Socioeconomic status Low: 11,752 (25.1%) vs. 3,079 (29.0%) Mid: 22,973 (49.1%) vs. 4,785 (45.0%) High: 12,039 (25.8%) vs. 2,768 (26.0%) Mean birth weight (grams): 3,552 ± 458 vs. 3,474 ± 500

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Gestational age, median (range): 40 (37 to 41) vs. 40 (37 to 41) Propensity Score Matched Cohort† Home (n = 10,632) vs. Hospital (n = 10,632) Maternal age <25: 1,308 (12.3%) vs. 1,305 (12.3%) 25 to 29: 2,454 (23.1%) vs. 2,361 (22.2%) 30 to 34: 3,611 (34.0%) vs. 3,719 (35.0%) ≥35: 3,259 (30.7%) vs. 3,247 (30.5%) Parity Nulliparous: 4,344 (40.9%) vs. 4,376 (41.2%) Multiparous: 6,288 (59.1%) vs. 6,256 (58.8%) Ethnicity Western: 7,379 (69.4%) vs. 7,406 (69.7%) Non-Western: 3,253 (30.6%) vs. 3,226 (30.3%) Socioeconomic status Low: 3,023 (28.4%) vs. 3,079 (29.0%) Mid: 4,796 (45.1%) vs. 4,785 (45.0%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			High: 2,813 (26.5%) vs. 2,768 (26.0%) Mean birthweight: 3,483 ± 463 vs. 3,474 ± 500 Median gestational age (range): 40 (37 to 41) vs. 40 (37 to 41) †Matched on maternal age, birth weight, parity, ethnicity, gestational age, socioeconomic status and gender of the child
Wiegerinck et al., 2015 The Netherlands Netherlands Perinatal Register with additionally retrieved data from hospitals and midwife practices 2005 to 2008 Poor quality	N = 47,490 Planned Home n = 26,128 Planned Hospital n = 21,362	Inclusion criteria: In the perinatal region of Amsterdam, singleton pregnancy, gave birth beyond 37+0 weeks gestation, in primary care (led by midwives or general practitioners) at onset of labor Exclusion criteria: Preplanned cesarean delivery, pregnancy complicated by congenital anomalies or antepartum fetal death (antenatal testing showed significant chromosomal anomaly, multiple anomalies were established at physical examination suggesting an underlying syndrome, or underlying syndrome was documented in the autopsy report)	Planned Home (n = 26,128) vs. Planned Hospital (n = 21,362) Mean maternal age: 30.8 ± 4.7 vs. 30.0 ± 5.3, p < 0.001 Primiparous: 11,214 (43%) vs. 11,022 (52%), p < 0.001 Mean gestational age: 40 (range, 37 to 42) vs. 40 (range, 37 to 42), p = 0.81 Ethnicity, p < 0.001 Non-Western: 4,278 (16%) vs. 7,282 (34%) Western 21,850 84% vs. 14,080 (66%) Socioeconomic status, p < 0.001 Low: 6,129 (23%) vs. 6,128 (29%) Mid: 13,494 (52%) vs. 9,768 (46%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			High: 6,505 (25%) vs. 5,466 (26%)

Appendix F. Outcome Data from Comparative Observational Studies

Table F1. Outcome Data from Comparative Studies: Delivery Mode

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
U.S. Studies			
Snowden, et al., 2015 Oregon, U.S. State vital statistics January 2012 to December 2013 Good quality	Planned Out-of-Hospital birth (n = 3,804) vs. Planned Hospital Birth (n = 75,923) Absolute difference in risk percentage points Unassisted vaginal delivery: 27.5, 95% CI 24.9 to 30.2, p < 0.001 Operative vaginal delivery: −4.7, 95% CI −5.8 to −3.5, p < 0.001 Cesarean delivery: −24.0, 95% CI −26.6 to −21.4, p < 0.001	NR	NR
Thornton et al., 2017 U.S. Uniform Data Set from American Association of Birth Centers at 79 U.S. birth centers in 43 states 2006 to 2011 Poor quality	Planned Birth Center (n = 8,776) vs. Planned Hospital (n = 2,527) Cesarean delivery: 363 (4.14%) vs. 126 (4.99%), aOR 0.63, 95% CI 0.50 to 0.79, p = NR Propensity weight adjustment using maternal age, parity, race, payment method, cohabitation status, trimester prenatal care began, gestational age at birth, newborn weight	NR	NR

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
Non-U.S. Studies			
Birthplace in England Collaborative, 2011 England Birthplace study April 2008 to April 2010 Good quality	Planned Home (n = 16,825) vs. Planned Hospital (n = 19,688) Spontaneous vertex: 15,590 (92.8%) vs. 14,645 (73.8%), aOR 3.61, 95% CI 2.97 to 4.38 Cesarean delivery 458 (2.8%) vs. 2158 (11.1%), aOR 0.31, 95% CI 0.23 to 0.41 Forceps: 372 (2.1%) vs. 1307 (6.8%), aOR 0.43, 95% CI 0.32 to 0.57 Vaginal breech: 63 (0.4%) vs. 43 (0.2%), aOR 2.13, 95% CI 1.15 to 3.96 Planned Freestanding Midwifery Unit (n = 11,280) vs. Planned Hospital (n = 19,688) Spontaneous vertex: 10,150 (90.7%) vs. 14,645 (73.8%), aOR 3.38, 95% CI 2.70 to 4.25 Cesarean delivery: 405(3.5%) vs. 2158 (11.1%), aOR 0.32, 95% CI 0.24 to 0.42 Forceps: 365 (2.9%) vs. 1307 (6.8%), aOR 0.45, 95% CI 0.32 to 0.63 Vaginal breech: 39 (0.4%) vs. 43 (0.2%), aOR 2.00, 95% CI 1.00 to 3.99 Adjusted for maternal age, ethnic group, understanding of English, marital or partner status, BMI,	NR	NR

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
	deprivation score quintile, previous pregnancies, weeks of gestation		
Davies-Tuck et al., 2018 Australia Victorian Perinatal Data Collection 2000 to 2015 Poor quality	Low risk, Planned Home (n = 3,202) vs. Planned Hospital (n = 701,058) Unplanned cesarean delivery: 81 (2.5%) vs. 87,716 (12.5%), p < 0.001 Instrumental delivery: 79 (2.5%) vs. 122,517 (17.5%), p < 0.001 Spontaneous vaginal: 3,038 (94.9%) vs. 490,748 (70.0%), p < 0.001	NR	NR
Halfdansdottir et al., 2018 Iceland Maternity notes review 2005 to 2009 Poor quality	No home birth contraindication Planned Home (n = 278) vs. Planned Hospital (n = 851) Operative: 12 (4.3%) vs. 60 (7.1%) Home birth contraindication present Planned Home (n = 29) vs. Planned Hospital (n = 70) Operative: 7 (24.1%) vs. 9 (12.9%)	NR	NR
Halfdansdottir et al., 2015 Iceland Review of midwives' and doctors' original hand-written maternity notes 2005 to 2009 Poor quality	Planned Home (n = 307) vs. Planned Hospital or Midwifery Alongside Unit (n = 921) Spontaneous vaginal birth: 288 (93.8%) vs. 852 (92.5%) Instrumental birth: 12 (3.9%) vs. 42 (4.6%)	Planned Home (n = 64) vs. Planned Hospital or Midwifery Alongside Unit (n = 192) Spontaneous vaginal birth: 52 (81.3%) vs. 154 (80.2%) Instrumental birth: 7 (10.9%) vs. 24 (12.5%)	Planned Home (n = 243) vs. Planned Hospital or Midwifery Alongside Unit (n = 729) Spontaneous vaginal birth: 236 (97.1%) vs. 698 (95.7%) Instrumental birth: 5 (2.1%) vs. 18 (2.5%)

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
	Cesarean delivery: 7 (2.3%) vs. 27 (2.9%)	Cesarean delivery: 5 (7.8%) vs. 14 (7.3%)	Cesarean delivery: 2 (0.8%) vs. 13 (1.8%)
Hutton et al., 2016 Ontario, Canada Chart review March 2016 to April 2009 Poor quality	Planned home (n = 11,493) vs. Planned hospital (n = 11,493) Assisted vaginal: 370 (3.2%) vs. 591 (5.1%), RR 0.61, 95% CI 0.54–0.70 Cesarean delivery: 672 (5.8%) vs. 903 (7.9%), RR 0.74, 95% CI 0.67–0.82	Planned Home (n = 4,027) vs. Planned Hospital (n = 4,027) Assisted vaginal: 313 (8.9%) vs. 452 (13.2%), RR 0.68, 95% CI 0.59 to 0.78 Cesarean delivery: 531 (13.2%) vs. 611 (15.2%), RR 0.87, 95% CI 0.78 to 0.97	Planned Home (n = 7,466) vs. Planned Hospital (n = 7,466) Assisted vaginal: 57 (0.8%) vs. 139 (1.9%), RR 0.40, 95% CI 0.30 to 0.55 Cesarean delivery: 141 (1.9%) vs. 292 (3.9%), RR 0.48, 95% CI 0.40 to 0.59
Hutton et al., 2009 Canada Ontario Ministry of Health database 2003 to 2006 Poor quality	Planned Home (n = 6,692) vs. Planned Hospital-Midwife (n = 6,692) Spontaneous vaginal: 6,146 (91.8%) vs. 5,852 (87.4%) Assisted vaginal: 195 (2.9%) vs. 293 (4.4%); RR 0.67, 95% CI 0.56 to 0.80 Cesarean delivery: 348 (5.2%) vs. 544 (8.1%), RR 0.64, 95% CI 0.56 to 0.73	Planned Home (n = 2,293) vs. Planned Hospital-Midwife (n = 2,298) Assisted vaginal delivery: 166 (7.2%) vs. 221 (9.6%) Cesarean delivery: 276 (12.0%) vs. 365 (15.9%)	Planned Home (n = 4,393) vs. Planned Hospital-Midwife (n = 4,394) Assisted vaginal delivery: 28 (0.6%) vs. 72 (1.6%) Cesarean delivery: 71 (1.6%) vs. 179 (4.1%)
Janssen et al., 2009 British Columbia, Canada Perinatal Database Registry and vital statistics 2000 to 2004 Poor quality	Planned Home vs. Planned Hospital-Midwife vs. Matched Sample of Physician-Attended Hospital Births Cesarean delivery: 208 /2899 (7.2%) vs. 498/4,752 (10.5%) vs. 588/5,331 (11.0%)	Planned Home vs. Planned Hospital-Midwife vs. Matched Sample of Physician-Attended Hospital Births Cesarean delivery: 158/1,215 (13.0%) vs. 453/2,428 (18.7%) vs. 481/2,204 (21.8%)	Planned Home vs. Planned Hospital-Midwife vs. Matched Sample of Physician-Attended Hospital Births Cesarean delivery: 50/1,684 (3.0%) vs. 45/2,324 (1.9%) vs. 107/3,127 (3.4%)

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
	Spontaneous vaginal: 2,605/2,899 (89.9%) vs. 3910/4752 (82.3%) vs. 4,007/5,331 (75.2%)		
Katoaka et al., 2018 Japan Review of medical records Birth centers: 2001 to 2006, one hospital: 2004 to 2006, other hospital: 2008 Poor quality	Planned Birth center (n = 5,379) vs. Planned Hospital (n = 4,209) Spontaneous vaginal delivery: 5,379 (100%) vs. 4,011 (95.3%) Vacuum extraction: 0 (0%) vs. 178 (4.2%) Forceps delivery: 0 (0%) vs. 20 (0.5%)	NR	NR
Kennare et al., 2010 Australia Pregnancy Outcome Unit of South Australia Health perinatal data 1991 to 2006 Poor quality	Planned Home vs. Planned Hospital Cesarean delivery: 104/1136 (9.2%) vs. 79,238/292,469 (27.1%), aOR 0.27, 95% CI 0.22 to 0.34, p < 0.001 Instrumental delivery: 50/1136 (4.4%) vs. 37,386/292,469 (12.8%), aOR 0.33, 95% CI 0.25 to 0.44, p < 0.001 Adjusted for maternal age, parity, occupational status, smoking, plurality, medical and obstetric complications (e.g., antepartum hemorrhage, diabetes, hypertension), gestational age, small for gestational age, congenital anomalies, city or country hospital, mode of delivery	NR	NR
Laws et al., 2014 Australia	Planned Birth Center (n = 14,707) vs. Planned Hospital (n = 29,414)	NR	NR

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
Registry of Births, Deaths, and Marriages, Midwives Data Collection, Admitted Patient Data Collection 2001 to 2009 Poor quality	Assisted vaginal: 980 (6.7%) vs. 4,137 (14.1%), aOR 0.32, 95% CI 0.29 to 0.35 Emergency cesarean delivery: 575 (3.9%) vs. 3,702 (12.6), aOR 0.23, 95% CI 0.20 to 0.25 Adjusted for maternal age, Australian/overseas-born, socioeconomic disadvantage, smoking during pregnancy, parity, preexisting medical conditions, admitted patient insurance status, obstetric complications, level of hospital, day of the week, and holidays.		
Monk et al., 2014 Australia ObstetriX surveillance system of point-of-care maternity data collection across the antenatal, intrapartum, and immediate postnatal periods 2005 to 2006 Fair quality	Planned Birth Center (n = 494) vs. Planned Tertiary Maternity Unit (n = 3,157) Spontaneous vaginal: 400 (81.0%) vs. 2,044 (64.7%), aOR 1.57, 95% CI 1.20 to 2.06, p = 0.001 Instrumental: 34 (6.9%) vs. 331 (10.5%), aOR 0.79, 95% CI 0.53 to 1.17, p = 0.237 Elective cesarean delivery: 20 (4.0%) vs. 369 (11.7%), aOR 0.50, 95% CI 0.29 to 0.88, p = 0.02 Intrapartum cesarean delivery: 40 (8.1%) vs. 413 (13.1%), aOR 0.76, 95% CI 0.53 to 1.10, p = 0.151	NR	NR

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
	Adjusted for maternal age, smoking status, parity, risk at the onset of labor, previous cesarean delivery and gestation at the time of birth		
Øian et al., 2018 Norway Medical Birth Registry with supplementary data collection January 2008 to December 2010 Poor quality	Births in Midwife-Led Birth Centers, Planned (n = 2,298) vs. Births Planned for a Midwife-led Birth Unit, Took Place Elsewhere (n = 220) vs. Births in Hospital, Low Risk (n = 105,358) Vacuum: 7 (.4%) vs. 25 (14.0%) vs. 9,218 (8.7%) Forceps: 0 vs. 1 (.6%) vs. 1,761 (1.7%) Cesarean, Elective: 0 vs. 0 vs. 0 Cesarean, Acute: 1 (.1%) vs. 21 (11.8%) vs. 6,564 (6.2%) Unspecified: 1 (.1%) vs. 0 vs. 8 (0%)	NR	NR
Schroeder et al., 2017 England Interviews and medical records from Barkantine Birth Centre and Royal London Hospital's obstetric unit in Tower Hamlets, a low-income borough in east London 2008 to 2009 Poor quality	Planned Birth Center (n = 167) vs. Planned Hospital (n = 164) Spontaneous vaginal delivery: 142 (85%) vs. 120 (73%), p = 0.006 Assisted delivery with ventouse: 8 (5%) vs. 9 (6%), p = 0.78 Assisted delivery with forceps: 7 (4%) vs. 8 (5%), p = 0.57 Lower segment cesarean delivery: 12 (7%) vs. 28 (17%), p = 0.003	NR	NR

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
Sprague et al., 2018 Ontario, Canada Better Outcomes Registry & Network, Canadian Institute of Health Information Discharge Abstracts Database, Statistics Canada census data, birth center records January 2014 to February 2015 Poor quality	Mode of Delivery Spontaneous vaginal: 435 (87.9%) vs. 1567 (79.1%), aRR 1.0 Reference Assisted (vacuum or forceps): 22 (4.4%) vs. 174 (8.8%), aRR 1.9, 95% CI 1.3 to 3.0 Cesarean: 38 (7.7%) vs. 239 (12.1%) aRR 1.5, 95% CI 1.1 to 2.1 Adjusted for BMI (<30, >30) and prior Cesarean delivery (yes, no)	NR	NR
van der Kooy et al., 2017 The Netherlands Netherlands Perinatal Registry 2000 to 2007 Good quality	Planned Home (n = 402,912) vs. Planned Hospital (n = 219,105) Vaginal Delivery: 359,146 (89%) vs. 188,970 (86%) Operative vaginal delivery and cesarean section: 43,766 (10.9%) vs. 30,135 (13.8%), aOR 0.77, 95% CI 0.75 to 0.78, p = NR Adjusted for maternal factors, child factors, health care factors	NR	NR
Wiegerinck et al., 2015 The Netherlands Netherlands Perinatal Register with additionally retrieved data from	Planned Home (n = 26,128) vs. Planned Hospital (n = 21,362) Mode of delivery	NR	NR

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
hospitals and midwife practices 2005 to 2008 Poor quality	Spontaneous: 23,055 (88%) vs. 18,166 (85%), OR 1.32, 95% CI 1.25 to 1.39, p < 0.001 Cesarean delivery: 988 (4%) vs. 1,131 (5%), OR 0.70, 95% CI 0.64 to 0.77, p < 0.001 Instrumental vaginal delivery: 2,085 (8%) vs. 2,065 (10%), OR 0.81, 95% CI 0.76 to 0.86, p < 0.001		
Non-U.S. Studies, by parity only			
Bailey, 2017 New Zealand Routinely collected maternity outcome data compiled from Counties-Manukau District Health Board (CMDHB) maternity facilities 2003 to 2010 Poor quality	NR	Planned Birth Center (n = 3,438) vs. Planned Hospital (n = 11,195) Instrumental delivery: 495 (14.4%) vs. 1981 (16.6%), aOR 0.47, 95% CI 0.41 to 0.53 Cesarean delivery: 247 (7.2%) vs. 1500 (12.6%), aOR 0.51, 95% CI 0.44 to 0.59 Adjusted for maternal age, ethnicity, and deprivation score	Planned Birth Center (n = 7,010) vs. Planned Hospital (n = 25,018) Instrumental delivery: 45 (0.6%) vs. 322 (1.3%), aOR 0.45, 95% CI 0.32 to 0.61 Cesarean delivery: 50 (0.7%) vs. 570 (2.3%), aOR 0.34, 95% CI 0.26 to 0.46 Adjusted for maternal age, ethnicity, and deprivation score
Bolten et al., 2016 The Netherlands DELIVER (Data EersteLIjns VERloskunde) Study 2009 to 2010 Poor quality	NR	Planned Home (n = 868) vs. Planned Hospital (n = 717) Spontaneous: 651 (75.0%) vs. 498 (69.5%), aOR 1.38, 95% CI 1.08 to 1.76 Instrumental: 156 (18%) vs. 150 (20.9%), aOR 0.77, 95% CI 0.60 to 1.01	Planned Home (n = 1,182) vs. Planned Hospital (n = 728) Spontaneous: 1,164 (98.5) vs. 703 (96.6%), aOR 2.29, 95% CI 1.21 to 4.36 Instrumental: 11 (0.9%) vs. 13 (1.8%), aOR 0.46, 95% CI 0.20 to 1.07

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
		Unplanned cesarean delivery: 61 (7.0%) vs. 69 (9.6%), aOR 0.72, 95% CI 0.48 to 1.09 Adjusted for maternal age, gestational age, ethnic background (Dutch/western background/non-western background), BMI, socio-economic position	Unplanned cesarean delivery: 7 (0.6%) vs. 12 (1.7%), aOR 0.42, 95% CI 0.16 to 1.10 Adjusted for maternal age, gestational age, ethnic background (Dutch/western background/non-western background), BMI, socio-economic position
Christensen & Overgaard, 2017 Denmark Data collected on sociodemographic characteristics, present and previous pregnancies and births, neonatal outcomes and transfers March 2004 to October 2008 Poor quality	NR	Planned Birth Center (n = 215) vs. Planned Obstetric Unit (n = 215) Uncomplicated birth: OR 2.2, 95% CI 1.4 to 3.3 Cesarean delivery: OR 0.4, 95% CI 0.2 to 0.9 Instrumental delivery: OR 0.4, 95% CI 0.2 to 0.7	Planned Birth Center (n = 624) vs. Planned Obstetric Unit (n = 624) Uncomplicated birth: OR 2.9, 95% CI 2.0 to 4.2 Cesarean delivery: OR 0.8, 95% CI 0.3 to 2.2 Instrumental delivery: OR 0.3, 95% CI 0.1 to 0.9
Hollowell et al., 2017 England Birthplace in England national prospective cohort study April 2008 to April 2010 Fair quality	NR	Planned Birthing Center (n = 5,187) vs. Planned Hospital (n = 8.,350) SVD: 78.8% vs. 71.5%, aOR 1.47, 99% CI 1.17 to 1.85, p < 0.001 Instrumental delivery (ventouse or forceps): 10.8% vs. 16.3%, aOR 0.63, 99% CI 0.46 to 0.86, p < 0.001	Planned Birthing Center (n = 6,078) vs. Planned Hospital (n = 8,323) SVD: 97.0% vs. 94.6%, aOR 1.86, 99% CI 1.35 to 2.57, p < 0.001 Instrumental delivery (ventouse or forceps): 1.1% vs. 2.5%, aOR 0.41, 99% CI 0.25 to 0.68, p < 0.001

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
		Intrapartum cesarean delivery: 6.7% vs. 7.7%, aOR 0.84, 99% CI 0.63 to 1.14, p = 0.15 Adjusted for maternal characteristics and complicating conditions identified at the start of care in labor	Intrapartum cesarean delivery: 0.7% vs. 0.1%, aOR 0.75, 99% CI 0.41 to 1.38, p = 0.224 Adjusted for maternal characteristics and complicating conditions identified at the start of care in labor
Li et al., 2015 England Birthplace national prospective cohort study April 2008 to April 2010 Good quality	NR	Planned Home (n = 201) vs. Planned Hospital (n = 2,504) Straightforward vaginal birth: 201 (73.5%) vs. 1305 (51.7%), aRR 1.63, 95% CI 1.47 to 1.81 Birth without intrapartum cesarean delivery, instrumental delivery, 3rd or 4th degree tear, blood transfusion. Adjusted for maternal age, ethnic group, marital/partner status, BMI in pregnancy, index of multiple deprivation score quintile, gestation at delivery and parity where appropriate.	Planned Home (n = 1,189) vs. Planned Hospital (n = 4,138) Straightforward vaginal birth: 1101 (92.7%) vs. 3109 (74.7%), aRR 1.20, 95% CI 1.16 to 1.23 Birth without intrapartum cesarean delivery, instrumental delivery, 3rd or 4th degree tear, blood transfusion. Adjusted for maternal age, ethnic group, marital/partner status, BMI in pregnancy, index of multiple deprivation score quintile, gestation at delivery and parity where appropriate
van Haaren-ten Haken et al., 2015 The Netherlands Self-reported questionnaires, medical records, and birth registration forms 2007 to 2011 Fair quality	NR	Planned Home with Midwife (n = 226) vs. Planned Hospital with Midwife (n = 168) vs. Planned Hospital with Obstetrician (n = 182) Spontaneous vaginal: 161 (74.5%) vs. 104 (66.2%) vs. 103 (63.6%) (reference)	NR (included nulliparous only)

