TITLE: **Midwifery Services for Socially Disadvantaged Populations: Review of Clinical Effectiveness and Guidelines**

DATE: 30 March 2016

CONTEXT AND POLICY ISSUES

Lower socio-economic status, lower education level, place of residence (e.g. rural, remote, urban), ethnicity status, and low social support are elements that can contribute to lower health status and are elements that are sometimes referred to as "social disadvantage." Women who are socially disadvantaged tend to have lower health literacy, fewer health information resources, and do not tend to have many choices with respect to the type of maternity care they receive.[1] In Canada, teenagers, women with lower education levels, and women with lower income, have been found to be more likely to initiate prenatal care later than recommended (after the first trimester).[2] In high-income countries, women from socially disadvantaged groups tend to have the highest rates of interventional birth[3] and of experiencing poor outcomes associated with those birth interventions (i.e., induction of labour, epidural anesthesia, the use of vacuum or forceps assisted birth, caesarian section).[4] They are also more likely to experience poor birth outcomes[1,3] and maternal death.[1]

The midwifery model of care is generally centred around a non-interventional approach to a low-risk pregnancy and birth.[3] It has been associated with greater levels of maternal satisfaction in the pregnancy and birth experience, with women citing a high level of emotional support and of involvement in decision-making.[1] The model tends to be described as taking a woman-centred approach[5] that treats pregnancy and childbirth as "normal" life events.[6] The midwifery-led model generally aims to provide continuity of care (including knowledge of the care provider at the time of birth),[1,6] and provides physical,[5,6] psychological,[6] and social pregnancy care,[5,6] through the pre- and post-natal periods.[5,6]

Midwifery in Canada is provincially regulated and is currently not available in three provinces (New Brunswick, Newfoundland and Labrador, and Prince Edward Island) and one territory (Yukon),[7] however, a midwifery pilot project is set for New Brunswick in the near future.[8] While regulated and available in the other provinces, the minority of births are attended by midwives (19% in British Columbia, 3% in Québec, data for other provinces or territories not readily available).[7] According to the Canadian Association of Midwives, the demand for midwives tends

to be higher than the number of midwives available – in 2015 there were 230 practicing midwives in BC, 189 in Québec, 52 in Manitoba, 13 in Saskatchewan, and 10 in Nova Scotia (the number in Nunavut or Northwest Territories not reported).[7] Alberta had 94 midwives practicing in 2013, but was graduating 48 per year and the number of practicing midwives was expected to grow by 11% per year,[7] and number of midwives in Ontario increased by 78 in in 2014/2015, representing almost a 10% growth.[9] There are currently 13 aboriginal midwifery practices in Canada that focus on First Nations, Inuit, and Métis populations.[7]

As midwifery may have an effect on maternal and infant outcomes and those at social disadvantage are at a higher risk for negative outcomes related to pregnancy and childbirth, the aim of this review is to summarize the evidence on the clinical effectiveness of midwifery services compared with usual maternity care for socially disadvantaged women with a low-risk pregnancy and to summarize the evidence-based guidelines regarding the implementation of midwifery services into communities with socially disadvantaged populations.

RESEARCH QUESTIONS

1. What is the clinical effectiveness of midwifery services compared with usual maternity care, for socially disadvantaged women with a low-risk pregnancy?

2. What are the evidence-based guidelines regarding the implementation of midwifery services into communities with socially disadvantaged populations?

KEY FINDINGS

Based on data from non-randomized, primarily retrospective studies, midwife-led care seems unlikely to have negative outcomes and likely to have positive outcomes on women during the prenatal, intrapartum, and postpartum periods of a low-risk pregnancy and may be beneficial to neonates as well. Midwife-led care may have more of a positive effect on process, maternal, and birth outcomes than on neonatal outcomes. No relevant evidence-based guidelines regarding the implementation of midwifery services into communities with socially disadvantaged populations were identified.

METHODS

Literature Search Methods

A limited literature search was conducted on key resources including PubMed, The Cochrane Library, University of York Centre for Reviews and Dissemination (CRD) databases, ECRI, Canadian and major international health technology agencies, as well as a focused Internet search. No filters were applied to limit the retrieval by study type. Where possible, retrieval was limited to the human population. The search was limited to English language documents published between January 1, 2011 and February 29, 2016.

Rapid Response reports are organized so that the evidence for each research question is presented separately.

Selection Criteria and Methods

One reviewer screened citations and selected studies. In the first level of screening, titles and abstracts were reviewed and potentially relevant articles were retrieved and assessed for inclusion. The final selection of full-text articles was based on the inclusion criteria presented in Table 1.

Table 1: Selection Criteria	
Population	Socially disadvantaged pregnant women with a low-risk pregnancy; communities with socially disadvantaged pregnant women (e.g., racial minorities, low-income, populations with low social support, remote communities)
Intervention	Midwifery services
Comparator	Usual maternity care (provided by family physician or obstetrician/gynecologist specialist)
Outcomes	Q1: Clinical benefits or harms for mothers or babies Q2: Guidelines on implementation
Study Designs	Health technology assessments, systematic reviews, meta-analyses, randomized controlled trials, non-randomized studies, evidence-based guidelines

Exclusion Criteria

Articles were excluded if they did not meet the selection criteria outlined in Table 1, they were duplicate publications, or were published prior to 2011.

Critical Appraisal of Individual Studies

The included non-randomized studies were critically appraised using the Downs and Black checklist.[10] Summary scores were not calculated for the included studies; rather, a review of the strengths and limitations of each included study were described narratively.

SUMMARY OF EVIDENCE

Quantity of Research Available

A total of 302 citations were identified in the literature search. Following screening of titles and abstracts, 291 citations were excluded and 11 potentially relevant reports from the electronic search were retrieved for full-text review. Four potentially relevant publications were retrieved from the grey literature search. Of these potentially relevant articles, 12 publications were excluded for various reasons, while three publications met the inclusion criteria and were included in this report. Appendix 1 shows the PRISMA flowchart of the study selection. Additional references of potential interest are provided in Appendix 5.

Summary of Study Characteristics

Study Design

The three included studies were non-randomized.[3,4,11] One study was a retrospective review of medical records,[4] one a before-and-after review of medical records,[11] and one was a prospective study with a propensity matched cohort.[3]

Country of Origin

The retrospective review of medical records was done in the United Kingdom (UK),[4] the before-and-after study in Australia,[11] and the propensity-matched cohort study was conducted in the United States.[3]

Patient Population

The Rayment-Jones study from the UK[4] examined the records of 194 pregnant women, with a mean age of 28 years, who were considered socially vulnerable. Most of the participants (77%) had two or more vulnerability factors (e.g., domestic violence, refugee status, homelessness, physical disability, mental disability), with 12% having four or more vulnerability factors. Seventy-five percent of the participants identified their ethnicity as something other than "white British."

The Reeve study[11] included the records of 213 Aboriginal and Indigenous women in Australia living in remote communities who were pregnant. The median age of the participants was 23 years. Further demographic characteristics were not reported.

The American