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
		Assisted vaginal (VE/FE): 37 (17.1%) vs. 29 (18.5%) vs. 37 (22.8%) Midwife at Home vs. Midwife at Hospital: aOR 0.94, 95% CI 0.49 to 1.83, Midwife at Home vs. Obstetrician at Hospital: aOR 0.83, 95% CI 0.45 to 1.53 Cesarean delivery (unplanned): 18 (8.3%) vs. 24 (15.3%) vs. 22 (13.6%) Midwife at Home vs. Midwife at Hospital: aOR 0.48, 95% CI 0.23 to 1.02, Midwife at Home vs. Obstetrician at Hospital: aOR 0.75, 95% CI 0.35 to 1.59 Midwife at Hospital vs. Obstetrician at Hospital: aOR 1.55, 95% CI 0.76 to 3.17	

Table F2. Outcome Data from Comparative Studies: Perinatal Mortality

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
U.S. Studies			
Grunebaum, McCullough, Sapra et al., 2017 U.S. CDC-linked birth-infant death files 2009 to 2013 Fair quality	Planned home birth (all providers) (n = 96,815) vs. Planned Hospital-Midwife (n = 1,077,197) Neonatal death, 0 to 27 days: 118 (0.12%) vs. 334 (0.03%) Standardized mortality ratio, 4.13, 95% CI 3.38 to 4.88 Indirectly standardized for maternal age (<35 or ≥35, parity (nulliparous vs. parous), and gestational age (37 to 40 vs. ≥41 weeks)	Planned home birth (n = 20,125) vs. Hospital-Midwife (n = 424,060) 45 (0.22%) vs. 157 (0.04%) SMR 6.06, 95% CI 4.30 to 7.83	Planned home birth (n = 75,809) vs. Hospital-Midwife (n = 641,625) 70 (0.09%) vs. 171 (0.03%) SMR 3.49, 95% CI 2.68 to 4.30
Grunebaum, McCullough, Arabin et al., 2017 U.S. CDC-linked birth-infant death data set 2008 to 2012 Poor quality	Planned Home (certified nurse or other midwife) vs. Planned Hospital-Midwife Neonatal mortality (birth through 27 days): 122/95,657 (0.127%) vs. 480/1,363,199 (0.035%)	Planned Home vs. Planned Hospital-Midwife Neonatal death, 0 to 27 days: 45/22,773 (0.198%) vs. 200/540,582 (0.037%) RR 5.34, 95% CI 3.9 to 7.4	Planned home vs. Planned Hospital-Midwife Neonatal death, 0 to 27 days: 77/72,884 (0.106%) vs. (280/822,617 (0.034%) RR 3.1, 95% CI 2.4 to 4

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
Snowden, et al., 2015 Oregon, U.S. State vital statistics January 2012 to December 2013 Good quality	Planned Home or Birth Center (n = 3,804) vs. Planned Hospital (n = 75,923) Fetal death ≥20 weeks, intrapartum, or neonatal death, 0 to 27 days: 15 (0.39%) vs. 137 (0.18%) Absolute difference in risk (percentage points), propensity score adjusted 0.158, 95% CI 0.055 to 0.261, p = 0.003 Fetal death ≥20 weeks: 9 (0.24%) vs. 91 (0.12%) Absolute difference in risk (percentage points), propensity score adjusted 0.088, 95% CI 0.005 to 0.171, p = 0.04 Neonatal death, 0 to 27 days: 6 (0.16%) vs. 46 (0.06%) Absolute difference in risk (percentage points), propensity score adjusted 0.077, 95% CI 0.013 to 0.140, p = 0.02	NR	NR
Thornton et al., 2017 U.S. Uniform Data Set from American Association of Birth Centers at 79 US birth centers in 43 states 2006 to 2011 Poor quality	Planned Birth Center (n = 8,776) vs. Planned Hospital (n = 2,527) Intrapartum or newborn death, days of life not reported: 3 (0.03%) vs. 1 (0.04%), OR 0.86, 95% CI 0.09 to 8.3, p = 0.99 RR calculated, 0.96, 95% CI 0.54 to 1.70	NR	NR

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
Non-U.S. Studies			
Birthplace in England Collaborative, 2011 England Birthplace study April 2008 to April 2010 Good quality	Planned Home vs. Planned Birth Center vs. Planned Hospital Intrapartum death 6/16,839 (0.04%) vs. 4/11,282 (0.04%) vs. 3/19,706 (0.02%) Neonatal death (0 to 7 days) 5/16,759 (0.03%) vs. 5/11,263 (0.04%) vs. 5/19,637 (0.03%) No statistical analysis provided, data from Appendix 8, table 8.4	Planned Home vs. Planned Birth Center vs. Planned Hospital Intrapartum death 4/4,568 (0.09%) vs. 1/5,187 (0.02%) vs. 1/10,626 (0.01%) Neonatal death (0 to 7 days) 2/4,544 (0.04%) vs. 3/5,180 (0.06%) vs. 4/10,593 (0.04%) No statistical analysis provided, data from Appendix 8, table 8.5	Planned Home vs. Planned Birth Center vs. Planned Hospital Intrapartum death 2/12,255 (0.02%) vs. 3/6,078 (0.05%) vs. 2/9,049 (0.02%) Neonatal death (0 to 7 days) 3/12,199 (0.02%) vs. 2/6,066 (0.03%) vs. 1/9,013 (0.01%) No statistical analysis provided, data from Appendix 8, table 8.5
Davies-Tuck et al., 2018 Australia Victorian Perinatal Data Collection 2000 to 2015 Poor quality	Low risk, Planned Home (n = 3,202) vs. Planned Hospital (n = 701,058) Stillbirth: 2 (0.062%) vs. 906 (0.129%), p = 0.29 Neonatal death: 3 (0.094%) vs. 262 (0.037%), p = 0.10 Still birth or neonatal death: 5 (0.16%) vs. 1,168 (0.17%), p = 0.90 Timing of stillbirth nor neonatal death reported.	NR	NR

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
Grigg et al., 2017 New Zealand Maternity and Midwifery Provider Organization data 2010 to 2011 Poor quality	Planned Birthing Center (n = 407) vs. Planned Hospital (n = 285) Intrauterine or intrapartum death: 2 (0.5%) vs. 0 (0.0%) Neonatal death, 0 to 27 days: 1 (0.26%) vs. 0 (0.0%) Intrauterine demise identified at 38 weeks during antenatal care visit. Freestanding Primary Level Midwife-led Maternity Units (PMUs) vs. Tertiary-level Obstetric-led Maternity Hospital (TMH)	NR	NR
Halfdansdottir et al., 2015 Iceland Review of midwives' and doctors' original hand-written maternity notes 2005 to 2009 Poor quality	Planned Home (n = 307) vs. Planned Hospital or Midwifery Alongside Unit (n = 921) Neonatal mortality: 0 (0%) vs. 0 (0%)	Planned Home (n = 64) vs. Planned Hospital or Midwifery Alongside Unit (n = 192) Neonatal mortality: 0 (0.0%) vs. 0 (0.0%)	Planned Home (n = 243) vs. Planned Hospital or Midwifery Alongside Unit (n = 729) Neonatal mortality: 0 (0.0%) vs. 0 (0.0%)

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
Homer et al., 2014 Australia Perinatal Data Collection, Admitted Patient Data Collection, Register of Congenital Conditions, Registry of Birth Deaths and Marriages, and the Australian Bureau of Statistics 2000 to 2008 Fair quality	Planned Home vs. Planned Birth Center vs. Planned Hospital Intrapartum or neonatal death, 0 to 7 days: 1/693 (0.14%) vs. 10/14,476 (0.06%) vs. 255/242,665 (0.01%) Planned Home vs. Planned Hospital: aOR 1.29, 95% CI 0.18 to 9.23 Planned Birth Center vs. Planned Hospital: aOR 0.66, 95% CI 0.35 to 1.24 Adjusted for maternal age, gestational age in weeks at delivery and parity. Any case with missing data was excluded from the regression.	Planned Home vs. Planned Birth Center vs. Planned Hospital Intrapartum or neonatal death, 0 to 7 days: 1/304 (0.329%) vs. 10/9,145 (0.109%) vs. 158/149,417 (0.106%) Planned Home vs. Planned Hospital: aOR 2.48, 95% CI 0.34 to 18.02 Birth center vs. Hospital: aOR 0.99, 95% CI 0.52 to 1.88 Adjusted for maternal age, gestational age in weeks at delivery and parity. Any case with missing data was excluded from the regression.	Planned Home vs. Planned Birth Center vs. Planned Hospital Intrapartum and neonatal death, 0 to 7 days: 0/392 (0%) vs. 0/5,332 (0%) vs. 96/93,298 (0.103%) Planned Home vs. Planned Hospital: Unable to calculate due to zero events Planned Birth center vs. Planned Hospital: Unable to calculate due to zero events
Hutton et al., 2016 Ontario, Canada Chart review March 2016 to April 2009 Poor quality	Planned Home (n = 11,493) vs. Planned Hospital (n = 11,493) Intrapartum or neonatal death, 0 to 27 days: 9 (0.1%) vs. 9 (0.1%), RR 1.00, 95% CI 0.40 to 2.52	Planned Home (n = 4,027) vs. Planned Hospital (n = 4,027) Intrapartum or neonatal death, 0 to 27 days: 7 (0.2%) vs. 6 (0.1%), RR 1.17, 95% CI 0.39 to 3.47	Planned Home (n = 7,466) vs. Planned Hospital (n = 7,466) Intrapartum or neonatal death, 0 to 27 days: 2 (0.03%) vs. 3 (0.04%), RR 0.67, 95% CI 0.11 to 3.99
Hutton et al., 2009 Canada Ontario Ministry of Health database 2003 to 2006 Poor quality	Planned Home (n = 6,692) vs. Planned Hospital-Midwife (n = 6,692) Intrapartum or neonatal death, 0 to 27 days: 9 (0.1%) vs. 6 (0.1%); RR 1.50, 95% CI 0.53 to 4.21	Planned Home (n = 2,293) vs. Planned Hospital-Midwife (n = 2,298) Intrapartum or neonatal death, 0 to 27 days: 5 (0.2%) vs. 4 (0.2%), no additional analysis reported	Planned Home (n = 4,393) vs. Matched, Planned Hospital-Midwife (n = 4,394) Intrapartum or neonatal death, 0 to 27 days: 4 (0.1%) vs. 2 (0.1%)

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
Janssen et al., 2009 British Columbia, Canada Perinatal Database Registry and vital statistics 2000 to 2004 Poor quality	Planned Home (n = 2,889) vs. Planned Hospital-Midwife (n = 4,752) vs. Matched Sample of Physician-attended Hospital Births (n = 5,331) Fetal death ≥ 20 weeks, intrapartum, or neonatal death, 0 to 7 days: 1 (0.035%) vs. 3 (0.057%) vs. 3 (0.064%) Planned Home vs. Planned Hospital-Midwife RR 0.61, 95% CI 0.06 to 5.88, p = NR Planned Home vs. Matched Hospital-Physician RR 0.55, 95% CI 0.06 to 5.25, p = NR	NR	NR
Katoaka et al., 2018 Japan Review of medical records Birth centers: 2001 to 2006, one hospital: 2004 to 2006, other hospital: 2008 Poor quality	Planned Birth Center (n = 5,379) vs. Planned Hospital (n = 4,209) Fetal death ≥22 weeks or intrapartum death: 0 (0%) vs. 11 (0.3%)	NR	NR

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
Kennare et al., 2010 Australia Pregnancy Outcome Unit of South Australia Health perinatal data for all births and data on perinatal deaths 1991 to 2006 Poor quality	Planned Home (n = 1,141) vs. Planned Hospital (n = 297,192) Fetal death ≥ 20 weeks, intrapartum, or neonatal deaths, 0 to 28 days: 9 (0.079%) vs. 2,440 (0.082%), aOR 1.38, 95% CI 0.56 to 3.41, p = 0.48 Adjusted for maternal age, parity, occupational status, smoking, plurality, medical and obstetric complications (e.g., antepartum hemorrhage, diabetes, hypertension), gestational age, small for gestational age, congenital anomalies, city or country hospital, mode of delivery	NR	NR
van der Kooy et al., 2011 The Netherlands Netherlands Perinatal Registry 2000 to 2007 Fair quality	Planned Home (n = 402,912) vs. Planned Hospital-Midwife (n = 219,105) Intrapartum or neonatal deaths, 0 to 7 days: 594 (0.15%) vs. 403 (0.18%), aOR 1.05, 95% CI 0.91 to 1.21 Adjusted for parity, age, ethnic background, and neighborhood, gestational age, congenital abnormalities, preterm birth, low Apgar score, small for gestational age	NR	NR

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
Wiegerinck et al., 2015 The Netherlands Netherlands Perinatal Register with additionally retrieved data from hospitals and midwife practices 2005 to 2008 Poor quality	Planned Home (n = 26,128) vs. Planned Hospital (n = 21,362) Intrapartum or neonatal death, 0 to 27 days: 19 (0.073%) vs. 12 (0.056%), OR 1.30, 95% CI 0.63 to 2.67, p = 0.61 RR calculated: 1.11, 95% CI 0.84 to 1.47	NR	NR
Non-U.S. Studies, by parity only			
New Zealand Routinely collected maternity outcome data compiled from Counties-Manukau District Health Board (CMDHB) maternity facilities 2003 to 2010 Poor quality	NR	Planned Birth Center (n = 3,438) vs. Planned Hospital (n = 11,195) Hypoxic peripartum mortality: 6 (0.17%) vs. 14 (0.12%), OR 1.30, 95% CI 0.46 to 3.23 Unadjusted OR because of small numbers RR calculated, 1.277, 95% CI 0.65 to 2.49	Planned Birth Center (n = 7,010) vs. Planned Hospital (n = 25,018) Hypoxic peripartum mortality: 4 (0.06%) vs. 8 (0.03%), OR 1.79, 95% CI 0.47 to 5.90 Unadjusted OR because of small numbers RR calculated, 1.52, 95% CI 0.68 to 3.39

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
de Jonge et al., 2015 The Netherlands Netherlands Perinatal Registry 2000 to 2009 Fair quality	NR	Planned Home vs. Planned Hospital-Midwife Intrapartum death: 113/198,515 (0.06%) vs. 86/137,168 (0.06%), aOR 1.02, 95% CI 0.76 to 1.37 Neonatal death, 0 to 7 days: 95/198,412 (0.05%) vs. 67/137,088 (0.05%), aOR 0.98, 95% CI 0.70 to 1.36 Neonatal death, 0 to 28 days: 100/198,412 (0.05%) vs. 70/137,088 (0.05%), aOR 0.97, 95% CI 0.70 to 1.34 Adjusted for gestational age, maternal age, socioeconomic status, ethnicity	Planned Home vs. Planned Hospital-Midwife Intrapartum death: 87/267,526 (0.03%) vs. 44/139,740 (0.03%), aOR 1.31, 95% CI 0.89 to 1.94 Neonatal death, 0 to 7 days: 72/267,444 (0.03%) vs. 36/139,697 (0.03%), aOR 1.07, 95% CI 0.70 to 1.65 Neonatal death, 0 to 28 days: 76/267,444 (0.03%) vs. 38/139,697 (0.03%), aOR 1.07, 95% CI 0.70 to 1.62 Adjusted for gestational age, maternal age, socioeconomic status, ethnicity
van Haaren-ten Haken et al., 2015 The Netherlands Self-reported questionnaires, medical records, and birth registration forms 2007 to 2011 Poor quality	NR	Planned Home (n = 226) vs. Planned Hospital-Midwife (n = 168) vs. Planned Hospital-Obstetrician (n = 182) Intrapartum or neonatal death, 0 to 7 days: 0 (0%) vs. 0 (0%) vs. 0 (0%)	NR (included only nulliparous)

Table F3. Outcome Data from Comparative Studies: Neonatal Morbidity

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
U.S. Studies			
Li et al., 2017 South Carolina Birth certificates 1996 to 2013 Poor quality	2004 to 2013 birth certificate data, Medicaid claims, or discharge abstracts Planned Home (n = 661) vs. Planned Birth Center (n = 1,233) vs. Planned Clinic (n = 9) vs. Planned Hospital (n = 547,523) Neonatal seizures: 1 (0.15%) vs. 0 (0.0%) vs. 0 (0.0%) vs. 131 (0.02%) Neonatal convulsions: 4 (0.61%) vs. 3 (0.24%) vs. 0 vs. 1,290 (0.24%)	NR	NR
Snowden, et al., 2015 Oregon, U.S. State vital statistics January 2012 to December 2013 Good quality	Absolute difference in risk percentage points 5-Minute Apgar score < 7: 0.50, 95% CI 0.07 to 0.93, p = 0.02 5-Minute Apgar < 4: 0.18, 95% CI 0.00 to 0.37, p = 0.05 Neonatal seizures: 0.07, 95% CI 0.02 to 0.13, p = 0.007 Ventilator support: 1.05, 95% CI 0.48 to 1.62, p < 0.001 NICU admission: −0.85, 95% CI -1.57 to -0.14, p = 0.02 Propensity score adjusted result	NR	NR
Thornton et al., 2017 U.S.	Planned Birth Center (n = 8,776) vs. Planned Hospital (n = 2,527)	NR	NR

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
Uniform Data Set from American Association of Birth Centers at 79 U.S. birth centers in 43 states 2006 to 2011 Poor quality	5-minute Apgar score 3 to 7: 70 (0.80%) vs. 13 (0.51%), aOR 1.60, 95% CI 0.82 to 3.16, p = NR Newborn septic workup: 62 (0.71%) vs. 35 (1.39%), aOR 0.51, 95% CI 0.32 to 0.81, p = NR Positive pressure ventilation < 10 minutes: 268 (3.05%) vs. 57 (2.26%), aOR 1.31, 95% CI 0.95 to 1.82, p = NR Neonatal composite: 39 (0.44%) vs. 11 (0.44%), aOR 1.44, 95% CI 0.66 to 3.14 Composite definition: intrapartum and newborn mortality, hypoxic neurologic injury, Apgar score less than 4 at 5 minutes, seizures, persistent pulmonary hypertension, positive pressure ventilation greater than 10 minutes, and meconium aspiration syndrome Propensity score adjustment with a covariate considering maternal age, parity, race, payment method, cohabitation status, trimester prenatal care began, gestational age at birth, and newborn weight		

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
Non-U.S. Studies			
Birthplace in England Collaborative, 2011 England Birthplace study April 2008 to April 2010 Good quality	Planned Home (n = 16,553) vs. Planned Hospital (n = 19,551) Birthplace composite: 70 (4.2%) vs. 81 (4.4%), aOR 1.16, 95 % CI 0.76 to 1.77 Planned Freestanding Midwifery Unit (n = 11,199) vs. Planned Hospital (n = 19,551) Birthplace composite: 41 (3.5%) vs. 81 (4.4%), aOR 0.92, 95 % CI 0.58 to 1.46 Adjusted for maternal age, ethnic group, understanding of English, marital or partner status, BMI, deprivation score quintile, previous pregnancies, weeks of gestation Birthplace composite definition: stillbirth after the start of care in labor, early neonatal death, neonatal encephalopathy, meconium aspiration syndrome, brachial plexus injury, fractured humerus or clavicle	Planned Home (n = 4,488) vs. Planned Hospital (n = 10,541) Birthplace composite: 39 (9.3%) vs. 52 (5.3%), aOR 1.75, 95 % CI 1.07 to 2.86 Planned Freestanding Midwifery Unit (n = 5,158) vs. Planned Hospital (n = 10,541) Birthplace composite: 24 (4.5%) vs. 52 (5.3%), aOR 0.91, 95 % CI 0.52 to 1.60 Adjusted for maternal age, ethnic group, understanding of English, marital or partner status, BMI, deprivation score quintile, previous pregnancies, weeks of gestation.	Planned Home (n = 12,050) vs. Planned Hospital (n = 8,980) Birthplace composite: 31 (2.3%) vs. 29 (3.3%), aOR 0.72, 95% CI 0.41 to 1.27 Planned Freestanding Midwifery Unit (n = 6,025) vs. Planned Hospital (n = 8,980) Birthplace composite: 17 (2.7%) vs. 29 (3.3%), aOR 0.91, 95% CI 0.46 to 1.80 Adjusted for maternal age, ethnic group, understanding of English, marital or partner status, BMI, deprivation score quintile, previous pregnancies, weeks of gestation

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
Davies-Tuck et al., 2018 Australia Victorian Perinatal Data Collection 2000 to 2015 Poor quality	Low risk, Planned Home (n = 3,202) vs. Planned Hospital (n = 701,058) Admission to SCN: 58 (1.8%) vs. 58,303 (8.3%), p < 0.001 NICU admission: 14 (0.4%) vs. 1,721 (0.2%), p = 0.03 5-minute Apgar < 7: 29 (0.9%) vs. 8,739 (1.2%), p = 0.08 HIE: 0 (0%) 133 vs. (0.2%), p = 0.44 Birth trauma: 46 (1.4%) vs. 46,502 (6.6%), p < 0.001 Intrauterine hypoxia: 47 (1.5%) vs. 40,760 (5.8%), p < 0.001 Other perinatal morbidity: 8 (0.3%) vs. 1,113 (0.2%), p = 0.20 Composite morbidity: 115 (3.6%) vs. 94,094 (13.4%), p < 0.001 Birth trauma: brachial plexus injury, fractured clavicle or humerus Other perinatal morbidity: meconium aspiration syndrome, congenital pneumonia or respiratory distress syndrome	NR	NR

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
Grigg et al., 2017 New Zealand Maternity and Midwifery Provider Organization data 2010 to 2011 Poor quality	Planned Birthing Center (n = 407) vs. Planned Hospital (n = 285) 5-minute Apgar score < 7: 8 (2.0%) vs. 6 (2.1%), aOR 0.82, 95% CI 0.27 to 2.52 Resuscitation not needed: 345 (84.8%) vs. 234 (82.1%), aOR 0.97, 95% CI 0.63 to 1.50‡ Admission to NNU: 24 (5.9%) vs. 14 (4.9%), aOR 1.44, 95% CI 0.70 to 2.96, p > 0.05 Freestanding Primary Level Midwife-led Maternity Units (PMUs) vs. Tertiary-level Obstetric-led Maternity Hospital (TMH) ‡Refers to a dichotomous outcome of "resuscitation or not" adjusted for maternal age, smoking status, parity, augmentation, induction, term	NR	NR

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
Halfdansdottir et al., 2018 Iceland Maternity notes review 2005 to 2009 Poor quality	No home birth contraindication Planned Home (n = 278) vs. Planned Hospital (n = 851) NICU admission: 16 (5.8%) vs. 57 (6.7%) 5-minute Apgar < 7: 2 (0.7%) vs. 14 (1.6%) Neonatal resuscitation: 6 (2.2%) vs. 15 (1.8%) Neonatal morbidity, 7 days: 28 (10.1%) vs. 116 (13.6%) Home birth contraindication present Planned Home (n = 29) vs. Planned Hospital (n = 70) NICU admission: 6 (20.7%) vs. 6 (8.6%) 5-minute Apgar < 7: 3 (10.3%) vs. 1 (1.4%) Neonatal resuscitation: 2 (6.9%) vs. 2 (2.9%) Neonatal morbidity, 7 days: 7 (24.1%) vs. 10 (14.3%)	NR	NR

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
Halfdansdottir et al., 2015 Iceland Review of midwives' and doctors' original hand-written maternity notes 2005 to 2009 Poor quality	Planned Home (n = 307) vs. Planned Hospital or Midwifery Alongside Unit (n = 921) NICU admission: 22 (7.2%) vs. 63 (6.8%) aOR 1.34, 95% CI 0.78 to 2.32 5-minute Apgar < 7: 5 (1.6%) vs. 15 (1.6%) aOR 0.98, 95% CI 0.30 to 3.19	Planned Home (n = 64) vs. Planned Hospital or Midwifery Alongside Unit (n = 192) NICU admission: 12 (18.8%) vs. 23 (12.0%); aOR 1.88, 95% Ci 0.81 to 4.36 5 minute Apgar < 7: 4 (6.3%) vs. 6 (3.1%), aOR 1.24, 95% Ci 0.25 to 6.28 Neonatal resuscitation: 4 (6.3%) vs. 3 (1.6%)	Planned Home (n = 243) vs. Planned Hospital or Midwifery Alongside Unit (n = 729) NICU admission: 10 (4.1%) vs. 40 (5.5%), aOR 1.04, 95% Ci 0.46 to 2.34 5 minute Apgar < 7: 1 (0.4%) vs. 9 (1.2%), aOR 0.38, 95% Ci 0.04 to 3.60 Neonatal resuscitation: 4 (1.7%) vs. 14 (1.9%)

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
Hitzert et al., 2016 The Netherlands Dutch Birth Centre Study August to December 2013 Poor quality	Planned Home (n = 350) vs. Planned Birth Center (n = 263) vs. Planned Hospital-Midwife (n = 262) vs. Planned Hospital-Obstetrician (n = 115) Hospital admission of the child after birth No: 304 (87.4%) vs. 188 (72.3%) vs. 196 (74.8%) vs. 58 (50.9%) Yes, at the maternity ward: 38 (10.9%) vs. 63 (24.2%) vs. 58 (22.1%) vs. 41 (36.0%) Yes, high care: 6 (1.7%) vs. 9 (3.5%) vs. 8 (3.1%) vs. 15 (13.2%) Experienced health baby after birth Healthy: 318 (91.4%) vs. 229 (87.4%) vs. 229 (87.4%) vs. 93 (80.9%) Small problems: 22 (6.3%) vs. 29 (11.1%) vs. 25 (9.5%) vs. 20 (17.4%) Big problems/problems with impact unclear: 8 (2.3%) vs. 4 (1.6%) vs. 8 (3.1%) vs. 2 (1.8%)	NR	NR

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
Homer et al., 2014 Australia Perinatal Data Collection, Admitted Patient Data Collection, Register of Congenital Conditions, Registry of Birth Deaths and Marriages, and the Australian Bureau of Statistics 2000 to 2008 Fair quality	Planned Home vs. Planned Birth Center vs. Planned Hospital Composite morbidity or mortality: 5/703 (0.07%) vs. 77/14,482 (0.05%) vs. 1,399/242,860 (0.05%) Home vs. Hospital: aOR 1.06, 95% CI 0.44 to 2.56 Birth center vs. Hospital: aOR 0.87, 95% CI 0.69 to 1.10 Composite represented any of the following: stillbirth, early neonatal death (<7 days), neonatal encephalopathy, meconium aspiration syndrome, brachial plexus injury, fractured clavicle, fractured humerus. Adjusted for maternal age, gestational age in weeks at delivery and parity	Planned Home vs. Planned Birth Center vs. Planned Hospital Composite morbidity or mortality: 4/304 (1.32%) vs. 65/9,145 (0.71%) vs. 949/149,417 (0.64%) Home vs. Hospital: aOR 1.72, 95% CI 0.64 to 4.63 Birth center vs. Hospital: aOR 1.04, 95% CI 0.81 to 1.34 Composite represented any of the following: stillbirth, early neonatal death (<7 days), neonatal encephalopathy, meconium aspiration syndrome, brachial plexus injury, fractured clavicle, fractured humerus. Adjusted for maternal age, gestational age in weeks at delivery and parity	Planned Home vs. Planned Birth Center vs. Planned Hospital Composite morbidity or mortality: 1/392 (0.26%) vs. 12/5,332 (0.23%) vs. 448/93,298 (0.48%) Home vs. Hospital: aOR 0.47, 95% CI 0.07 to 3.38 Birth center vs. Hospital: aOR 0.45, 95% CI 0.26 to 0.81 Composite represented any of the following: stillbirth, early neonatal death (<7 days), neonatal encephalopathy, meconium aspiration syndrome, brachial plexus injury, fractured clavicle, fractured humerus Adjusted for maternal age, gestational age in weeks at delivery, parity

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
Hutton et al., 2016 Ontario, Canada Chart review March 2016 to April 2009 Poor quality	Planned Home (n = 11,493) vs. Planned Hospital (n = 11,493) Neonatal morbidity: 38 (0.3%) vs. 40 (0.3%), RR 0.95, 95% CI 0.6 to 1.48 5 minute Apgar < 4, positive pressure ventilation, or chest compressions	Planned Home (n = 4,027) vs. Planned Hospital (n = 4,027) Neonatal morbidity: 27 (0.7%) vs. 26 (0.6%), RR 1.04, 95% CI 0.61 to 1.78 5 minute Apgar < 4, positive pressure ventilation, or chest compressions	Planned Home (n = 7,466) vs. Planned Hospital (n = 7,466) Neonatal morbidity: 11 (0.2%) vs. 14 (0.2%), RR 0.79, 95% CI 0.36 to 1.73 5 minute Apgar < 4, positive pressure ventilation, or chest compressions
Hutton et al., 2009 Canada Ontario Ministry of Health database 2003 to 2006 Poor quality	Planned Home (n = 6,692) vs. Planned Hospital-Midwife (n = 6,692) Neonatal morbidity: 155 (2.3%) vs. 189 (2.8%), RR 0.82, 95% CI 0.66 to 1.01 Birthweight <2,500: 38 (0.6%) vs. 56 (0.8%) 5-minutes Apgar < 4: 10 (0.1%) vs. 8 (0.1%) positive pressure ventilation and cardiac compressions: 21 (0.3%) vs. 23 (0.3%) NICU >4 days: 102 (1.5%) vs. 115 (1.7%)	Planned Home (n = 2,293) vs. Planned Hospital-Midwife (n = 2,298) Neonatal morbidity: 78 (3.4%) vs. 84 (3.7%)	Planned Home (n = 4,393) vs. Planned Hospital-Midwife (n = 4,394) Neonatal morbidity: 77 (1.8%) vs. 105 (2.4%)
Janssen et al., 2009 British Columbia, Canada Perinatal Database Registry and vital statistics 2000 to 2004 Poor quality	Planned Home (n = 2,889) vs. Planned Hospital-Midwife (n = 4,752) RR - Planned Home vs. Hospital with Midwife 1-minute Apgar score < 7: RR 0.76, 95% CI 0.66 to 0.88 5-minute Apgar score < 7: RR 0.92, 95% CI 0.58 to 1.47	NR	NR

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
	Meconium aspiration: RR 0.83, 95% CI 0.38 to 1.81 Asphyxia at birth: RR 0.79, 95% CI 0.30 to 2.05 Birth trauma: RR 0.26, 95% CI 0.11 to 0.58 Resuscitation at birth: RR 0.23, 95% CI 0.14 to 0.37 Birth weight < 2500 g: RR 0.44, 95% CI 0.25 to 0.78 Seizures: RR 0.61, 95% CI 0.12 to 3.03 Assisted ventilation > 24 h: RR 1.02, 95% CI 0.34 to 3.04 Birth trauma: subdural or cerebral hemorrhage, fracture of clavicle, long bones or skull, facial nerve injury, Erb palsy, or unspecified birth trauma		

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
Katoaka et al., 2018 Japan Review of medical records Birth centers: 2001 to 2006, one hospital: 2004 to 2006, other hospital: 2008 Poor quality	Planned Birth Center (n = 5,379) vs. Planned Hospital (n = 4,209) Birth weight (grams) <2,500: 171 (3.2%) vs. 234 (5.6%), aOR 0.67, 95% CI 0.55 to 0.82 2,500 to 3,999: 5,120 (95.3%) vs. 3,896 (92.7%), aOR = Reference >4,000: 82 (1.5%) vs. 72 (1.7%), aOR 0.65, 95% CI 0.46 to 0.92 Apgar score <7 at 1 minute: 20 (0.4%) vs. 115 (2.7%), aOR 0.17, 95% CI 0.10 to 0.28 <7 at 5 minutes: 5 (0.1%) vs. 26 (0.6%), aOR 0.23, 95% CI 0.10 to 0.63 Adjusted for age, parity, mode of delivery, and gestational weeks	NR	NR

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
Kennare et al., 2010 Australia Pregnancy Outcome Unit of South Australia Health perinatal data for all births and data on perinatal deaths 1991 to 2006 Poor quality	Planned Home (n = 1,136) vs. Planned Hospital (n = 295,568) 5-minute Apgar score < 7: 12 (1.1%) vs. 4,243 (1.4%), aOR 1.43, 95% CI 0.66 to 3.07, p = 0.36 Specialized neonatal care: 88 (7.7%) vs. 44,410 (15.0%), aOR 0.80, 95% CI 0.62 to 1.03), p = 0.08 Adjusted for maternal age, parity, occupational status, smoking, plurality, medical and obstetric complications (e.g., antepartum hemorrhage, diabetes, hypertension), gestational age, small for gestational age, congenital anomalies, city or country hospital, mode of delivery	NR	NR

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
Monk et al., 2014 Australia ObstetriX surveillance system of point-of-care maternity data collection across the antenatal, intrapartum, and immediate postnatal periods 2005 to 2006 Fair quality	Planned Birth Center (n = 494) vs. Planned Tertiary Maternity Unit (n = 3,157) 5-minute Apgar < 7: 6 (1.2%) vs. 88 (2.8%), aOR 0.57, 95% CI 0.25 to 1.35, p = 0.203 Admitted to SCN/NICU: 33 (6.7%) vs. 432 (13.7%), aOR 0.60, 95% CI 0.39 to 0.91, p = 0.017 Birth weight <2,500: 9 (1.8) vs. 176 (5.6), aOR 0.38, 95% CI 0.16 to 0.89, p = 0.026 2,500 to 4,500: 472 (96.3) vs. 2,899 (92.2%), aOR 1.74, 95% CI 1.00 to 3.03, p = 0.050 >4500: 9 (1.8%) vs. 70 (2.2%), aOR 0.77, 95% CI 0.37 to 1.58, p = 0.473 Adjusted for maternal age, smoking status, parity, augmentation, induction, previous cesarean delivery and risk at the onset of labor	NR	NR

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
Øian et al., 2018 Norway Medical Birth Registry with supplementary data collection January 2008 to December 2010 Poor quality	Births in Midwife-Led Birth Centers, Planned (n = 2,298) vs. Births Planned for a Midwife-led Birth Unit, Took Place Elsewhere (n = 220) vs. Births in Hospital, Low Risk (n = 105,358) 5-minute Apgar Score < 7: 1 (.1%) vs. 2 (1.1%) vs. 1,029 (1.0%)	NR	NR
Schroeder et al., 2017 England Interviews and medical records from Barkantine Birth Centre and Royal London Hospital's obstetric unit in Tower Hamlets, a low-income borough in east London 2008 to 2009 Poor quality	Planned Birth Center (n = 167) vs. Planned Hospital (n = 164) Mean Days in NICU: 0.00 ± 0.0 vs. 0.01 ± 0.1, p = NR	NR	NR

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
Sprague et al., 2018 Ontario, Canada Better Outcomes Registry & Network, Canadian Institute of Health Information Discharge Abstracts Database, Statistics Canada census data, birth center records January 2014 to February 2015 Poor quality	Planned birth center (n = 495) vs. Matched Planned Midwifery (n = 1980) NICU admission: 27 (5.5%) vs. 141 (7.1%), aRR 1.3, 95% CI 0.9 to 2.0	NR	NR
Wiegerinck et al., 2015 The Netherlands Netherlands Perinatal Register with additionally retrieved data from hospitals and midwife practices 2005 to 2008 Poor quality	Planned Home (n = 26,128) vs. Planned Hospital (n = 21,362) 5-minute Apgar score: < 7: 181 (0.693%) vs. 159 (0.744%), OR 0.93, 95% CI 0.75 to 1.15, p = 0.54 NICU admittance >24 hours: 43 (0.165%) vs. 55 (0.258%), OR 0.64, 95% CI 0.43 to 0.95, p = 0.03	NR	NR

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
Non- U.S., by parity only			
Bailey, 2017 New Zealand Routinely collected maternity outcome data compiled from Counties-Manukau District Health Board (CMDHB) maternity facilities 2003 to 2010 Poor quality	NR	Planned Birth Center (n = 3,438) vs. Planned Hospital (n = 11,195) Neonatal unit admission: 155 (4.5%) vs. 226 (6.4%), aOR 0.70, 95% CI 0.58 to 0.86 Adjusted for maternal age, ethnicity, and deprivation score	Planned Birthing Center (n = 7,010) vs. Planned Hospital (n = 25,018) Neonatal unit admission 168 (2.4%) vs. 718 (2.9%), aOR 0.85, 95% CI 0.71 to 1.01 Adjusted for maternal age, ethnicity, deprivation score
Christensen & Overgaard, 2017 Denmark Data collected on sociodemographic characteristics, present and previous pregnancies and births, neonatal outcomes and transfers March 2004 to October 2008 Poor quality	NR	Planned Birth Center (n = 215) vs. Planned Obstetric Unit (n = 215) 5-minute Apgar score < 9: OR 0.6, 95% CI 0.2 to 1.9 NICU admission <24 h: 0.8, 95% CI 0.4 to 1.9 Infant readmission: 0.4, 95% CI 0.1 to 1.4	Planned Birth Center (n = 624) vs. Planned Obstetric Unit (n = 624) 5-minutes Apgar score < 9: OR 0.8, 95% CI 0.4 to 1.9 NICU admission <24 h: OR 0.7, 95% CI 0.3 to 1.8 Infant readmission: OR 0.7, 95% CI 0.4 to 1.3

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
de Jonge et al., 2015 The Netherlands Netherlands Perinatal Registry 2000 to 2009 Fair quality	NR	Planned Home vs. Planned Hospital-Midwife 5-minute Apgar score < 7: 1,568/198,372 (0.80%) vs. 1,213/137,054 (0.90%), aOR 0.95, 95% CI 0.87 to 1.02 5-minute Apgar score < 4: 209/198,372 (0.11%) vs. 166/137,054 (0.12%), aOR 0.91, 95% CI 0.74 to 1.14 Admission to NICU within 7 days: 644/198,412 (0.03%) vs. 476/137,088 (0.03%), aOR 1.04, 95% CI 0.91 to 1.18 Admission to NICU within 28 days: 677/198,412 (0.03%) vs. 495/137,088 (0.04%), aOR 1.05, 95% CI 0.92 to 1.18 Adjusted for gestational age, maternal age, socioeconomic status, and ethnicity	Planned Home vs. Planned Hospital-Midwife 5-minute Apgar score < 7: 855/267,371 (0.32%) vs. 638/139,656 (0.46%), aOR 0.77, 95% CI 0.69 to 0.86 5-minute Apgar score < 4: 167/267,371 (0.06%) vs. 100/139,656 (0.07%), aOR 0.92, 95% CI 0.70 to 1.20 Admission to NICU within 7 days: 327/267,444 (0.12%) vs. 232/139,697 (0.17%), aOR 0.84, 95% CI 0.70 to 1.01 Admission to NICU within 28 days: 363/267,444 (0.14%) vs. 272/139,697 (0.20%), aOR 0.79, 95% CI 0.66 to 0.93 Adjusted for gestational age, maternal age, socioeconomic status, and ethnicity

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
Hollowell et al., 2017 England Birthplace in England national prospective cohort study April 2008 to April 2010 Fair quality	NR	Planned Birthing Center (n = 5,187) vs. Planned Hospital (n = 8.,350) Birthplace primary perinatal outcome: 0.045% vs. 0.027%, aOR 0.96, 95% CI 0.51 to 1.82, p = 0.91 Composite measure defined as any of: stillbirth after the start of care in labor, early neonatal death, neonatal encephalopathy, meconium aspiration syndrome, brachial plexus injury, fractured humerus or clavicle Adjusted for maternal characteristics and complicating conditions identified at the start of care in labor	Planned Birthing Center (n = 6,078) vs. Planned Hospital (n = 8,323) Birthplace primary perinatal outcome: 0.047% vs. 0.024%, aOR 1.14, 95% CI 0.52 to 2.50, p = 0.745 Composite measure defined as any of: stillbirth after the start of care in labor, early neonatal death, neonatal encephalopathy, meconium aspiration syndrome, brachial plexus injury, fractured humerus or clavicle Adjusted for maternal characteristics and complicating conditions identified at the start of care in labor

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
Li et al., 2015 United Kingdom Birthplace national prospective cohort study April 2008 to April 2010 Good quality	NR	Planned Home (n = 283) vs. Planned Hospital (n = 2,503) Adverse perinatal outcomes (main composite): 9 (27.7%) vs. 107 (19.3%), aRR 0.60, 95% CI 0.25 to 1.43 A composite consisting of the birthplace intrapartum and admission to a neonatal unit within 48 hours of birth for more than 48 hours. Adjusted for maternal age, ethnic group, marital/partner status, BMI in pregnancy, index of multiple deprivation score quintile, gestation at delivery, parity where appropriate	Planned Home (n = 1,186) vs. Planned Hospital (n = 4,133) Adverse perinatal outcomes (main composite): 16 (12.3%) vs. 108 (26.8%), aRR 0.47, 95% CI 0.25 to 0.88 Composite consisting of the birthplace intrapartum and admission to a neonatal unit within 48 hours of birth for more than 48 hours Adjusted for maternal age, ethnic group, marital/partner status, BMI in pregnancy, index of multiple deprivation score quintile, gestation at delivery and parity where appropriate
van Haaren-ten Haken et al., 2015 The Netherlands Self-reported questionnaires, medical records, and birth registration forms 2007 to 2011 Poor quality	NR	Planned Home (n = 226) vs. Planned Hospital-Midwife (n = 168) vs. Planned Hospital-Obstetrician (n = 182) 5-minute Apgar score < 7: 4 (1.8%) vs. 3 (1.8%) vs. 4 (2.2%) Resuscitation: 1 (0.4%) vs. 0 (0%) vs. 0 (0%)	NR (included only nulliparous)

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
		Birth weight M (SD): 3,365 (543) vs. 3,401 (575) vs. 3210 (555) 2500 to 3999 gram: 195 (86.3%) vs. 135 (80.4%) vs. 155 (85.2%) (reference) <2500 grams: 11 (4.9%) vs. 10 (6.0%) vs. 15 (8.2) Midwife at Home vs. Midwife at Hospital: aOR 0.68, 95% CI 0.16 to 2.84 Midwife at Home vs. Obstetrician at Hospital: aOR 0.83, 95% CI 0.22 to 3.12 ≥4000 grams: 20 (8.8) 23 (13.7) 12 (6.6) Midwife at Home vs. Midwife at Hospital: aOR 0.69, CI 0.32 to 1.52 Midwife at Home vs. Obstetrician at Hospital: aOR 1.02, 95% CI 0.44 to 2.40 Adjusted for maternal age, method of conception, first pregnancy (previous miscarriage or ectopic pregnancy), gestational age at birth, medical indications pregnancy	

Table F4. Outcome Data from Comparative Studies: Maternal Morbidity

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
U.S. Studies			
Snowden, et al., 2015 Oregon, U.S. State vital statistics January 2012 to December 2013 Good quality	Absolute difference in risk percentage points Maternal ICU admission: −0.04, 95% CI −0.18 to 0.10, p = 0.58 Maternal blood transfusion: 0.27, 95% CI 0.08 to 0.46, p = 0.006 Severe perineal lacerations: −0.54, 95% CI −0.98 to −0.11, p = 0.02 Propensity score adjusted result	NR	NR
Thornton et al., 2017 U.S. Uniform Data Set from American Association of Birth Centers at 79 U.S. birth centers in 43 states 2006 to 2011 Poor quality	Planned Birth Center (n = 8,776) vs. Planned Hospital (n = 2,527) Postpartum hemorrhage: 542 (6.18%) vs. 117 (4.63%), aOR 1.25, 95% CI 0.99 to 1.58, p = NR Propensity score adjustment with a covariate considering maternal age, parity, race, payment method, cohabitation status, trimester prenatal care began, gestational age at birth, newborn weight	NR	NR

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
Non-U.S. Studies			
Birthplace in England Collaborative, 2011 United Kingdom Birthplace April 2008 to April 2010 Good quality	Planned Home (n = 16,800) vs. Planned Hospital (n = 19,638) Third or fourth degree perineal: 318 (1.9%) vs. 625 (3.2%), aOR 0.77, 95% CI 0.57 to 1.05 Planned Freestanding Midwifery Unit (n = 11,262) vs. Planned Hospital (n = 19,638) Third or fourth degree perineal: 259 (2.3%) vs. 625 (3.2%), aOR 0.78, 95% CI 0.58 to 1.05 Planned Home (n = 16,687) vs. Planned Hospital (n = 19,579) Blood transfusion: 101 (0.6%) vs. 241 (1.2%), aOR 0.72, 95% CI 0.47 to 1.12 Planned Freestanding Midwifery Unit (n = 11,230) vs. Planned Hospital (n = 19,579) Blood transfusion:67 (0.5%) vs. 241 (1.2%), aOR 0.48, 95% CI 0.32 to 0.73	NR	NR
Davis et al., 2012 New Zealand New Zealand College of Midwives research database, managed by the	Planned Home (n = 1,830) vs. Planned Primary Unit (n = 2,877) vs. Planned Secondary Hospital (n = 7,380) vs. Planned Tertiary Hospital (n = 4,123)	NR	NR

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
Midwifery Maternity Provider Organisation 2006 to 2007 Fair quality	Blood loss > 1,000 mL Home: 19 (1.0%), aRR 0.93, 95% CI 0.49 to 1.74, p = 0.97 Primary Unit: 32 (1.1%), Reference Secondary Hospital: 96 (1.3%), aRR 1.07, 95% CI 0.68 to 1.69, p = 0.45 Tertiary Hospital: 67 (1.6%), aRR 1.10, 95% CI 0.67 to 1.79, p = 0.23 Adjusted for smoking, maternal age, parity, ethnicity, augmentation, length of labor, mode of birth, episiotomy, perineal trauma, newborn birthweight > 4,000 g, mode of third stage management		
Davies-Tuck et al., 2018 Australia Victorian Perinatal Data Collection 2000 to 2015 Poor quality	Low risk, Planned Home (n = 3,202) vs. Planned Hospital (n = 701,058) Postpartum hemorrhage: 291 (9.1%) vs. 90,603 (12.9%), p < 0.001 Mother admitted to HDU/ICU: 6 (0.2%) vs. 4,217 (0.6%), p = 0.002 3rd/4th degree tear, 31 (1.0%) vs. 14,000 (2.0%), p < 0.001	NR	NR
de Jonge, et al., 2013 The Netherlands LEMMoN study merged with Netherlands Perinatal Registry	Planned Home (n = 92,333) vs. Planned Hospital (n = 54, 419) Severe acute maternal morbidity: 141 (1.5%) vs. 147 (2.7%)	Planned Home (n = 38,728) vs. Planned Hospital (n = 26,499) Severe acute maternal morbidity: 89 (0.23%) vs. 82 (0.31%), aOR 0.77, 95%	Planned Home (n = 53,602) vs. Planned Hospital (n = 27,919) Severe acute maternal morbidity: 52 (0.10%) vs. 65 (0.23%), aOR 0.43, 95%

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
August 2004 to August 2006 Fair quality	Admission to intensive care unit: 32 (0.3%) vs. 38 (0.7%) Blood transfusion ≥4 packed cells: 134 (1.5%) vs. 122 (2.2%) Postpartum hemorrhage (>1,000 mL): 2,699 (29.2%) vs. 2172 (39.9%) Manual removal of placenta: 1,550 (16.8%) vs. 1315 (24.2%) No statistical analysis reported.	CI 0.56 to 1.06, RRR 25.7%, 95% CI −0.1% to 53.5% Blood transfusion ≥4 packed cells: 85 (0.22%) vs. 68 (0.26%), aOR 0.90, 95% CI 0.65 to 1.27, RRR 14.5%, 95% CI −14.7% to 45.8% Postpartum hemorrhage: 1,655 (4.31%) 1,134 (4.33%), aOR 0.92, 95% CI 0.85 to 1.00, RRR 0.5%, 95% CI −6.8% to 7.9% Manual removal of placenta: 1,099 (2.90%) vs. 773 (2.98%), aOR 0.91, 95% CI 0.83 to 1.00, RRR 2.8%, 95% CI −6.1% to 11.8% Severe acute maternal morbidity includes admission to ICU, eclampsia/HELLP, blood transfusion of 4 or more packed calls, or other serious event Adjusted for parity, gestational age, maternal age, ethnicity, socioeconomic position	CI 0.29 to 0.63, RRR 58.3%, 95% CI 33.2% to 87.5% Blood transfusion ≥4 packed cells: 49 (0.09%) vs. 54 (0.19%), aOR 0.45, 0.30 to 0.68, RRR 52.7, 95% CI 24.9 to 85.3 Postpartum hemorrhage: 1,044 (1.96%) vs. 1,038 (3.76%), aOR 0.50, 95% CI 0.46 to 0.55, RRR 47.9%, 95% CI 41.2% to 54.7% Manual removal of placenta: 451 (0.85%) vs. 542 (1.96%), aOR 0.41, 95% CI 0.36 to 0.47, RRR 56.9%, 95% CI 47.9% to 66.3% Severe acute maternal morbidity includes admission to ICU, eclampsia, blood transfusion of 4 or more packed cells, or other serious event Adjusted for parity, gestational age, maternal age, ethnicity, socioeconomic position
Grigg et al., 2017 New Zealand Maternity and Midwifery Provider Organization data 2010 to 2011 Poor quality	Planned Birthing Center (n = 407) vs. Planned Hospital (n = 285) Postpartum hemorrhage >1,000 ml: 24 (5.9%) vs. 13 (4.6%), aOR 1.74, 95% CI 0.85 to 3.59, p > 0.05	NR	NR

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
	Perineal trauma Third/fourth: 9 (2.2%) vs. 5 (1.8%), aOR 1.43, 95% CI 0.46 to 4.42, p > 0.05 Adjusted for maternal age, smoking status, parity, term, augmentation, induction		
Halfdansdottir et al., 2018 Iceland Maternity notes review 2005 to 2009 Poor quality	No home birth contraindication Planned Home (n = 278) vs. Planned Hospital (n = 851) Postpartum hemorrhage ≥1,000 mL: 6 (2.2%) vs. 31 (3.7%) OASI: 7 (2.5%) vs. 26 (3.1%) Home birth contraindication present Planned Home (n = 29) vs. Planned Hospital (n = 70) Postpartum hemorrhage ≥1,000 mL: 3 (10.7%) vs. 3 (4.3%) OASI: 1 (3.4%) vs. 2 (2.9%)	NR	NR
Halfdansdottir et al., 2015 Iceland Review of midwives' and doctors' original hand-written maternity notes 2005 to 2009	Planned Home (n = 307) vs. Planned Hospital or Midwifery Alongside Unit (n = 921) Maternal blood transfusion: 1 (0.3) vs. 19 (2.1%), aOR 0.91, 95% Ci 0.41 to 2.05	Planned Home (n = 64) vs. Planned Hospital or Midwifery Alongside Unit (n = 192) Postpartum hemorrhage ≥1,000 mL: 4 (6.3%) vs. 19 (2.6%); aOR 0.71, 95% CI 0.20 to 2.58	Planned Home (n = 243) vs. Planned Hospital or Midwifery Alongside Unit (n = 729) Postpartum hemorrhage ≥1,000 mL: 5 (2.1%) vs. 19 (2.6%), aOR 1.02, 95% CI 0.34 to 3.02

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
Poor quality	OASI: 8 (2.6%) vs. 28 (3.0%), aOR 0.97, 95% CI 0.41 to 2.27 Adjusted for maternal age, gestational age, presentation, water birth, birth weight, gender	OASI: 4 (6.3%) vs. 12 (6.3%), aOR 1.37, 95% CI 0.40 to 4.63	OASI: 4 (1.6%) vs. 16 (2.2%), aOR 0.73, 95% CI 0.20 to 2.59
Hutton et al., 2016 Ontario, Canada Chart review March 2016 to April 2009 Poor quality	Planned Home (n = 11,493) vs. Planned Hospital (n = 11,493) 3rd or 4th degree perineal laceration: 151 (1.3%) vs. 266 (2.3%), RR 0.57, 95% CI 0.47 to 0.69 Postpartum hemorrhage: 286 (2.5%) vs. 348 (3.0%), RR 0.82, 95 % CI 0.70 to 0.96	Planned Home (n = 4,027) vs. Planned Hospital (n = 4,027) 3rd or 4th degree perineal laceration: 126 (3.1%) vs. 189 (4.7%), RR 0.67, 95% CI 0.53 to 0.83 Postpartum hemorrhage: 130 (3.2%) vs. 146 (3.6%), RR 0.89, 95% CI 0.71 to 1.12	Planned Home (n = 7,466) vs. Planned Hospital (n = 7,466) 3rd or 4th degree perineal laceration: 25 (0.3%) vs. 77 (1.0%), RR 0.33, 95% CI 0.21 to 0.51 Postpartum hemorrhage: 156 (2.1%) vs. 202 (2.7%), RR 0.77, 95% CI 0.63 to 0.95
Hutton et al., 2009 Canada Ontario Ministry of Health database 2003 to 2006 Poor quality	Planned Home (n = 6,692) vs. Planned Hospital-Midwife (n = 6,692) Estimated intrapartum blood loss >1,000 mL: 56 (0.8%) vs. 82 (1.2%), RR 0.68, 95% CI 0.49 to 0.96	Planned Home (n = 2,293) vs. Planned Hospital-Midwife(n = 2,298) Estimated intrapartum blood loss >1,000 mL: 29 (1.3%) vs. 31 (1.3%)	Planned Home (n = 4,393) vs. Planned Hospital-Midwife (n = 4,394) Estimated intrapartum blood loss >1,000 mL: 27 (0.6%) vs. 51 (1.2%)
Janssen et al., 2009 British Columbia, Canada Perinatal Database Registry and vital statistics 2000 to 2004 Poor quality	Planned Home (n = 2,889) vs. Planned Hospital-Midwife (n = 4,752) vs. Matched Sample of Physician-attended Hospital Births (n = 5,331) Prolapsed cord: 2 (0.1%%) vs. 6 (0.1%%) vs. 9 (0.2%)	NR	NR

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
	Uterine rupture: 0 (0.0%) vs. 0 (0.0%) vs. 2 (0.04%) Postpartum hemorrhage: 110 (3.8%) vs. 285 (6.0%) vs. 357 (6.7%) Blood transfusion: 2 (0.1%) vs. 10 (0.2%) vs. 15 (0.3%) Obstetric shock: 1 (0.03%) vs. 1 (0.02%) vs. 1 (0.02%) Manual removal of placenta: 28 (1.0%) vs. 85 (1.8%) vs. 90 (1.7%) Uterine prolapse: 1 (0.03%) vs. 1 (0.02%) vs. 2 (0.04%) Puerperal fever: 1 (0.03%) vs. 4 (1.0%) vs. 7 (0.1%) Third- or fourth-degree perineal tear: 34 (1.2%) vs. 137 (2.9%) vs. 183 (3.4 %) Cervical tear: 2 (0.1%) vs. 5 (0.1%) vs. 4 (0.1%) Third- or fourth-degree perineal tear*: RR 0.43, 95% CI 0.29 to 0.63 Postpartum hemorrhage: RR 0.62, 95% CI 0.49 to 0.77 Infection: RR 0.39, 95% CI 0.13 to 1.14 *Adjusted for parity		
Katoaka et al., 2018 Japan Review of medical records	Planned Birth Center (n = 5,379) vs. Planned Hospital (n = 4,209) Total blood loss (mL)	NR	NR

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
Birth centers: 2001 to 2006, one hospital: 2004 to 2006, other hospital: 2008 Poor quality	≥1,000: 193 (3.6%) vs. 101 (2.4%), aOR 1.77, 95% CI 1.35 to 2.32 Perineal laceration: 2,085 (40.9%) vs. 2,773 (66.1%), aOR 0.38, 95% CI 0.35 to 0.42 Adjusted for age, parity, mode of delivery and gestational weeks		
Kennare et al., 2010 Australia Pregnancy Outcome Unit of South Australia Health perinatal data for all births and data on perinatal deaths 1991 to 2006 Poor quality	Planned Home vs. Planned Hospital Third or fourth degree perineal tears: 6/577 (1%) vs. 2,030/112,737 (1.8%), aOR 0.77, 95% CI 0.34 to 1.74, p = 0.53 Postpartum hemorrhage: Planned home births 50/1,136 (4.4%) vs. 16,200/292,469 (5.5%), aOR 0.72, 95% CI 0.47 to 1.11, p = 0.14 Adjusted for maternal age, parity, occupational status, smoking, plurality, medical and obstetric complications (e.g., antepartum hemorrhage, diabetes, hypertension), gestational age, small for gestational age, congenital anomalies, city or country hospital, mode of delivery	NR	NR

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
Laws et al., 2014 Australia Registry of Births, Deaths, and Marriages, Midwives Data Collection, Admitted Patient Data Collection 2001 to 2009 Poor quality	Planned Birth Center (n = 14,707) vs. Planned Hospital (n = 29,414) Uterine rupture: 4 (0.03%) vs. 24 (0.08%), aOR 0.17, 95% CI 0.04 to 0.73 Third/fourth degree tears: 360 (2.5%) vs. 779 (3.0%), aOR 0.85, 95% CI 0.74 to 0.99 Postpartum hemorrhage: 1,270 (8.6%) vs. 3,128 (10.6%), aOR 0.79, 95% CI 0.73 to 0.86 Postpartum infection: 153 (1.0%) vs. 421 (1.4%), aOR 0.74, 95% CI 0.59 to 0.92 Hysterectomy: 0 (0.0%) vs. 15 (0.1%) Admitted to intensive care: 3 (0.02%) vs. 23 (0.08%), aOR 0.12, 95% CI 0.02 to 0.89 Hospital readmission within 42 days: 691 (4.7%) vs. 1,235 (4.2%), aOR 1.08, 95% CI 0.97 to 1.21 Adjusted for maternal age, Australian/overseas-born, socioeconomic disadvantage, smoking during pregnancy, parity, preexisting medical conditions, admitted patient insurance status, obstetric complications, level of hospital, day of the week, and holidays	NR	NR

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
Monk et al., 2014 Australia ObstetriX surveillance system of point-of-care maternity data collection across the antenatal, intrapartum, and immediate postnatal periods 2005 to 2006 Fair quality	Planned Birth Center (n = 494) vs. Planned Tertiary Maternity Unit (n = 3,157) Blood loss (mL) >1,000: 18 (3.6%) vs. 139 (4.4%), aOR 0.88, 95% CI 0.52 to 1.47, p = 0.618 3rd/4th degree tear: 24 (4.9%) vs. 132 (4.2%), aOR 0.90, 95% CI 0.56 to 1.45, p = 0.671 Adjusted for maternal age, smoking status, parity, augmentation, induction, previous cesarean delivery and risk at the onset of labor	NR	NR
Nove et al., 2012 United Kingdom St Mary's Maternity Information System 1988 to 2000 Fair quality	Planned Home (n = 5,998) vs. Planned Hospital (n = 267,874) Postpartum hemorrhage: 23 (0.38%) vs. 2,785 (1.04%), aOR 0.4, 95% CI 0.3 to 0.6, p < 0.001 Adjusted for macrosomia, previous baby with birthweight > 4,500 g, BMI, borderline anemia, parity, mother's age, ethnicity, birthweight, sex of baby, year of delivery, number of ultrasounds, hospital providing care, time of delivery	NR	NR

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
Øian et al., 2018 Norway Medical Birth Registry with supplementary data collection January 2008 to December 2010 Poor quality	Births in Midwife-Led Birth Centers, Planned (n = 2,298) vs. Births Planned for a Midwife-led Birth Unit, Took Place Elsewhere (n = 220) vs. Births in Hospital, Low Risk (n = 105,358) Sphincter Injury, Grade 3/4: 13 (.8%) vs. 2 (1.1%) vs. 2,410 (2.3%) Hemorrhage > 500 mL 500 to 1,500 mL: 58 (3.7%) vs. 15 (8.4%) vs. 12,378 (11.7%) > 1,500 mL, Transfusion: 10 (.6%) vs. 5 (2.8%) vs. 1,604 (1.5%) > 500 mL, No Further Details: 15 (1.0%) vs. 5 (2.8%) vs. 264 (.3%)	NR	NR
Schroeder et al., 2017 England Interviews and medical records from Barkantine Birth Centre and Royal London Hospital's obstetric unit in Tower Hamlets, a low-income borough in east London 2008 to 2009 Poor quality	Planned Birth Center (n = 167) vs. Planned Hospital (n = 164) Mean Days in ICU: 0.00 ± 0.0 vs. 1.00 ± 0.0, p = NR	NR	NR
Wiegerinck et al., 2015 The Netherlands	Planned Home (n = 26,128) vs. Planned Hospital (n = 21,362)	NR	NR

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
Netherlands Perinatal Register with additionally retrieved data from hospitals and midwife practices 2005 to 2008 Poor quality	Postpartum hemorrhage: 928 (4%) vs. 1,096 (5%), OR 0.68, 95% CI 0.62 to 0.74, p < 0.001		
Non-US, by parity only			
Bailey, 2017 New Zealand Routinely collected maternity outcome data compiled from Counties-Manukau District Health Board (CMDHB) maternity facilities 2003 to 2010 Poor quality	NR	Planned Birthing Center vs. Planned Hospital 2005 to 2010 data Blood transfusion: 24/2,710 (0.9%) vs. 219/9,260 (2.4%), aOR 0.40, 95% CI 0.25 to 0.62 Adjusted for maternal age, ethnicity, deprivation score	Planned Birth Center vs. Planned Hospital 2005 to 2010 data Blood transfusion: 0.4% vs. 1.0%, aOR 0.54, 95% CI 0.35 to 0.83 Adjusted for maternal age, ethnicity, and deprivation score
Bolten et al., 2016 The Netherlands DELIVER (Data EersteLIjns VERloskunde) Study 2009 to 2010 Poor quality	NR	Planned Home (n = 868) vs. Planned Hospital (n = 717) Anal sphincter damage (third-or fourth degree): 45 (5.3%) vs. 23 (3.2%), aOR 1.75, 95% CI 1.01 to 3.03 Hemorrhage postpartum >1,000 ml: 65 (7.7%) vs. 46 (6.5%), aOR 1.03, 95% CI 0.67 to 1.59 Adjusted for maternal age, gestational age, ethnic background	Planned Home (n = 1,182) vs. Planned Hospital (n = 728) Anal sphincter damage (third-or fourth degree): 17 (1.4%) vs. 14 (1.9%), aOR 0.73, 95% CI 0.34 to 1.58 Hemorrhage postpartum >1,000 ml: 28 (2.4%) vs. 24 (3.3%), aOR 0.68, 95% CI 0.38 to 1.23 Adjusted for maternal age, gestational age, ethnic background

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
		(Dutch/western background/non-western background), BMI, socio-economic position	(Dutch/western background/non-western background), BMI, socio-economic position
Christensen & Overgaard, 2017 Denmark Data collected on sociodemographic characteristics, present and previous pregnancies and births, neonatal outcomes and transfers March 2004 to October 2008 Poor quality	NR	Planned Birth Center (n = 215) vs. Planned Obstetric Unit (n = 215) 3rd-4th degree tear: OR 0.9, 95% CI 0.4 to 2.0 Maternal readmission: OR 0.3, 95% CI 0.1 to 0.9	Planned Birth Center (n = 624) vs. Planned Obstetric Unit (n = 624) 3rd-4th degree tear: OR 0.6, 95% CI 0.2 to 1.7 Maternal readmission: OR 0.4, 95% CI 0.1 to 1.3
Hollowell et al., 2017 England Birthplace in England national prospective cohort study April 2008 to April 2010 Fair quality	NR	Planned Birthing Center (n = 5,187) vs. Planned Hospital (n = 8.,350) Third or fourth degree perineal trauma: 4.0% vs. 4.9%, aOR 0.82, 99% CI 0.59 to 1.15, p = 0.13 Blood transfusion: 0.8% vs. 1.3%, aOR 0.71, 99% CI 0.44 to 1.14, p = 0.063 Maternal admission for higher level care: 0.2% vs. 1.0%, aOR 0.28, 99% CI 0.07 to 1.20, p = 0.025	Planned Birthing Center (n = 6,078) vs. Planned Hospital n = 8,323) Third or fourth degree perineal trauma: 0.9% vs. 1.6%, aOR 0.60, 99% CI 0.36 to 1.00, p = 0.010 Blood transfusion: 0.3% vs. 0.6%, aOR 0.56, 99% CI 0.26 to 1.21, p = 0.052 Maternal admission for higher level care: 0.1% vs. 0.4%, aOR 0.30, 99% CI 0.07 to 1.10, p = 0.016

Citation, Location, Data Source, Dates	Combined Parity	Nulliparous	Multiparous
		Adjusted for maternal characteristics and complicating conditions identified at the start of care in labor	Adjusted for maternal characteristics and complicating conditions identified at the start of care in labor
van Haaren-ten Haken et al., 2015 The Netherlands Self-reported questionnaires, medical records, and birth registration forms 2007 to 2011 Poor quality	NR	Planned Home (n = 221) vs. Planned Hospital-Midwife (n = 160) vs. Planned Hospital-Obstetrician (n = 176) Postpartum hemorrhage ≥1000: 13 (5.9%) vs. 10 (6.3%) vs. 19 (10.8%), aOR 0.70, 95% CI 0.30 to 1.63 Adjusted for maternal age, method of conception, first pregnancy (previous miscarriage or ectopic pregnancy), gestational age at birth, medical indications pregnancy	Included nulliparous only

Table F5. Outcome Data from Comparative Studies: Breastfeeding

Citation, Location, Data Source, Dates , Quality Assessment	Combined Parity	Nulliparous	Multiparous
U.S. Studies			
MacDorman & Declercq, 2016 United States Birth certificates in 47 states and DC 2004 to 2014 Poor quality	Planned Home (n = 29,021) vs. Planned Birthing Center (n = 18,047) vs. Planned Hospital (n = 3,773,115) Breastfeeding initiation: 97.9% vs. 98.1% vs. 80.8% Excludes births in California and Michigan that did not report breastfeeding	NR	NR
Thornton et al., 2017 U.S. Uniform Data Set from American Association of Birth Centers at 79 US birth centers in 43 states 2006 to 2011 Poor quality	Planned Birth Center (n = 8,776) vs. Planned Hospital (n = 2,527) Breastfeeding at discharge: 8,294 (94.51%) vs. 1,839 (72.77%), aOR 9.12, 95% CI 7.45 to 11.16, p = NR Propensity score adjustment with a covariate considering maternal age, parity, race, payment method, cohabitation status, trimester prenatal care began, gestational age at birth, and newborn weight	NR	NR
Non-U.S. Studies			
de Cock et al., 2015 The Netherlands Survey data, DELIVER study	Planned Home (n = 547) vs. Planned Hospital-Midwife (n = 165)	NR	NR

Citation, Location, Data Source, Dates , Quality Assessment	Combined Parity	Nulliparous	Multiparous
September 2009 to April 2011 Poor quality	Exclusive breastfeeding at median 5 weeks postpartum: 410 (75.0%) vs. 113 (68.5%), aOR 0.79, 95% CI 0.53 to 1.19 Adjusted for parity, age, education level, education level partner, ethnicity, smoking, birth weight aOR 0.80, 95% CI 0.53 to 1.18 Adjusted for characteristics listed above and early opportunity to breastfeed, early skin-to-skin contact, postnatal breastfeeding consult		
Grigg et al., 2017 New Zealand Maternity and Midwifery Provider Organization data 2010 to 2011 Poor quality	Planned Birthing Center (n = 407) vs. Planned Hospital (n = 285) Exclusive or fully at 6 weeks: 328 (80.6%) 224 (78.6%), aOR 1.14, 95% CI 0.76 to 1.70, p > 0.05 Adjusted for maternal age, smoking status, parity, augmentation, induction, term	NR	NR
Hutton et al., 2016 Ontario, Canada Chart review March 2016 to April 2009 Poor quality	Planned Home (n = 11,493) vs. Planned Hospital (n = 11,493) At 10 days: 9,566 (87.8%) vs. 8,459 (78.9%), RR 1.11, 95% CI 1.10 to 1.13	Planned Home (n = 4,027) vs. Planned Hospital (n = 4,027) At 10 days: 3,220 (84.8%) vs. 2,825 (74.9%), RR 1.13, 95% CI 1.11 to 1.16	Planned Home (n = 7,466) vs. Planned Hospital (n = 7,466) At 10 days: 6,346 (89.6%) vs. 5,634 (81.2%), RR 1.10, 95% CI 1.09 to 1.12

Citation, Location, Data Source, Dates , Quality Assessment	Combined Parity	Nulliparous	Multiparous
Hutton et al., 2009 Canada Ontario Ministry of Health database 2003 to 2006 Poor quality	Planned Home (n = 6,692) vs. Planned Hospital-Midwife (n = 6,692) Infant feeding at 6 weeks Exclusively breastfed: 5,853 (87.5%) vs. 5,140 (76.8%)	Planned Home (n = 2,293) vs. Planned Hospital-Midwife (n = 2,298) Infant feeding at 6 weeks exclusively breastfed: 1,962 (89.1%) vs. 1,680 (76.7%)	Planned Home (n = 4,393) vs. Planned Hospital-Midwife (n = 4,394) Infant feeding at 6 weeks exclusively breastfed: 3,887 (91.1%) vs. 3,460 (82.2%)
Laws et al., 2014 Australia Registry of Births, Deaths, and Marriages, Midwives Data Collection, Admitted Patient Data Collection 2001 to 2009 Poor quality	Planned Birth Center (n = 14,707) vs. Planned Hospital (n = 29,414) Breastfeeding on discharge: 4,951 (93.7%) vs. 9,129 (86.4%), aOR 2.32, 95% CI 2.04 to 2.65 Adjusted for maternal age, Australian/overseas-born, socioeconomic disadvantage, smoking during pregnancy, parity, preexisting medical conditions, admitted patient insurance status, obstetric complications, level of hospital, day of the week, and “holidays.”	NR	NR
Monk et al., 2014 Australia ObstetriX surveillance system of point-of-care maternity data collection across the antenatal, intrapartum, and immediate postnatal periods	Planned Birth Center (n = 494) vs. Planned Tertiary Maternity Unit (n = 3,157) Exclusive on discharge: 447 (91.22%) vs. 2,586 (82.23%), aOR 1.59, 95% CI 1.14 to 2.24, p = 0.007	NR	NR

Citation, Location, Data Source, Dates , Quality Assessment	Combined Parity	Nulliparous	Multiparous
2005 to 2006 Fair quality			
Quigley et al., 2016 Ireland and United Kingdom Growing Up in Ireland study, 2008 to 2009 United Kingdom Millennium Cohort Study, 2001 to 2002 Fair quality	Ireland Planned Home (n = 157) vs. Planned Hospital (n = 10,447) EBF at 6 months: 35 (22%) vs. 928 (9%), aOR 2.77, 95% CI 1.78 to 4.33, p = 0.007 United Kingdom Planned Home (n = 340) vs. Planned Hospital (n = 17,181) EBF at 6 months: 13 (4%) vs. 213 (1%), aOR 2.24, 95% CI 1.14 to 4.03, p < 0.001	NR	NR

Appendix G. Outcome Data by Subgroups for Comparative Observational Studies

Table G1. Outcome Data by Maternal Age

Cite, Location, Data source, Dates, Quality Assessment	Findings
Grunebaum, McCullough, Arabin et al., 2017 U.S. CDC linked birth-infant death data set 2008 to 2012 Poor quality	Planned home vs. Planned Hospital-Midwife vs. Planned Hospital-Physician Neonatal mortality (birth to 27 days) <35 years 92/74,850 (0.123%) vs. 429/1,216,860 (0.035%) vs. 7,527/12,359,811 (0.061%) Planned home vs. Planned Hospital-Midwife: RR 3.49, 95% CI 2.8 to 4.4 ≥ 35 years 30/20,807 (0.144%) vs. 51/146,339 (0.035%) vs. 1168/2,087,544 (0.056%) Planned home vs. Planned hospital-Midwife: RR 4.1, 95% CI 2.6 to 6.5
Grunebaum, McCullough, Sapra et al., 2017 U.S. CDC linked birth-infant death files 2009 to 2013 Fair quality	Planned Home Birth vs. Hospital-Midwife Neonatal deaths <35: 90/76,703 (0.12%) vs. 302/958,141 (0.03%), SMR 3.72, 95% CI 2.95 to 4.50 ≥ 35: 27/20,106 (0.13%) vs. 32/119,030 (0.03%), SMR 5.11, 95% CI 3.19 to 7.03
Li et al., 2014 United Kingdom Birthplace April 2008 to April 2010 Good quality	Maternal composite outcome per 5- year increase in maternal age Non-Obstetric Unit: aRR 1.21, 95% CI 1.18 to 1.25 Obstetric Unit: aRR 1.12, 95% CI 1.10 to 1.15 Adjusted for ethnic group, understanding of English, marital/partner status, BMI in pregnancy, index of multiple deprivation score quintile, gestation at delivery Intrapartum cesarean section per 5 year increase in maternal age, controlling for birth setting Nulliparous: aRR 1.27, 95% CI 1.23 to 1.32 Multiparous: aRR 1.16, 95% CI 1.06 to 1.28

Cite, Location, Data source, Dates, Quality Assessment	Findings
	Instrument delivery by 5 year increase in maternal age, controlling for birth setting Nulliparous: aRR 1.18, 95% CI 1.12 to 1.25 Multiparous: aRR 1.15, 95% CI 1.05 to 1.27 Third/fourth degree perineal tear, controlling for birth setting Nulliparous: aRR 1.12, 95% CI 1.02 to 1.23 Multiparous: aRR 1.01, 95% CI 0.89 to 1.15 Maternal blood transfusion, controlling for birth setting Nulliparous: aRR 1.13, 95% CI 0.95 to 1.34 Multiparous: aRR 1.24, 95% CI 0.94 to 1.62 Adjusted for ethnic group, understanding of English, marital/partner status, BMI in pregnancy, index of multiple deprivation score quintile, gestation at delivery and planned place of birth (Obstetric Unit vs. Alongside Midwifery Unit vs. Freestanding Midwifery Unit vs. home) Maternal composite outcome by age in nulliparous women, non-Obstetric Unit vs. Obstetric Unit 16 to 19: 252/1553 (17.5%) vs. 480/1239 (39.4%), aRR 0.45, 95% CI 0.38 to 0.54 20 to 24: 886/3679 (24.2%) vs. 1229/2577 (47.9%), aRR 0.51, 95% CI 0.45 to 0.58 25 to 29: 1680/5354 (32.3%) vs. 1670/3003 (55.6%), aRR 0.59, 95% CI 0.54 to 0.65 30 to 34: 1730/4897 (36.6%) vs. 1402/2322 (61.1%), aRR 0.61, 95% CI 0.56 to 0.67 35 to 39: 792/1995 (39.9%) vs. 622/957 (65.5%), aRR 0.62, 95% CI 0.56 to 0.69 40+: 83/196 4(4.8%) vs. 108/148 (71.9%), aRR 0.66, 95% CI 0.51 to 0.87 Adjusted for ethnic group, understanding of English, marital/partner status, BMI in pregnancy, index of multiple deprivation score quintile, gestation at delivery Maternal composite outcome by age in nulliparous women, also adjusted for complicating conditions at start of labor

Cite, Location, Data source, Dates, Quality Assessment	Findings
	16 to 19: aRR 0.49, 95% CI 0.42 to 0.58 20 to 24: aRR 0.55, 95% CI 0.49 to 0.62 25 to 29: aRR 0.63, 95% CI 0.57 to 0.70 30 to 34: aRR 0.66, 95% CI 0.60 to 0.73 35 to 39: aRR 0.68, 95% CI 0.61 to 0.76 40+: aRR 0.70, 95% CI 0.53 to 0.93 Adjusted for ethnic group, understanding of English, marital/partner status, BMI in pregnancy, index of multiple deprivation score quintile, gestation at delivery, complicating conditions identified at the start of care in labor Maternal composite: augmentation, instrument delivery, intrapartum cesarean delivery, general anesthesia, blood transfusion, 3rd or 4th degree tear, or admission to higher level of care Perinatal composite outcome, nulliparous women, controlling for place of birth 40+ vs. 25 to 29 years: aRR 2.29, 95% CI 1.28 to 4.09 Perinatal composite outcome, multiparous women, controlling for place of birth 40+ vs. 25 to 29 years: aRR 1.21, 95% CI 0.60 to 2.43 Adjusted for ethnic group, understanding of English, marital/partner status, BMI in pregnancy, index of multiple deprivation score quintile, gestation at delivery, and planned place of birth (Obstetric Unit vs. Alongside Midwifery Unit vs. Freestanding Midwifery Unit vs. home) Perinatal composite: stillbirth after start of care in labor, early neonatal death, neonatal encephalopathy, meconium aspiration syndrome, brachial plexus injury, fractured humerus or clavicle, neonatal unit admission within 48 hours of birth for at least 48 hours

Table G2. Outcome Data by Gestational Age

Cite, Location, Data source, Dates, Quality Assessment	Findings
Grunebaum, McCullough, Arabin et al., 2017 U.S. CDC linked birth-infant death data set 2008 to 2012 Poor quality	Planned home vs. Planned Hospital-Midwife vs. Planned Hospital-Physician Neonatal mortality (birth to 27 days): ≥ 37 to < 41 weeks: 77/67,832 (0.114%) vs. 378/1,083,665 (0.035%) vs. 7,487/12,194,578 (0.061%), Planned home vs. Planned Hospital-Midwife: RR 3.25, 95% CI 2.6 to 4.2 ≥ 41 weeks: 45/27,825 (0.162%) vs. 102/279,534 (0.037%) vs. 1,208/2,252,777 (0.054%), Planned home vs. Planned Hospital-Midwife: RR 4.43, 95% CI 3.1 to 6.3
Grunebaum, McCullough, Sapra et al., 2017 U.S. CDC linked birth-infant death data set 2009 to 2013 Poor quality	Planned home vs. Planned Hospital-Midwife Neonatal mortality (birth to 27 days) ≥ 37 to < 41 weeks 0.0994% vs. 0.0295%, SMR 3.37, 95% CI 2.57 to 4.17 ≥41 weeks 0.1717% vs. 0.0359%, SMR 4.78, 95% CI 3.43 to 6.12

Table G3. Outcome Data by Race/Ethnicity

Cite, Location, Data source, Dates, Quality Assessment	Findings
Grunebaum, McCullough, Arabin et al., 2017 U.S. CDC linked birth-infant death data set 2008 to 2012 Poor quality	Planned home vs. Planned Hospital-Midwife vs. Planned Hospital-Physician Neonatal Mortality (birth to 27 days) White non-Hispanic: 112/84,759 (0.132%) vs. 260/728,918 (0.036%) vs. 4,663/7,779,467 (0.06%), Planned home vs. Planned Hospital-Midwife: RR 3.71, 95% CI 3 to 4.6 Others: 10/10,898 (0.918%) vs. 220/634,281 (0.035%) vs. 4,032/6,667,888 (0.061%), Planned home vs. Planned Hospital-Midwife: RR 2.65, 95% CI 1.4 to 5

Table G4. Outcome Data by Composite Risk Scores

Cite, Location, Data source, Dates, Quality Assessment	Findings
Birthplace in England Collaborative, 2011 United Kingdom Birthplace April 2008 to April 2010 Good quality	Without complicating condition at start of labor Nulliparous women Planned Home (n = 4,063) vs. Planned Hospital (n = 8,018) Birthplace composite: 36 (9.5%) vs. 28 (3.5%), aOR 2.80, 95% CI 1.59 to 4.92 Planned Freestanding Midwifery Unit (n = 4,785) vs. Planned Hospital (n = 8,018) Birthplace composite: 22 (4.5%) vs. 28 (3.5%), aOR 1.40, 95% CI 0.74 to 2.65 Multiparous women Planned Home (n = 11,461) vs. Planned Hospital (7,637) Birthplace composite:26 (2.0%) vs. 20 (2.6%), aOR 0.83, 95% CI 0.44 to 1.58 Planned Freestanding Midwifery Unit (n = 5,772) vs. Planned Hospital (7,637) Birthplace composite: 13 (2.2%) vs. 20 (2.6%), aOR 0.97, 95% CI 0.46 to 2.04 Adjusted for maternal age, ethnic group, understanding of English, marital or partner status, body mass index, deprivation score quintile, previous pregnancies, weeks of gestation Test for statistical interaction between planned place of birth and parity. P values for parity adjusted regression tests of heterogeneity: overall 0.03, pairwise (vs. obstetric unit) for home 0.006, freestanding midwifery unit 0.47, and alongside midwifery unit 0.66. All women without complicating condition at start of labor (n = 55,849) Planned Home (n = 15,675) vs. Planned Hospital (n = 15,689) Normal births: 13,902 (89.0%) vs. 9840 (62.2%), aOR 4.12, 95% CI 3.37 to 5.04

Cite, Location, Data source, Dates, Quality Assessment	Findings
	Planned Freestanding Midwifery Unit (n = 10,620) vs. Planned Hospital (n = 15,689) Normal births: 8892 (84.1%) vs. 9849 (62.2%), aOR 3.42, 95% CI 2.74 to 4.27 Normal birth: birth without induction of labor, epidural or spinal analgesia, general anesthesia, forceps or ventouse delivery, cesarean section, or episiotomy
Davies-Tuck et al., 2018 Australia Victorian Perinatal Data Collection 2000 to 2015 Poor quality	High risk, Planned Home (n = 755) vs. Planned Hospital (n = 131,726) Unplanned cesarean: 66 (8.9%) vs. 41,530 (32.4%) < 0.001 Instrumental delivery: 34 (46%) vs. 18,407 (14.4%) < 0.001 Spontaneous vaginal: 640 (86.1%) vs. 68,219 (53.2%) < 0.001 Admission to special care nursery: 33 (4.4%) vs. 17,995 (13.7%), p < 0.001 NICU admission: 12 (1.6%) vs. 555 (0.4%), p < 0.001 5-minute Apgar < 7: 18 (2.4%) vs. 2,390 (1.8%), p = 0.24 HIE: 1 (0.13%) vs. 42 (0.03%), p = 0.13 Birth trauma: 23 (3.1%) vs. 10,056 (7.6%), p < 0.001 Intrauterine hypoxia: 24 (3.2%) vs. 8,714 (6.6%), p < 0.001 Other perinatal morbidity: 3 (0.4%) vs. 287 (0.2%), p = 0.29 Composite morbidity: 59 (7.8%) vs. 22,223 (16.9%), p < 0.001 Postpartum hemorrhage: 108 (14.5%) vs. 25,079 (19.6%), p < 0.001 Mother admitted to high dependency or intensive care unit: 4 (0.5%) vs. 1,459 (1.1%), p = 0.06 3rd/4th degree tear: 12 (1.6%) vs. 2,443 (1.9%), p = 0.58 High risk defined as any of the following: multiple pregnancy, post-term (> 41 and 6 weeks), non-cephalic presentation in labor, obesity (BMI Class 2 or greater), a prior cesarean, previous uterine surgery, grand multiparity (≥5 previous births), any significant maternal medical condition such as pre-existing diabetes, hypertension, renal, cardiac, liver, respiratory, endocrine, immunological, renal, or gastrointestinal disease as determined by individual ICD-10 codes.

Cite, Location, Data source, Dates, Quality Assessment	Findings
	Birth trauma: brachial plexus injury, fractured clavicle or humerus Other perinatal morbidity: meconium aspiration syndrome, congenital pneumonia or respiratory distress syndrome
Homer et al., 2014 Australia Perinatal Data Collection, Admitted Patient Data Collection, Register of Congenital Conditions, Registry of Birth Deaths and Marriages, and the Australian Bureau of Statistics 2000 to 2008 Fair quality	Planned Home vs. Planned Birth Center vs. Planned Hospital Women without complications at the start of care in labor Stillbirth during labor and early neonatal death: 0/688 (0%) vs. 8/13,718 (0.058%) vs. 198/221,056 (0.089%) Birth center vs. Hospital: aOR 0.63, 95% CI 0.31 to 1.28 Composite morbidity or mortality: 4/695 (0.58%) vs. 66/13,723 (0.48%) vs. 1,221/221,193 (0.552%) Home vs. Hospital: aOR 0.87, 95% CI 0.33 to 2.35 Birth center vs. Hospital: aOR 0.82, 95% CI 0.64 to 1.05 Composite: stillbirth, early neonatal death (<7 days), neonatal encephalopathy, meconium aspiration syndrome, brachial plexus injury, fractured clavicle, fractured humerus Adjusted for maternal age, gestational age in weeks at delivery, parity
Li et al., 2015 United Kingdom Birthplace national prospective cohort study April 2008 to April 2010 Good quality	Higher risk without complicating factor at start of labor Nulliparous - Planned Home (n = 247) vs. Planned Hospital (n = 1,523) Straightforward vaginal birth: 180 (75.9%) vs. 906 (59.0%), aRR 1.43, 95% CI 1.29 to 1.58 Interventions and adverse maternal outcomes: 85 (31.4%) vs. 841 (56.6%), aRR 0.50, 95% CI 0.40 to 0.63 Nulliparous- Planned Home (n = 248) vs. Planned Hospital (n = 1,528) Adverse perinatal outcomes (main composite): 6 (21.1%) vs. 64 (44.7%), aRR 0.43, 95% CI 0.16 to 1.16 Multiparous- Planned Home (n = 1,065) vs. Planned hospital (n = 3,181)

Cite, Location, Data source, Dates, Quality Assessment	Findings
	Straightforward vaginal birth: 992. (93.4%) vs. 2,484 (77.7%), aRR 1.17, 95% CI 1.13 to 1.20 Interventions and adverse maternal outcomes: 86 (7.9%) vs. 969 (30.7%), aRR 0.26, 95% CI 0.21 to 0.34 Multiparous- Planned Home (n = 1,062) vs. Planned Hospital (n = 3,183) Adverse perinatal outcomes (main composite): 12 (10.5) vs. 75 (24.6%), aRR 0.41, 95% CI 0.18 to 0.89 Straightforward: birth without intrapartum CS, instrumental delivery, 3rd or 4th degree tear, blood transfusion. Adverse perinatal outcomes (main composite): stillbirth after the start of care in labor, early neonatal death, neonatal encephalopathy, meconium aspiration syndrome, brachial plexus injury, fractured humerus or clavicle) or admission to a neonatal unit within 48 hours of birth for more than 48 hours. Adverse maternal outcomes: augmentation, instrumental delivery, intrapartum CS, general anesthesia, maternal blood transfusion, 3rd/4th degree perineal tear, maternal admission for higher level care

Table G5. Outcome Data by TOLAC

Cite, Location, Data source, Dates, Quality Assessment	Findings
Grunebaum, McCullough, Sapra et al., 2017 U.S. CDC linked birth-infant death files 2009 to 2013 Fair quality	Planned Home Birth vs. Hospital-Midwife Previous cesarean delivery No: SMR 3.72, 95% CI 3.01 to 4.43 Yes: SMR 8.33, 95% CI 2.59 to 14.07
Rowe et al., 2016 England Birthplace in England national prospective cohort study	Planned Home vs. Planned Hospital Study inclusion criteria of prior cesarean delivery Any vaginal birth: 182/209 (87.6%) vs. 853/1227 (69.1%), aRR 1.15, 95% CI 1.06 to 1.24

Cite, Location, Data source, Dates, Quality Assessment	Findings
April 2008 to April 2010 Good quality	Any vaginal birth includes, spontaneous vertex birth, spontaneous breech birth, assisted by vacuum or forceps. Adjusted for maternal age, ethnic group, understanding of English, marital/partner status, BMI in pregnancy, index of multiple deprivation score quintile, gestation at delivery, parity where appropriate, complicating conditions identified at the start of care in labor Unadjusted analyses Stillbirth OR Apgar < 7 at 5 minutes: 4/206 (1.87%) vs. 20/1225 (1.57%), RR 1.19, 95% CI 0.41 to 3.44 Neonatal unit admission: 8/205 (3.71%) vs. 40/1223 (3.04%), RR 1.22, 95% CI 0.57 to 2.59 Maternal blood transfusion or maternal admission for higher level care: 7/209 (2.99%) vs. 36/1218 (2.85%), RR 1.05, 95% CI 0.49 to 2.26
Tilden et al., 2017 U.S. Birth and death certificates 2007 to 2010 Fair quality	TOLAC: Planned Home and Freestanding Birth Center (n = 3,147) vs. Planned Hospital (n = 106,823) Neonatal death: 4 (0.13%) vs. 84 (0.08%), aOR 2.10, 95% CI 0.73 to 6.05, p > 0.05 Apgar score < 7: 139 (4.42%) vs. 2859 (2.68%), aOR 1.62, 95% CI 1.35 to 1.96, p < 0.001 Apgar score < 4: 23 (0.73%) vs. 431 (0.40%), aOR 1.77, 95% CI 1.12 to 2.79, p = 0.016 Neonatal seizures: 6 (0.19%) vs. 23 (0.02%), aOR 8.53, 95% CI 2.87 to 25.4, p = 0.003 Ventilator support: 12 (0.38%) vs. 309 (0.29%), aOR 1.36, 95% CI 0.75 to 2.46, p = 0.31 NICU: 35 (1.11%) vs. 3,292 (3.10%), aOR 0.40, 95% CI 0.29 to 0.57, p < 0.001 Birth injury: 1 (0.03%) vs. 109 (0.10%), aOR 0.78, 95% CI 0.58 to 1.04, p = 0.089 Adjusted for maternal race, maternal age, maternal education (high school education as referent), Kotelchuck Index (adequate plus as referent), parity, number of previous Cesarean deliveries, maternal weight gain 40 pounds

Table G6. Outcome Data by Breech

Cite, Location, Data source, Dates, Quality Assessment	Findings
Grunebaum, McCullough, Sapra et al., 2017 U.S. CDC linked birth-infant death files 2009 to 2013 Fair quality	Planned Home Birth vs. Hospital-Midwife Cephalic: SMR 3.61, 95% CI 2.92 to 4.31 Breech: SMR 8.14, 95% CI 2.17 to 14.11

Table G7. Outcome Data by Other Factors

Cite, Location, Data source, Dates, Quality Assessment	Findings
Grunebaum, McCullough, Sapra et al., 2017 U.S. CDC linked birth-infant death files 2009 to 2013 Fair quality	Planned Home Birth (n = NR) vs. Planned Hospital-Midwife (n = NR) Nulliparous & ≥35 Y: 0.523% vs. 0.042%, SMR 12.41, 95% CI 4.33 to 20.49 Nulliparous & ≥41 weeks: 0.403% vs. 0.041%, SMR 9.57, 95% CI 5.84 to 13.30 Nulliparous <35 Y: 0.197% vs. 0.036%, SMR 5.35, 95% CI 3.61 to 7.09 ≥41 weeks & ≥35 Y: 0.199% vs. 0.041%, SMR 4.87, 95% CI 2.00 to 7.73 37 to 40 weeks & ≥35 Y: 0.112% vs. 0.024%, SMR 4.71, 95% CI 2.41 to 7.01 ≥41 weeks & <35 Y: 0.165% vs. 0.035%, SMR 4.66, 95% CI 3.16 to 6.15 Nulliparous & 37 to 40 weeks: 0.145% vs. 0.036%, SMR 4.07, 95% CI 2.29 to 5.84 ≥41 Weeks & Parous: 0.106% vs. 0.031%, SMR 3.45, 95% CI 2.04 to 4.85 Parous & 35 Y: 0.099% vs. 0.023%, SMR 4.30, 95% CI 2.32 to 6.28 37 to 40 weeks & <35 Y: 0.096% vs. 0.030%, SMR 3.18, 95% CI 2.31 to 4.04 Parous & <35 Y: 0.091% vs. 0.027%, SMR 3.34, 95% CI 2.43 to 4.24 37 to 40 weeks & Parous: 0.088% vs. 0.026%, SMR 3.41, 95% CI 2.44 to 4.38
Halfdansdottir et al., 2018 Iceland	Within Planned Home Births Contraindication present (n = 29) vs. no home birth contraindication present (n = 274)

Cite, Location, Data source, Dates, Quality Assessment	Findings
Maternity notes review 2005 to 2009 Poor quality	Maternal Operative birth: OR 5.42, 95% CI 0.60 to 48.99 Postpartum hemorrhage ≥500 mL: OR 3.14, 95% CI 1.05 to 9.37 Postpartum hemorrhage ≥800 mL: OR 7.96, 95% CI 1.70 to 37.36 Postpartum hemorrhage ≥1000 mL: OR 7.29, 95% CI 1.16 to 45.88 OASI: OR 0.44, 95% CI 0.02 to 11.97 Maternal morbidity, 7 days: OR 2.50, 95% CI 0.74 to 8.49 Neonatal NICU admission: OR 1.88, 95% CI 0.41 to 8.64 5-minute Apgar < 7: OR 8.37, 95% CI 0.37 to 189.36 Neonatal resuscitation: OR 1.89, 95% CI 0.14 to 9.68 Neonatal morbidity, 7 days: OR 1.16, 95% CI 0.65 to 5.51
Li et al., 2015 United Kingdom Birthplace national prospective cohort study April 2008 to April 2010 Good quality	All planned home births Nulliparous - Higher risk planned home (n = 283) vs. Low risk planned home (n = 4,399) Adverse perinatal outcomes (main composite): 9 (27.7%) vs. 84 (19.3%), aRR 1.82, 95% CI 0.89 to 3.72 Multiparous - Higher risk planned home (n = 1,186) vs. Low risk planned home (n = 11,910) Adverse perinatal outcomes (main composite): 16 (12.3%) vs. 93 (7.5%), aRR 1.92, 95% CI 1.02 to 3.64 Planned home, without complicating condition at start of labor Nulliparous - Higher risk planned home (n = 248) vs. Low risk planned home (n = 3,983) Adverse perinatal outcomes (main composite): 6 (21.1%) vs. 69 (17.8%), aRR 1.69, 95% CI 0.73 to 3.89 Multiparous - Higher risk planned home (n = 1,062) vs. Low risk planned home (n = 11,335) Adverse perinatal outcomes (main composite): 12 (10.5%) vs. 82 (7.1%), aRR 1.69, 95% CI 0.79 to 3.6 Low risk planned home birth from original birthplace cohort

Cite, Location, Data source, Dates, Quality Assessment	Findings
	Adverse perinatal outcomes (main composite): stillbirth after the start of care in labor, early neonatal death, neonatal encephalopathy, meconium aspiration syndrome, brachial plexus injury, fractured humerus or clavicle) or admission to a neonatal unit within 48 hours of birth for more than 48 hours

Appendix H. ~~Study~~ Characteristics of Noncomparative Observational Studies

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
Bachilova et al., 2018 U.S. Period Linked Birth/Infant Death databases from the National Center for Health Statistics at the Centers for Disease Control and Prevention (CDC) 2011 to 2013 Poor quality	N = 71,704	Inclusion criteria: Planned home births Exclusion criteria: Births occurring in hospitals, freestanding birth centers, doctors' offices, clinics, other locations, or at an unknown location, home births that were accidental or not planned, planned home births that occurred ≤ 34 weeks gestation, infants born with congenital or chromosomal anomalies including anencephaly, Down syndrome, congenital diaphragmatic hernia, congenital heart disease, omphalocele, gastroschisis, cleft lip and/or palate, and limb defects.	Home Birth (N = 71,704) Maternal race White: 64,323 (89.7%) Black: 1,436 (2.0%) Hispanic: 3,327 (4.6%) Other: 1,190 (1.7) Maternal education < 12 Grades: 18,896 (26.4%) High School: 21,612 (30.1%) University: 30,381 (42.4%) Unknown: 815 (1.1%) Maternal age < 25 Years: 11,092 (15.5%) 25 to 34 Years: 45,621 (63.6%) ≥ 35 Years: 14,991 (20.9%) Parity Nulliparous: 12,103 (17.3%) Multiparous: 57,864 (82.7%) Unknown: 1,737 (2.4%) Fetal presentation Vertex: 47,158 (65.8%) Non-Vertex: 652 (.9%) Unknown: 23,894 (33.3%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Previous cesarean delivery: 3,140 (4.4%) Plurality Single: 71,145 (99.2%) Twins or greater: 559 (.8%)
Blix et al., 2015 Norway, Denmark, Sweden, Iceland Midwives attending planned home births submitted data through a questionnaire January 2008 to December 2013 Poor quality	N = 3,068 Norway n = 482 Sweden n = 445 Denmark n = 1,843 Iceland n = 298	Inclusion criteria: Planned home births in Norway, Denmark, Sweden, and Iceland between 2008 and 2013 Exclusion criteria: NR	Home Birth (N = 3,068) Age < 20 Years: 10 (.3%) 20 to 24 Years: 201 (6.6%) 25 to 29 Years: 767 (25.0%) 30 to 34 Years: 1,199 (39.1%) 35 to 39 Years: 736 (24.0%) ≥ 40 Tears: 138 (4.4%) Missing Data: 17 (.6%) Marital status Married/Cohabit: 2,992 (97.5%) Not Married/Cohabit: 48 (1.6%) Missing Data: 28 (.9%) Smokers Yes: 204 (6.7%) No: 2,805 (91.4%) Missing Data: 59 (1.9%) Parity Nulliparous: 572 (18.6%) Multiparous: 2,446 (81.4%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Missing Data: 50 Previous cesarean delivery (Total) No: 2,923 (95.3%) Yes: 144 (4.7%) Missing Data: 1 (0.0%) Previous cesarean (multiparous women) No: 2,301 (94.1%) Yes: 144 (5.9%) Missing Data: 1 (0.0%) Gestational age < 37 Weeks: 8 (0.3%) 37 to 42 Weeks: 2,956 (96.3%) > 42 Weeks: 22 (0.7%) Missing Data: 82 (2.7%) Fetal presentation Occipito-Anterior: 2,887 (94.1%) Abnormal Cephalic: 126 (4.1%) Breech: 7 (.2%) Missing Data: 48 (1.6%) BMI < 18.5: 103 (3.4%) 18.5 to 24.9: 1,994 (65.0%) 25.0 to 29.9: 535 (17.4%) > 30: 199 (6.5%) Missing: 237 (7.7%)
Bovbjerg et al., 2017 U.S.	N = 47,394	Inclusion criteria: Planned home or birth center births, primiparous, multiparous	Planned Out-of-Hospital Birth (N = 47,394)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
Midwives Alliance of North America Statistics Project (MANA Stats) 2.0 and 4.0 2004 to 2009, 2012 to 2014 Poor quality	MANA Stats 2.0 (2004 to 2009) n = 20,887 MANA Stats 4.0 (2012 to 2014) n = 26,507	without a history of cesarean delivery, multiparous with a history of cesarean delivery and also a history of vaginal birth, or multiparous with a history of cesarean delivery but without a history of vaginal birth Exclusion criteria: NR	Maternal Race/Ethnicity White, non-Hispanic: 41,626 (88.3%) Other: 5,513 (11.7) Expected Source of Payment Medicaid: 5,344 (11.3%) Not Medicaid: 42,042 (88.7%) Obstetric History Primiparous: 14,591 (30.8%) Multiparous, No History of Cesarean: 30,107 (63.6%) Multiparous, History of Both Cesarean and Vaginal Birth: 1,571 (3.3%) Multiparous, History of Cesarean Only: 1,086 (2.3%) BMI < 25: 30,578 (70.1%) 25 ≤ 30: 8,480 (19.4%) 30 ≤ 35: 2,954 (6.8%) 35+: 1,613 (3.7%) Maternal Age 35 Years or Older: 8,805 (18.8%) Maternal Education (fewer than 4 years of college): 20,988 (46.5%) Twin Pregnancy: 138 (0.3%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Postterm Pregnancy (more than 42 completed weeks): 3,160 (6.7%) Pregnancy Complications Gestational Diabetes: 516 (1.1%) Preeclampsia: 63 (0.1%) Breech Presentation at Birth: 539 (1.2%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
Catling-Paull et al., 2013 Australia 12 publicly funded home birth programs 2005 to 2010 Poor quality	N = 1,807	Inclusion criteria: Planned to have a home birth at the onset of labor Exclusion criteria: Women who had planned a homebirth but were transferred to hospital-based care during pregnancy (i.e., before the onset of labor)	Home Birth (N = 1,807) Maternal Age (n = 1,805) ≤ 25 Years: 219 (12.1%) 26 to 35 Years: 1,210 (67.0%) 36 to 40 Years: 337 (18.6%) > 40 Years: 39 (2.2%) Gestational Age at Birth (n = 1,807) < 37 Weeks: 19 (1.1%) 37 to 42 Weeks: 1,754 (97.1%) > 42 Weeks: 34 (1.9%) Parity (n = 1,807) Nulliparous: 575 (31.8%) Multiparous: 1,232 (68.2%) Place of Birth (n = 1,807) Home: 1,521 (84.2%) Birth Center:26 (1.4%) Hospital Labor Ward: 163 (9.0%) Operating Theater: 97 (5.4%)
Cheyney et al., 2014 U.S. Midwives Alliance of North America Statistics Project (MANA Stats) 2.0 dataset 2004 to 2009 Poor quality	N = 16,924	Inclusion criteria: Planned home births Exclusion criteria: Women transferred care to another provider prior to the onset of labor, women who at the onset of labor had a planned birth location other than home, women who did not live in the U.S.	Planned Out-of-Hospital Birth (N = 16,924) Race/Ethnicity White: 15,614 (92.3%) Black: 361 (2.1%) Latina: 714 (4.2%) Asian/Pacific Islander: 760 (4.5%) Native American: 163 (1.0%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Other 145 (.9%) Belongs to Amish, Mennonite, or Other Plain Church: 1,098 (6.5%) Age at First Prenatal Visit, Mean Years: 30.3 ± 5.3 Education High School Graduate: 15,283 (92.4%) Completed ≥ 4 Years of College: 8,300 (58.0%) Marital Status Married: 14,961 (88.4%) Unmarried With a Partner: 1,579 (9.3%) Single (Includes Separated, Divorced): 331 (2.0%) Other: 51 (.3%) MANA Region of Residence New England: 873 (5.2%) North Atlantic: 1,992 (11.8%) Southeast: 2,054 (12.2%) Midwest: 2,646 (15.6%) West: 3,949 (23.4%) Pacific: 5,364 (31.8) Method of Payment Self-Pay: 10,888 (64.4%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Private Insurance: 4,092 (24.2%) Government Insurance (Includes Medicaid, CHAMPUS): 1,361 (8.0%) Other: 576 (3.4%) Parity Nulliparous: 3,773 (22.3%) Multiparous: 13,150 (77.7%) Grand Multiparous (≥ 5 Pregnancies): 1,150 (9.2%) TOLAC: 1,052 (8.0%) Normal BMI Prepregnancy (18.5 to 25 kg/m2): 11,144 (66.9%) Mother's Pregravid BMI (kg/m2), Median: 22.5 (IQR, 20.6 to 25.7) Complications/Comorbid Conditions Affecting This Pregnancy Chronic Hypertension: 59 (.3%) Pregnancy-Induced Hypertension: 243 (1.4%) Preeclampsia: 29 (.2%) Eclampsia: 10 (.1%) Gestational Diabetes: 132 (.8%) Persistent Anemia: 146 (.9%) Rh Sensitization: 41 (.2%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Multiple Gestation: 60 (.4%) Breech Presentation: 222 (1.3%) Gestational Age of Neonate Preterm: 423 (2.5%) Postterm: 862 (5.1%)
Cox et al., 2015 U.S. Midwives Alliance of North America Statistics (MANA Stats) Project 2.0 2004 to 2009 Poor quality	N = 13,144 TOLAC n = 1,052 Comparison Group: 12,092	Inclusion criteria: Multiparous women without a history of cesarean delivery Exclusion criteria: Care transferred to another provider prior to the onset of labor, planned birth location other than home prior to the onset of labor, did not live in the U.S., Primiparous women, previous cesarean status unknown	Planned Out-of-Hospital Birth (N = 13,144) TOLAC (n = 1,052) vs. Comparison Group (n = 12,092) Median maternal age at first prenatal visit: 32 (IQR, 28 to 36) vs. 31 (IQR, 27 to 34), p ≤ 0.001 Median maternal pregravid BMI: 24.0 (IQR, 21.3 to 28.0) vs. 22.7 (IQR, 20.6 to 25.8), p ≤ 0.001 Race/ethnicity White: 970 (92.2%) vs. 11,172 (92.4%) Black: 21 (2.0%) vs. 253 (2.1%) Latina: 42 (4.0%) vs. 474 (4.0%) Asian: 46 (4.4%) vs. 487 (4.0%) Native American: 7 (.7%) vs. 120 (1.0%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Other: 11 (1.0%) vs. 237 (2.0%), p ≤ 0.05 Amish/Mennonite: 54 (5.1%) vs. 875 (7.2%), p ≤ 0.01 Education High School Graduate: 966 (91.8%) vs. 10,843 (89.7%), p ≤ 0.05 4 or More Years of College: 531 (50.5%) vs. 5,694 (47.1%) Partner status Married: 986 (93.7) vs. 10.923 (90.3%), p ≤ 0.001 Partnered: 49 (4.7%) vs. 942 (7.8%), p ≤ 0.001 Separated/Divorced, Single, or Other: 17 (1.6%) vs. 227 (1.9%), p ≤ 0.001 MANA region of residence New England: 54 (5.2%) vs. 614 (5.1%) North Atlantic: 131 (12.5%) vs. 1,384 (11.5%) Southeast: 187 (17.9%) vs. 1,456 (12.1%), p ≤ 0.001 Midwest: 182 (17.4%) vs. 1,940 (16.1%) West: 214 (20.4%) vs. 2,935 (24.3%), p ≤ 0.01

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Pacific: 279 (26.6%) vs. 3,738 (31.0%), p ≤ 0.01 Previous pregnancies 1: 275 (26.1%) vs. 3,971 (32.8%), p ≤ 0.001 2: 247 (23.5%) vs. 3,002 (24.8%), p ≤ 0.001 3 or 4: 287 (27.3%) vs. 3,145 (26.0%), p ≤ 0.001 Previous cesarean deliveries (TOLAC group only) 1: 943 (89.6%), p ≤ 0.001 2: 91 (8.7%), p ≤ 0.001 3 or More: 18 (1.7%), p ≤ 0.001 Previous vaginal births (TOLAC group only): 721 (68.7%), p ≤ 0.001 Previous VBAC (TOLAC group only): 454 (43.3%), p ≤ 0.001 Comorbid conditions Gestational diabetes: 17 (1.6%) vs. 93 (.8%), p ≤ 0.01 Pregnancy-induced hypertension: 20 (1.9%) vs. 140 (1.2%), p ≤ 0.05 Chronic hypertension: 8 (.8%) vs. 40 (.3%), p ≤ 0.05

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Twin pregnancy: 5 (.5%) vs. 49 (.4%), p ≤ 0.05
Edqvist et al., 2016 Norway, Denmark, Sweden, Iceland Midwives attending planned home births submitted data through a questionnaire 2008 to 2012 Poor quality	N = 2,992 (subpopulation of Blix et al., 2015) Norway n = 468 Sweden n = 438 Denmark n = 1,799 Iceland n = 287	Inclusion criteria: NR Exclusion criteria: women who had a cesarean delivery or instrumental delivery after transfer to hospital	Home Birth (N = 2,992) Age Groups < 25 Years: 202 (6.8%) 25 to 34 Years: 1,923 (64.3%) > 35 years: 850 (28.4%) Missing Data: 17 (.6%) Marital Status Married/Cohabit: 2,918 (97.5%) Not Married/Cohabit: 51 (1.7%) Missing Data: 23 (.8%) Tobacco Use Yes: 198 (6.6%) No: 2,735 (91.4%) Missing Data: 59 (2.0%) Number of Children* First Baby: 524 (17.5%) 1 Previous Child: 1,257 (42.0%) 2 Previous Children: 828 (27.7%) 3 or More Previous Children: 322 (10.8%) Missing Data: 61 (2.0%) * 141 women had 1 previous cesarean, 3 women had 2 previous cesareans BMI < 18.5: 101 (3.3%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			18.5 to 24.9: 1,943 (64.9%) 25.0 to 29.9: 516 (17.2%) > 30: 196 (6.6%) Missing Data: 236 (7.9%)
Eto et al., 2017 Japan Birth records from 9 Tokyo midwifery centers January 2001 to August 2006 Poor quality	N = 4,051	Inclusion criteria: Delivery at one of 9 birth centers during January 2001 to August 2006 Exclusion criteria: Need for medical treatment related to breach delivery, preterm premature rupture of membrane, weak contractions, weaker fetal heartbeat, or returning to parents' home for delivery, high risk situations (e.g., primary hemorrhage, placenta accrete, hematoma formation)	Planned Birth Center (N = 4,051) Mean maternal age (n = 4,033): 31.7 ± 4.2 Parity Nulliparous: 1,157 (28.6%) Multiparous: 2,893 (71.4%) Mean Gestational Period (n = 4,040): 39.9 ± 1.1 weeks
Johnson & Daviss, 2005 North America (U.S. and Canada) North American Registry of Midwives (planned home birth data), birth certificate data from the National Center for Health Statistics (used as proxy for a comparable low risk hospital group) 2000 Poor quality	N = 5,418	Inclusion criteria: Women who engaged the services of a certified professional midwife in Canada or the U.S. as their primary caregiver for a birth with the expected date of delivery in 2000 Exclusion criteria: Individuals who left care because of social reasons (e.g., chose hospital birth, moved, changed midwife) or medical reasons (e.g., referred for pregnancy complications, miscarried, preterm labor, stillbirths before labor, set of twins)	Home Birth (N = 5,418) Maternal Age ≤ 19 Years: 130 (2.4%) 20 to 24 Years: 930 (17.2%) 25 to 29 Years: 1,554 (28.7%) 30 to 34 Years: 1,423 (26.3%) 35 to 39 Years: 969 (17.9%) ≥ 40 Years: 327 (6.0%) Parity 0: 1,690 (31.2%) 1: 1,295 (23.9%) ≥ 2: 2,415 (44.6%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Mother's Formal Education High School or Less: 2,152 (39.2%) Any College: 1,272 (23.2%) College Graduate: 1,169 (21.3%) Postgraduate: 692 (12.7%) Partner Status at Time of Birth Has Partner: 5,169 (95.4%) No Partner: 164 (3.1%) Ethnicity White: 4,846 (89.4%) Hispanic: 216 (4.0%) African-American: 70 (1.3%) Other: 140 (2.6%) Other Special Groups Amish: 467 (8.7%) Mennonite: 194 (3.6%) Socioeconomic Status Low: 1,256 (23.2%) Middle: 3,244 (59.9%) Upper: 664 (12.3%) Location City: 1,891 (34.9%) Small Town: 1,506 (27.9%) Rural: 1,734 (32.0%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Time (Trimester) Prenatal Care Began 1st: 2,483 (45.8%) 2nd: 2,975 (38.2%) 3rd: 803 (14.8%) Smoked During Pregnancy No: 5,099 (94.1%) Yes, 1 to 9 Cigarettes/Day: 164 (3.0%) Yes, ≥ 10 Cigarettes/Day: 78 (1.4%) Unknown or Not Stated: 155 (2.9%(Alcohol Intake (Drinks/Week) During Pregnancy Non: 5,162 (95.3%) Yes, Total: 136 (2.5%) Yes, < 2: 136 (2.5%) Yes, ≥ 2: 23 (.4%) Unknown or Not Stated: 120 (2.2%) Gestational Age < 37 Weeks: 77 (1.4%) 37 to 41 Weeks: 4,834 (89.2%) ≥ 42 Weeks: 361 (6.7%)
Nethery et al., 2017 U.S. Midwives Alliance of North America Statistics Project (MANA Stats) 2.0 dataset 2004 to 2009	N = 18,724 Rural n = 3,373 Nonrural n = 14,986	Inclusion criteria: Planned community births (home or birth center), in midwife care at time of delivery Exclusion criteria: Multi-fetal pregnancies, breech, congenital anomalies, pre-	Planned Out-of-Hospital Birth (N = 18,724) Rural (n = 3,737) vs. Nonrural (n = 14,986)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
Poor quality		existing maternal conditions (e.g., chronic anemia not resolved, chronic hypertension, eclampsia, preeclampsia, Rh sensitization, gestational diabetes), prior cesarean delivery	Race/Ethnicity (p ≤ 0.001) African or Caribbean: 18 (.5%) vs. 140 (.9%) Asian: 9 (.2%) vs. 133 (.9%) Caucasian: 3,422 (91.6%) vs. 13,266 (88.5%) Hispanic or Latina: 67 (1.8%) vs. 248 (1.7%) Native American: 18 (.5%) vs. 20 (.1%) Other: 25 (.7%) vs. 124 (.8%) More than 1 race indicated: 167 (4.5%) vs. 914 (6.1%) Education (p ≤ 0.001) Any High School or Completed: 1,832 (49.0%) vs. 3,868 (25.8%) Any Postsecondary up to 4 Years: 1,429 (38.2) vs. 7,607 (50.8%) More Than 4 Years of Postsecondary: 417 (11.2%) vs. 3,187 (21.3%) Belongs to Amish, Mennonite, or other Plain Church: 777 (20.8%) vs. 258 (1.7%0) (p ≤ 0.001) Any Medicaid, Primary or Secondary: 499 (13.4%) vs. 1,635 (10.9%) (p ≤ 0.001)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Any Other Insurance (Non-Medicaid), Primary or Secondary: 745 (19.9%) vs. 6,408 (42.8%) (p ≤ 0.001) Marital Status: Married, Partnered, or Common-Law: 3,643 (97.5%) vs. 14,558 (97.1%) Age, in Years: 29 (IQR, 25 to 33) vs. 30 (IQR, 26 to 33) (p ≤ 0.001) BMI at Beginning of Pregnancy: 22.8 (IQR, 21 to 26) vs. 22.5 (IQR, 21 to 25) (p ≤ 0.001) Nulliparous: 1,182 (49.7%) vs. 5,801 (38.7%) (p ≤ 0.001) Grand Multiparity (> 4 Prior Vaginal Deliveries): 446 (11.9%) vs. 611 (4.1%) (p ≤ 0.001) History of Home or Birth Center Birth: 1,858 (49.7%) vs. 5,596 (39.8%) (p ≤ 0.001)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Planned Birth Location at Onset of Labor ($p \leq 0.001$) Freestanding Birth Center: 620 (16.6%) vs. 2,910 (19.4%) Home: 3,117 (83.4%) vs. 12,076 (80.6%) Number of Prenatal Care Visits With This Midwife: 10 (IQR, 7 to 12) vs. 11 (IQR, 9 to 12) ($p \leq 0.001$) Weeks (From Last Menstrual Period) That Any Prenatal Care Began: 12 (IQR, 9 to 16) vs. 11 (IQR, 8 to 13) ($p \leq 0.001$) Birth Location (Actual) ($p \leq 0.001$) Freestanding Birth Center: 520 (13.9%) vs. 2,394 (16.0%) Home: 2,881 (77.1%) vs. 10,819 (72.2%) Hospital: 327 (8.8%) vs. 1,751 (11.7%) Other: 9 (.2%) vs. 21 (.1%)
Schuit et al., 2016 The Netherlands Netherlands Perinatal Registry 2000 to 2007 Poor quality	N = 746,642 No Referral to Secondary Care n = 505,047 (68%) Referral to Secondary Care n = 241,595 (32%)	Inclusion criteria: Singleton pregnancy, gestational age between 37 and 42 weeks, started labor in primary care Exclusion criteria: Women with prolonged rupture of membranes without contractions	Planned Out-of-Hospital Birth (N = 746,642) Maternal Age > 25 Years: 96,060 (13%) 25 to 35 Years: 563,724 (76%) > 35 Years: 86,858 (12%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Ethnicity Caucasian: 613,898 (82%) Creole: 15,079 (2%) Hindu: 7,050 (1%) Other Non-Western: 110,615 (15%) Degree of Urbanization Low: 148,462 (20%) Average: 457,988 (61%) High: 140,192 (19%) Social Economic Status Low: 221,039 (30%) Average: 345,612 (46%) High: 179,991 (24%) Birth History Nulliparous: 332,854 (45%) Multiparous, Without Previous Instrumental Vaginal Delivery: 374,350 (50%) Multiparous, With Previous Instrumental Vaginal Delivery: 39,438 (5%) Intended Place of Delivery Home n = 466,662 (63%) Midwife-Led Birth Center n = 5,367 (1%) Hospital n = 274,613 (37%) Gestational Age

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			37+0 to 37+6 Weeks: 31,070 (4%) 38+0 to 40+6 Weeks: 549,026 (74%) ≥ 41+0 Weeks: 166,546 (22%)
Stapleton et al., 2013 U.S. American Association of Birth Centers Uniform Data Set (online data registry) 2007 to 2010 Poor quality	N = 15,574	Inclusion criteria: Planned home center birth; estimated dates of birth during 2007 through 2010; singleton, full-term gestation in vertex presentation with no medical or obstetric risk factors precluding a normal vaginal birth or necessitating interventions such as continuous electronic fetal monitoring or induction of labor Exclusion criteria: NR	Birth Center (N = 15,574) Maternal Age < 18 Years: 171 (1.1%) 18 to 34 Years: 13,218 (85.4%) ≥ 35 Years: 2,093 (13.5%) Race Non-Hispanic White: 11,810 (77.4%) Hispanic: 1,711 (11.2%) Black: 840 (5.5%) Asian or Pacific Islander: 349 (2.3%) Native American or Native Alaskan: 101 (.7%) Unknown or Other: 440 (2.9%) Marital Status Married: 12,109 (80.1%) Unmarried: 3,015 (19.9%) Parity Nulliparous: 7,355 (47.2%) Multiparous: 8,219 (52.8%) Payment Method

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Private Insurance: 8,325 (53.5%) Medicaid: 3,701 (23.8%) Self-Pay: 2,261 (14.5%) Military Coverage: 411 (2.6%) Other Insurance/Grants: 406 (2.6%) Medicare: 374 (2.4%) Unknown: 96 (.6%) Education < 12 Years: 1,184 (8.7%) 12 Years: 2,669 (19.6%) 13 to 15 Years: 2,727 (20.0%) ≥ 16 Years: 7,067 (51.8%)
Stephenson-Famy et al., 2017 U.S. Washington State birth certificate data 2004 to 2011 Poor quality	N = 7,118	Inclusion criteria: Planned to give birth in a birth center who delivered a singleton, vertex, live born infant at ≥ 37 weeks gestation Exclusion criteria: Preterm birth, previous cesarean delivery, nonvertex presentation, multiple gestations, or fetal death	Planned Birth Center Birth (N = 7,118) Actual Birth Center Birth (n = 6,617) vs. Actual Hospital Birth (n = 501) Maternal Age (p < 0.001) < 20 Years: 166 (2.5%) vs. 21 (4.2%) 20 to 29 Years: 3,565 (53.9%) vs. 247 (49.4%) 30 to 34 Years: 1,931 (29.3%) vs. 142 (28.4%) 35 to 40 Years: 780 (11.8%) vs. 61 (12.2%) > 40 Years: 169 (2.6%) vs. 29 (5.8%) Race White: 6,139 (93.8%) vs. 446 (92.3%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			African American: 114 (1.7%) vs. 10 (2.1%) American Indian/Alaska Native: 56 (.9%) vs. 6 (1.2%) Asian: 239 (3.6%) vs. 21 (4.4%) Ethnicity ($p < 0.05$) Non-Hispanic: 6,330 (96.1%) vs. 462 (94.1%) Hispanic: 261 (3.9%) vs. 29 (5.9%) Marital Status ($p < 0.001$) Married: 5,518 (83.6%) vs. 361 (72.2%) Not Married: 1,085 (16.4%) vs. 139 (27.8%) Maternal Education ($p < 0.05$) Less Than High School: 256 (3.9%) vs. 26 (5.2%) High School Graduate: 1,141 (17.3%) vs. 78 (15.7%) Some College: 2,311 (35.1%) vs. 151 (30.4%) College Graduate: 2,041 (31.0%) vs. 151 (30.4%) Graduate Level: 838 (12.7%) vs. 91 (18.3%) BMI ($p < 0.001$) < 18.5: 223 (3.5%) vs. 221 (52.6%) 18.5 to 25.9: 4,062 (64.2%) vs. 9 (2.1%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			25.0 to 29.9: 1,306 (20.6%) vs. 114 (27.1%) ≥ 30: 736 (11.6%) vs. 76 (18.1%) Residence Urban: 5,777 (87.9%) vs. 450 (90.4%) Rural: 793 (12.1%) vs. 48 (9.6%) Insurance Status (p < 0.001) Self-Pay: 265 (4.0%) vs. 19 (3.0%) Medicaid: 1,958 (29.7%) vs. 115 (23.8%) Private Insurance: 4,316 (65.6%) vs. 322 (66.7%) Government Insurance: 49 (.7%) vs. 27 (5.6%) Prenatal Smoking No: 6,390 (96.6%) vs. 473 (95.0%) Yes: 227 (3.4%) vs. 25 (5.0%) Parity (p < 0.001) 0: 2,738 (42.3%) vs. 417 (83.7%) 1: 3,729 (57.7%) vs. 81 (16.3%) (p < 0.001) Gestational Age (p < 0.001) 37 Weeks: 266 (4.0%) vs. 30 (6.0%) 38 Weeks: 744 (11.2%) vs. 42 (8.6%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			39 Weeks: 1,368 (20.7%) vs. 104 (20.6) 40 Weeks: 3,085 (46.7%) vs. 162 (32.3%) 41 Weeks: 1,027 (15.5%) vs. 124 (24.9%) ≥ 42 Weeks: 127 (1.9%) vs. 38 (7.6%) Adequacy of Prenatal Care (Kotelchuck Index) (p < 0.001) Inadequate: 637 (9.9%) vs. 134 (28.9%) Intermediate: 561 (8.7%) vs. 75 (16.2%) Adequate: 4,480 (69.7%) vs. 199 (42.8%) Adequate Plus: 753 (11.7%) vs. 56 (12.1%) Prior Preterm Birth No: 6,544 (98.9%) vs. 496 (99.4%) Yes: 71 (1.1%) vs. 3 (.6%) Maternal Diabetes No: 6,538 (98.8%) vs. 496 (98.2%) Yes: 77 (1.2%) vs. 3 (.6%) Includes preexisting and gestation diabetes Maternal Hypertension (p < 0.001) No: 6,576 (99.4%) vs. 457 (91.6%) Yes: 39 (.6%) vs. 42 (8.4%)

Citation, Location, Data Source, Dates, Quality Assessment	N	Inclusion and Exclusion Criteria	Population Characteristics
			Includes chronic hypertension, gestational hypertension, preeclampsia, and eclampsia Group B Streptococcus Positive No: 5,156 (77.9%) vs. 393 (78.8%) Yes: 1,459 (22.1%) vs. 106 (21.2%)
Suto et al., 2015 Japan Data collected from 3 midwife-led birth centers in Tokyo January 2008 to June 2011 Poor quality	N = 1,521 Nulliparous n = 422 Multiparous n = 1,099	Inclusion criteria: Pregnant women who receive initial antenatal care at 1 of 3 birth centers between January 1, 2008 and June 30, 2011 Exclusion criteria: Women who changed childbirth facilities during pregnancy for personal reasons, referral to hospital during pregnancy for pregnancy-related complications, transfer to hospital from the onset of the end of the third stage of labor, gave birth at home unexpectedly, preterm birth, no record of perineal laceration status after birth	Birth Center (N = 1,521) Nulliparous (n = 422) vs. Multiparous (n = 1,099) Maternal Age (Years): 31 ± 4.4 vs. 33.6 ± 3.9 BMI 16.00 to 16.99: 0 (0%) vs. 1 (.1%) 17.00 to 18.49: 2 (.5%) vs. 3 (.3%) 18.50 to 22.99: 180 (44.0%) vs. 316 (30.4%) 23.00 to 24.99: 116 (28.4%) vs. 364 (35.0%) 25.00 to 29.99: 111 (27.1%) vs. 356 (34.2%) Living With Partner: 421 (99.8%) vs. 1,099 (100%)

Appendix I. ~~Guidelines~~ Risk Criteria Matrix: Maternal ~~Indications~~/Fetal

3	2	1	NA	--
High-risk condition requiring planned hospital birth or transfer to hospital	Consultation required	Eligible for planned out-of-hospital birth provided no other complicating conditions are present	Not applicable or superseded by a separate recommendation	No recommendation identified

Condition	Sub-condition	HERC 2015 CG	Other	Oregon State DEM	2019 HERC CG proposed	Footnotes	EbGS Discussion Guide Comments
Amniotic Membrane Rupture	**Pre-labor rupture of membranes > 24 hours**	3	NICE 3 WA (2)	--	3		No change
	Rupture before 36 weeks	NA*	CMBC 2^	3	--	*superseded by gestational age recommendation ^34 + 0 to 36 and 6 weeks	No change
	Rupture before 37 weeks 0 days	NA*	WA 3	--	3		Added new criteria
Anemia	**Hemoglobin < 10 g/dL, unresponsive to treatment**	2*	CMBC 2 WA 2	2	2^	*10.5 ^10	Clarified existing criteria
	Hemoglobin < 9 g/dL unresponsive to treatment	--	--	3	--		No change
	Hemoglobin < 8.5 g/ dL (current pregnancy)	3	NICE 3*	--	3	* at onset of labor	No change
	Hemoglobin < 8.5 g/ dL (during prior pregnancy)	2	--	--	2		No change
Cancer	**Cancer affecting site of delivery**	--	WA 3	3	3*	*At site of delivery	Added new criteria
Cardiovascular	**Cardiovascular disease causing functional impairment**	--	ACNM 3* CMBC 3^ NICE 3	2~	3%	*cardiac disease ^disease with failure ~cardiac condition	Added new criteria

Condition	Sub-condition	HERC 2015 CG	Other	Oregon State DEM	2019 HERC CG proposed	Footnotes	EbGS Discussion Guide Comments
			WA 3			%cardiovascular disease with functional impairment	
Cervical conditions	**Insufficiency or cerclage**	2*	CMBC 2*	--	2*	*history of	No change
Collagen-vascular diseases		--	WA 3	--	2	No specific disease listed	Added new criteria
Congenital or hereditary anomaly	**Prior child with congenital or hereditary disorder**	2	--	--	2		No change (see below)
	Known fetal anomalies or conditions affected by site of birth	--	WA 3	2*	--	*that may require medical attention	No change (see below)
	Evidence of congenital anomalies requiring immediate assessment and/or management by a neonatal specialists	--	ACNM 3	--	3		Clarified criteria
	Suspected or diagnosed fetal anomaly that may require physician management during or immediately after delivery	--	CMBC 2	--	--		No change
	Life-threatening congenital anomalies (unless non-resuscitation planned)	2	--	--	--		Clarified criteria
Delivery history	**Less than 12 months from last delivery to present due date**	--	CMBC 2	--	--		No change

Condition	Sub-condition	HERC 2015 CG	Other	Oregon State DEM	2019 HERC CG proposed	Footnotes	EbGS Discussion Guide Comments
	1 Prior cesarean delivery	3	ACNM 3 NICE 3 ACOG 3 WA 3 CMBC 2	1	3		No change
	2 Prior cesarean deliveries	3	ACNM 3 NICE 3 ACOG 3 WA 3 CMBC 2	1	3		No change
	3 Prior cesarean deliveries with a previous successful vaginal birth	3	ACNM 3 ACOG 3 NICE 3 WA 3	1	3		No change
	3 Prior cesarean deliveries without a prior successful vaginal birth	3	ACNM 3 NICE 3 ACOG 3 WA 3	3	3		No change
	4 or more cesarean deliveries	3	ACNM 3 ACOG 3 NICE 3 WA 3	3	3		No change
Diabetes	**Type 1**	3	WA 3 NICE 3	--	3		No change
	Type 2	3	WA 3 NICE 3	2*	3	*blood glucose dysregulation well-controlled with diet and exercise	No change
	Gestational – diet controlled	2	NICE 3	2	2		No change
	Gestational – on medication or uncontrolled	3	CMBC 2* NICE 3 WA 3	--	3	*insulin treated	No change
Endocrine conditions other than diabetes	**Hyperthyroidism**	--	--	2	2		Added new criteria
	Significant endocrine disorders	--	WA 3	--	2*	*Endocrine disorders (e.g. hypothyroidism)	

Condition	Sub-condition	HERC 2015 CG	Other	Oregon State DEM	2019 HERC CG proposed	Footnotes	EbGS Discussion Guide Comments
Fetal demise or stillbirth	Fetal demise	2	CMBC 2 WA 2*	--	2	*After 12 completed weeks gestation	No change
	Prior unexplained stillbirth/neonatal death or death unrelated to intrapartum difficulty	2	CMBC 2	--	2		No change
	History of unexplained stillbirth/neonatal death or previous death related to intrapartum difficulty	3	CMBC 2	--	3		No change
Fetal Monitoring or Movement	Repetitive or persistent abnormal fetal heart rate pattern during labor	3	WA 3 ACNM 3	3	3		No change
	Abnormal fetal heart rate, Doppler, or surveillance studies	3	CMBC 3 NICE 3 --	2* 3^ --	3	*abnormal fetal cardiac rate or rhythm ^abnormal fetal surveillance testing	No change
	Rate below 110 or above 160 beat/minute, deceleration auscultated	--	NICE 3	--	--		No change
	Inability to adequately follow an intermittent auscultation protocol	--	--	3	3		Added new criteria
	Abnormally decreased fetal movement antepartum	--	--	2	2		Added new criteria

Condition	Sub-condition	HERC 2015 CG	Other	Oregon State DEM	2019 HERC CG proposed	Footnotes	EbGS Discussion Guide Comments
	Abnormally decreased fetal movement at onset of labor		NICE 3*		3*	*reported in the last 24 hours	Revised criteria
Fetal presentation	**Breech or non-cephalic presentation**	3	AABC 3 ACNM 3 ACOG 3 CMBC 2/3* NICE 3 WA 2/3^	2/3~ frank or complete: 2 footling or kneeling: 3 Transverse: 3	3	*consult for breech, transfer for non-cephalic other than breech, greater clarification in guidance ^2 at 37 weeks, 3 if intrapartum ~2 at 36 weeks, intrapartum varies by breech presentation	No change
Gastrointestinal or hepatological	**Excessive vomiting, dehydration, ~~acidosis,~~ or exhaustion unresponsive to treatment**	--	--	3*	3*	*Intrapartum	Added new criteria
	Hepatic disorders including uncontrolled intrahepatic cholestasis of pregnancy and or abnormal liver function tests	--	WA 3 NICE 3	2	2		Added new criteria
General medical conditions	**Actively being treated with prescription medication for any medical condition**	--	--	2	--		No change
	Adverse socio-economic conditions	--	CMBC 2	--	--		No change
		--	CMBC 2	--	--		No change

Condition	Sub-condition	HERC 2015 CG	Other	Oregon State DEM	2019 HERC CG proposed	Footnotes	EbGS Discussion Guide Comments
	Current medical conditions that may affect pregnancy or are exacerbated due to pregnancy						
	Current medical conditions that may affect pregnancy or are exacerbated by pregnancy that require specialized medical care (e.g., cardiac disease, renal disease, pre-existing insulin-dependent diabetes mellitus)	--	CMBC 3	--	3	(this is a modification from prior CMBC)	Clarified language
	Declining all blood products	--	CMBC 2	--	--	(this is a change from prior CMBC)	No change
	Family history of genetic/heritable disorders that would impact labor, delivery or care of newborn	2	CMBC 2	--	2		No change
	History of trauma or sexual abuse	--	CMBC 2	--	--		No change
	Low-risk uncomplicated pregnancies	1	AABC 1 AAP 1 ACNM 1 ACOG 1 CMBC 1 NICE 1	1	1		No change

Condition	Sub-condition	HERC 2015 CG	Other	Oregon State DEM	2019 HERC CG proposed	Footnotes	EbGS Discussion Guide Comments
			SOGC 1				
	Medical, obstetric, fetal and/or neonatal condition precluding a safe labor, birth and postpartum period in a birth center	--	AABC 3	--	--		No change
	Medical conditions arising during prenatal care, for example: endocrine disorders, renal disease, suspected or confirmed significant infection including H1N1, hyperemesis unresponsive to pharmacologic al therapy	--	CMBC 2	--	--		No change
	Pain which persists, worsens, or is unresponsive to therapy within the midwife's scope of practice	--	CMBC 2 NICE 3*	--	--	*differs from pain normally associated with contractions	No change
	Poor nutrition	--	CMBC 2	--	--		No change
	Significant medical illness history	--	CMBC 2	--	--		No change
	Unstable health status	--	ACNM 3	--	--		No change

Condition	Sub-condition	HERC 2015 CG	Other	Oregon State DEM	2019 HERC CG proposed	Footnotes	EbGS Discussion Guide Comments
	Other significant deviations from normal as assessed by the provider	--	WA 2	--	--		No change
	Development of any high risk condition	--	WA 3 NICE 3	--	3		Added new criteria
Gestational age including prior preterm birth	**Uncertain expected date of delivery**	--	CMBC 2	--	2		Added new criteria
	34 weeks or earlier	3	CMBC 3	--	3		No change
	35 weeks, 0 to 6 days	3	CMBC 2*	3	3	*history of	No change
	36 weeks, 0 to 6 days	3	AABC 1 ACNM 3 CMBC 2* WA 3	--	3	*history of or presenting in labor at	No change
	37 weeks 0 days to 41 weeks, 6 days	1	AABC 1 ACNM 1	--	1		No change
	42 weeks, 0 to 6 days	3	ACNM 3 WA 2	--	3		No change
	43 weeks or greater	3	CMBC 2	3	3		No change
Group B streptococcus	**Unknown carrier state**	3	--	--	3		No change
	Lack of informed consent on prophylaxis if mother is GBS positive	3	--	--	3		No change
Hematological conditions other than anemia	**Hemoglobinopathies**	--	ACNM 3 CMBC 2 NICE 3	2	2		No change
	Thrombosis or thromboembolism (or history of)	3	ACNM 3 CMBC 2	2/3*	3	*listed under both consult and transfer	No change
	Thrombophlebitis	--	CMBC 2	2	--		No change
	Suspected embolus	--	CMBC 3	--	3		Added new criteria

Condition	Sub-condition	HERC 2015 CG	Other	Oregon State DEM	2019 HERC CG proposed	Footnotes	EbGS Discussion Guide Comments
	Family history of thrombophilia	--	--	2	2		Added new criteria
	Maternal bleeding disorder (or history of)	3	NICE 3	2	3		No change
	Thrombocytopenia (platelets <100,000)	3	NICE 3	2*	3	* platelets < 115,000	No change
Hemorrhage or vaginal bleeding, including history of	**Abnormal bleeding in pregnancy**	3	WA 3 NICE 3*	2	3	*in labor	No change
	Antepartum hemorrhage, recurrent	3	NICE 3 CMBC 2	-- --	3		No change
	Repeated vaginal bleeding other than transient spotting or uncomplicated spontaneous abortion less than 14 weeks	--	CMBC 2	--	--		No change
	Hemorrhage (hypovolemia, shock, need for transfusion, vital sign instability)	3	CMBC 3* WA 3	3	3	*unresponsive to therapy, shock	No change
	History of postpartum hemorrhage or bleeding requiring additional procedures such as Bakri-balloon, dilation and curettage, transfusion, and manual removal of placenta	--	ACNM 3 NICE 3	--	--		No change
		2	CMBC 2	--	2		

Condition	Sub-condition	HERC 2015 CG	Other	Oregon State DEM	2019 HERC CG proposed	Footnotes	EbGS Discussion Guide Comments
	History of postpartum hemorrhage requiring intervention		WA 3				No change
Hyperemesis gravidarum		3*	WA 2	--	3*	*refractory	No change
Discussion to begin here for September 12, 2019 meeting							
	Eclampsia (or history of)	3	CMBC 2/3* NICE 3	3^	3	*consult for history, transfer for current ^ only in postpartum period	No change
	HELLP (or history of)	3	CMBC 3	--	3		No change
	History of hypertensive disorders of pregnancy	2*	CMBC 2	--	2	*History of pre-eclampsia not requiring preterm birth.	No change
Hypertensive disorders	**Systolic ≥ 140 or diastolic ≥ 90, on 2 occasions 30 minutes apart in pregnancy (e.g. gestational hypertension or pregnancy-induced hypertension)**	3	NICE 3* CMBC 2 WA 2/3^	3 (4 hours apart)	3	*any hypertensive disorder ^ consult antenatally, transfer intrapartum	No change
	Systolic ≥ 140 or diastolic ≥ 90, on 2 occasions 4 hours apart, and proteinuria (e.g., pre-eclampsia without severe features)	--	CMBC 3 NICE 3*	3^	--	* any hypertensive disorder is a 3 ^ only in postpartum	No change
		--	CMBC 3	3*	3		

Condition	Sub-condition	HERC 2015 CG	Other	Oregon State DEM	2019 HERC CG proposed	Footnotes	EbGS Discussion Guide Comments
	Systolic ≥ 160 or diastolic ≥ 110, on one occasion, or systolic ≥ 140 or Diastolic ≥ 90 with severe features (e.g. pre-eclampsia with severe features)		NICE 3			*only in postpartum, systolic ≥ 150 or ≥ 100 on 2 occasions, 4 hours apart or one ≥ 160 or ≥ 110	Discuss clarification of existing criteria
	Pre-eclampsia requiring preterm birth (or history of)	3	NICE 3	3	3		No change
	Pre-existing or chronic hypertension	3	ACNM 3 CMBC 2 NICE 3* WA 3	2	3	*any hypertensive disorder	No change
Infectious Conditions (except for group B streptococcal related)	**AIDS**	--	--	3	3		Discuss addition of new criteria
	Chorioamnionitis	3	ACNM 3	3	3		No change
	Cytomegalovirus	3	--	--	3		No change
	Maternal temperature ≥ 38.0 C in labor/postpartum	3	CMBC 2 NICE 3 WA 2	3*	3	*two over 100.4 or one over 102.2	No change
	Genital herpes at time of labor	3	ACNM 3* CMBC 2 WA 2^	3	3	*or at rupture of membranes ^also for primary infection past 1st trimester	No change
	HIV (unknown or positive)	3	WA 3 CMBC 2	2	3		No change
	Hepatitis B (unknown or positive)	3	--	--	3		No change
	Hepatitis B or C with abnormal liver function tests	--	ACNM 3 NICE 3 WA 3	--	--		
		3 *	WA 2	--	3*		No change

Condition	Sub-condition	HERC 2015 CG	Other	Oregon State DEM	2019 HERC CG proposed	Footnotes	EbGS Discussion Guide Comments
	Maternal infection postpartum (e.g., endometritis, sepsis, wound)		CMBC 2			*requiring hospital treatment	
	Rubella	3	ANCM 3	--	3		No change
	Sexually transmitted infection requiring treatment	--	CMBC 2	--	2		Discuss clarification of existing criteria
	Syphilis (unknown or positive)	3	ACNM 3 WA 3	2	3		No change
	Tuberculosis	--	ACNM 3 NICE 3	--	3		Discuss clarification of existing criteria
	Toxoplasmosis	--	NICE 3*	--	3	*women receiving treatment	Discuss clarification of existing criteria
	Urinary tract infection unresponsive to pharmacologic therapy	--	CMBC 2	--	2		Discuss clarification of existing criteria
	Varicella (active at labor)	3	--	--	3		No change
	Any infection whose treatment is beyond the scope of the provider	--	WA 2	--	2		Discuss clarification of existing criteria
Intrauterine growth	**IUGR (defined as fetal weight**	3	ACNM 3 NICE 3	--	3	*suspected growth restriction	No change

Condition	Sub-condition	HERC 2015 CG	Other	Oregon State DEM	2019 HERC CG proposed	Footnotes	EbGS Discussion Guide Comments
	less than fifth percentile using ethnically-appropriate growth tables, or concerning reduced growth velocity on ultrasound)		WA 3			^size/dates discrepancies	
	History of IUGR as defined above	2	--	--	2		No change
	Inappropriate uterine growth	--	CMBC 2 NICE 3* WA 2^	--	2		Discuss addition of new criteria
	Prior small for gestational age infant	2	CMBC 2	--	2		No change
	Uteroplacental insufficiency	3	NICE 3	--	3		No change
Isoimmunization	**Blood group incompatibility and/or Rh sensitization in current pregnancy**	3	ACNM 3 CMBC 2 WA 3 NICE 3	2	3		No change
	Blood group incompatibility and/or Rh sensitization in a prior pregnancy	2	WA 3	2	2		No change
Labor management	**Induction**	3	NICE 3 ACNM 3	--	3		No change
	Augmentation	--	CMBC 2	--	3		Discuss addition of new criteria
	Desire for pain management	--	WA 3	--	3		Discuss addition of new criteria
	Failure to progress/failure of head to engage in active labor	3	CMBC 2 WA 3* NICE 3*	--	3	*nullipara	No change

Condition	Sub-condition	HERC 2015 CG	Other	Oregon State DEM	2019 HERC CG proposed	Footnotes	EbGS Discussion Guide Comments
	Lack of adequate progress in 2nd stage with cephalic presentation	3	--	3*	3	*No descent after 3 hours of pushing where the mother is fully dilated and has ruptured membranes; and active pushing	No change
	Lack of adequate progress in 2nd stage with breech presentation	--	--	2*	--	*No descent after 1 hour active pushing	No change
Macrosomia	**Prior baby > 4.5 kg or 9 lbs 14 oz.**	2	CMBC 2	--	2		No change
	Suspected (estimated weight >4.5 kg or 9lbs 14 oz.)	2	NICE 3	--	2 or 3		Discuss clarification of existing criteria
Maternal Age	**<17 or > 40 years**	--	CMBC 2	--	2		Discuss addition of new criteria
Miscarriage/non viable pregnancy	**Ectopic**	--	--	3	--		Out of report scope
	Incomplete miscarriage	--	--	3	--		Out of report scope
	Molar	3	CMBC 3 WA 3	--	3		No change
	1st trimester spontaneous (history of) **(≥ 3 or more) (history of)**	2	CMBC 2	--	2		No change
	2nd trimester spontaneous (history of) **(> 1) (history of)**	2	CMBC 2	--	2		No change
Meconium	**Thick meconium staining of amniotic fluid**	3	CMBC 2 any NICE 3 WA 3	3*	3	*birth not imminent	No change
Multiple gestations		3	AABC 3 ACNM 3 ACOG 3	3	3	*consult for twins, transfer for others with additional	No change

Condition	Sub-condition	HERC 2015 CG	Other	Oregon State DEM	2019 HERC CG proposed	Footnotes	EbGS Discussion Guide Comments
			CMBC 2/3* NICE 3 WA 3			guidance in document	
Neonatal encephalopathy in prior pregnancy		3	NICE 3	--	3		No change
Neurological	**Maternal confusion or disorientation**	--	WA 2	--	--	Postpartum	Discuss addition of new criteria
	Maternal seizure disorder (excluding eclampsia) (History of)	2	--	--	2		Discuss clarification of existing criteria
	Neurological disorders or active seizure disorders	--	ACNM 3* NICE 3^ WA 3	--	3	*epilepsy ^epilepsy, myasthenia gravis, previous cerebrovascular accident	Discuss clarification of existing criteria
Obesity or overweight	**Low or high BMI**	--	CMBC 2*	--	--	*specifics not provided BMI At first prenatal visit	No change
	BMI 25 to 29.9	--	--	--	--		
	Class 1: BMI 30 to 34.9	--	--	--	--		
	Class 2 or 3: ≥ 35.0	2	NICE 3	--	2		Discuss clarification of existing criteria
Oligohydramnios or polyhydramnios		3	ACNM 3 CMBC 2 NICE 3* WA 2	2	3	*oligohydramnios with additional complicating factors, transfer if suspected in labor	No change
Parity	**Grand multipara (5 or more previous births)**	--	CMBC 2	--	2		Discuss addition of new criteria

Condition	Sub-condition	HERC 2015 CG	Other	Oregon State DEM	2019 HERC CG proposed	Footnotes	EbGS Discussion Guide Comments
	Nulliparity		HERC draft Evidence Review				Discuss
Preterm birth (history of)	**History of >1 preterm birth**	2	CMBC 2	--	2		No change
	History of preterm birth (before 34 weeks)	2	CMBC 2	--	2		
Perineal laceration or obstetric anal sphincter injury	**3rd degree prior pregnancy**	2	CMBC 2	--	2		No change
	4th degree prior pregnancy	2*/3	CMBC 2 WA 3	3	2*/3	*with satisfactory functional recovery	
	3rd degree current pregnancy	2*/3	CMBC 2	--	2*/3	*not requiring hospital repair	
	4th degree current pregnancy	3	CMBC 2 WA 3	3	3		
	History of obstetrical anal sphincter injury without satisfactory functional recovery	3	--	--	3		No change
	Laceration requiring hospital repair or beyond expertise of attendant	3	ACNM 3 WA 3	3	3		No change
	Bladder or Rectal dysfunction	3	CMBC 2	--	3		No change
	Enlarging Hematoma	3	--	3	3		No change
Placental conditions	**Low lying placenta within 2 cm or less of cervical os at term**	3	--	3	3		Discuss clarification of existing criteria: change term to >36 weeks

Condition	Sub-condition	HERC 2015 CG	Other	Oregon State DEM	2019 HERC CG proposed	Footnotes	EbGS Discussion Guide Comments
	Placenta previa	3	ACNM 3 CMBC 2/3* NICE 3 WA 3	3	3	*consult at third trimester if asymptomatic, transfer if symptomatic	No change
	Vasa previa	3	CMBC 2	--	3		No change
	Evidence of or suspected placenta accreta	--	--	3	3		Discuss addition of new criteria
	Abruption	3	CMBC 3* NICE 3 WA 3^	3/2^	3	*if only suspected, consult ^past the first trimester	No change
	Retained placenta	--	ACNM 2 CMBC 2 WA 3	3	--		No change
	Retained placenta > 60 minutes	3	--	--	3		No change
	History of retained placenta requiring surgical removal	3	ACNM 3	--	3		No change
	History of retained placenta requiring manual removal	NA	ACNM 3	--	--		Discuss clarification of existing criteria
Prenatal care	**No prenatal care until 3rd trimester**	--	CMBC 2 WA 2	--	--		No change
	Inadequate prenatal care*	2	--	--	2	* < 5 visits or care began in 3rd trimester	No change
	Noncompliance with the plan of care (e.g., frequent missed prenatal visits)	--	WA 3	--	3		Discuss clarification of existing criteria

Condition	Sub-condition	HERC 2015 CG	Other	Oregon State DEM	2019 HERC CG proposed	Footnotes	EbGS Discussion Guide Comments
Psychiatric disease	**Mental health concerns presenting or worsening during pregnancy**	--	CMBC 2	--	--		No change
	Postpartum psychosis	--	CMBC 3	--	3*	*Serious maternal mental illness (such as postpartum psychosis, bipolar disorder, history of requiring psychiatric hospitalization) = 3	Discuss clarification of existing criteria
	Maternal mental illness under outpatient psychiatric care with suspicion for psychosis or potential harm to self or infant	2	--	--	2*	*Maternal mental illness requiring psychological or psychiatric intervention = 2	Discuss clarification of existing criteria
	Severe psychiatric illness	--	WA 3	--	--		Discuss clarification of existing criteria
	Psychiatric condition that may affect intrapartum care management or maternal or neonatal transition following birth	--	ACNM 3	--	--		No change
	Postpartum depression or (postpartum) mood disorder with suspicion of possible endangerment to self or others	--	--	3	--		No change

Condition	Sub-condition	HERC 2015 CG	Other	Oregon State DEM	2019 HERC CG proposed	Footnotes	EbGS Discussion Guide Comments
	History of serious psychological problems	--	CMBC 2	--	--		No change
	Psychiatric disorders with concern for maternal and fetal safety	--	--	2	--		No change
	Maternal mental illness requiring inpatient care	3*	--	--	--	*history of	Discuss clarification of existing criteria (consider deletion and using language above)
Pulmonary	**Active respiratory distress**	--	WA 3*	--	3	*postpartum	Discuss addition of new criteria
	Pulmonary disease	--	WA 3 NICE 3*	--	3	*asthma requiring an increase in treatment of hospital treatment, cystic fibrosis"	Discuss addition of new criteria
Renal	**Acute pyelonephritis**	--	WA 2	--	2		Discuss addition of new criteria
	Renal disease	--	CMBC 3* NICE 3^ WA 3	3	3	*with failure ^abnormal renal function, renal disease requiring supervision by a renal specialist"	Discuss addition of new criteria
Rheumatological	**Systemic lupus erythematosus**	--	NICE 3	--	3		Discuss addition of new criteria
	Scleroderma	--	NICE 3	--	3		Discuss addition of new criteria
Shoulder dystocia	**History of, with or without fetal clavicular fracture**	2	NICE 2 ACNM 3	--	2		Discuss clarification of existing criteria

Condition	Sub-condition	HERC 2015 CG	Other	Oregon State DEM	2019 HERC CG proposed	Footnotes	EbGS Discussion Guide Comments
Substance Use	Cigarette and/or cannabis use	--	CMBC 2	--	2		Discuss clarification of existing criteria
	Drug or alcohol use with high-risk for adverse effects to fetal or maternal health	3	--	--	3		Discuss clarification of existing criteria
	Significant use of drugs, alcohol or other toxic substances	--	CMBC 2	--	--		No change
	Substance abuse/dependence	--	ACNM 3	--	--		No change
	Substance misuse, alcohol dependency requiring assessment or treatment	--	NICE 3	--	--		No change
	Active substance abuse	--	--	3	--		No change
	Substance use disorder	--	--	2			Discuss clarification of existing criteria
Surgical	Laparotomy during pregnancy	2	--	--	2		Discuss addition of new criteria
Umbilical cord	Prolapse	3	CMBC 3 WA 3	3	3		No change
Uterine condition	Anatomic anomaly (e.g. bicornuate, large fibroid impacting delivery)	--	WA 2 CMBC 2	2	2		Discuss addition of new criteria
	Prior hysterotomy	3	CMBC 2 NICE 3	--	3		No change
		--	CMBC 2	2	2 or 3		

Condition	Sub-condition	HERC 2015 CG	Other	Oregon State DEM	2019 HERC CG proposed	Footnotes	EbGS Discussion Guide Comments
	Prior myomectomy		NICE 3				Discuss clarification of existing criteria (hysterotomy)
	Uterine rupture, inversion or prolapse	3	CMBC 3 NICE 3 WA 3	3	3		No change

Appendix J. Risk Criteria Matrix: Newborn ~~Guidelines Risk Criteria: Newborn Indications~~

3	2	1	NA	--
High-risk condition requiring planned hospital birth or transfer to hospital	Consultation required	Eligible for planned out-of-hospital birth provided no other complicating conditions are present	Not applicable or superseded by a separate recommendation	No recommendation identified

Condition	Sub-condition	2015 HERC CG	Other	Oregon State DEM	2019 HERC CG proposed	Footnotes	EbGS Discussion Guide Comments
Apgar score	**< 5 at 5 minutes**	3	--	--	3		No change
	< 7 at 10 minutes	3	CMBC 3	3	3		No change
Appearance	**Excessive ruddiness**	--	--	2	--		No change
	Not clinically well appearing	--	AAP 3	--	3		Discuss clarification of existing criteria
	Persistent poor suck, poor feeding, lethargy, hypotonia or abnormal cry	--	CMBC 2	2	2		Discuss clarification of existing criteria
Blood Sugar	**Hyperglycemia/hypoglycemia unresponsive to treatment**	3	AAP 3	--	3		No change
	Prolonged glycemic instability	--	WA 3	--	--		No change
Dermatological	**Abrasions, unusual pigmentation and/or lesions**	--	CMBC 2	--	2		Discuss addition of new criteria
	Any generalized rash at birth	--	--	2	2		Discuss addition of new criteria
Anatomic anomaly	**Unexpected significant or life-threatening**	3	--	--	--		Discuss clarification of existing criteria (suggest modification below)
	Major apparent abnormalities	--	WA 3	--	--		No change

Condition	Sub-condition	2015 HERC CG	Other	Oregon State DEM	2019 HERC CG proposed	Footnotes	EbGS Discussion Guide Comments
	Evidence of or suspected major congenital anomaly or abnormality	3	CMBC 2	3	3		Discuss clarification of existing criteria
	Significant congenital anomaly requiring immediate medical intervention, for example omphalocele, myelomeningocele	--	CMBC 3	--	--		No change
	Any other abnormal findings on physical exam	--	CMBC 2	--	--		No change
	Fewer than 3 vessels in umbilical cord	--	CMBC 2	--	2		Discuss addition of new criteria
Gastrointestinal	**Vomiting, diarrhea**	3	CMBC 2	--	3		No change
	Persistent projectile or bilious vomiting or emesis of fresh blood	--	--	3	--		No change
	Significant distended abdomen	--	--	3	3		Discuss addition of new criteria
	Jaundice prior to 24 hours	--	CMBC 2 WA 3	--	--		No change
	Jaundice at birth	--	--	3	3		Discuss addition of new criteria
	Failure to pass stool within 48 hours after birth	--	--	2	--		No change
General medical	**In utero exposure to significant drugs, alcohol, or other substances with known or suspected teratogenicity**	--	CMBC 2	--	--		No change
Gestational age	**34 + 0 to 36 + 6 weeks**	--	CMBC 2	2*	--	*less than 36 weeks and 0 days	No change
	Clinical evidence of prematurity (age < 35 weeks)	--	WA 3	--	3		Discuss addition of new criteria

Condition	Sub-condition	2015 HERC CG	Other	Oregon State DEM	2019 HERC CG proposed	Footnotes	EbGS Discussion Guide Comments
	< 37 weeks	--	AAP 3	--	3		Discuss addition of new criteria
Infectious disease/HIV	**Infant born to an HIV positive mother**	--	--	2*	--	*consult must be with a pediatrician	No change
	Infection of umbilical stump site	--	CMBC 2	--	3		Discuss addition of new criteria
	Maternal chorioamnionitis	--	AAP 3	--	3		Discuss clarification of existing criteria (listed under fetal but not infant)
Hematological	**Direct Coomb's positive**	--	--	2*	2*	*consult must be with a pediatrician	Discuss addition of new criteria
Musculoskeletal	**Excessive bruising, enlarging cephalohematoma, significant birth trauma**	3	CMBC 2	--	3		No change
	Birth injury such as facial or brachial plexy, suspected fracture or severe bruising	--	CMBC 2*	2	--	*birth injury requiring investigation	No change
	Birth injury requiring medical attention	--	WA 3	--	--		No change
Neurological	**Hypotonia, tremors, seizures, hyperirritability**	3	CMBC 3	--	3	--	No change
	Seizures	3	CMBC 3 WA 3	3	3		No change
	Evidence or suspected neonatal abstinence syndrome or withdrawal	--	--	2	2		Consider addition of new criteria
Temperature	**Instability, fever, suspected infection or dehydration**	3	CMBC 2	3	3		No change

Condition	Sub-condition	2015 HERC CG	Other	Oregon State DEM	2019 HERC CG proposed	Footnotes	EbGS Discussion Guide Comments
	Persistent inability to maintain temperature between 97 to 100 degree Fahrenheit	--	CMBC 2	3	--		No change
	Prolonged temperature instability when intervention has failed	--	WA 3	--	--		No change
Respiratory or cardiac	**Irregularities, cyanosis, pallor**	3	CMBC 2 WA 3	--	3		No change
	Respiratory rate > 100 within 2 hours of birth and > 80 lasting more than 1 hours without improvement	--	--	3	--		Discuss clarification of existing criteria (is detail needed?)
	Heart rate less than 80 or greater than 160 (at rest) without improvement	--	--	2	--		Discuss clarification of existing criteria (is detail needed?)
	Pulse oximeter reading of less than 90 percent on right hand at greater than 24 hours	--	--	2	--		Discuss clarification of existing criteria (is detail needed?)
	Apnea, central cyanosis, unresolved pallor at birth	--	CMBC 2	3	--		No change
	Prolonged positive pressure ventilation or significant resuscitation	--	CMBC 3	--	3		Discuss addition of new criteria
	Abnormal heart rate pattern or persistent/symptomatic murmur	--	CMBC 3	2	3		Discuss clarification of existing criteria
Urinary	**Failure to urinate within 24 hours after birth**	--	CMBC 2*	2		*36 hours of life	No change
Weight	**< 5th percentile for gestational age**	3	CMBC 2	--	3		No change
	<2000 grams	--	WA 3	--	--		No change

Condition	Sub-condition	2015 HERC CG	Other	Oregon State DEM	2019 HERC CG proposed	Footnotes	EbGS Discussion Guide Comments
	<2,270 grams (5 lbs)	--	--	3	3		Discuss addition of new criteria
	< 2500 grams	--	CMBC 2	--	--		No change
	Loss > 10% of birth weight/ failure to thrive	--	CMBC 2 WA 3	--	--		No change
	Weight decrease in excess of 10% of birth weight that does not respond to treatment	--	CMBC 2	2	--		No change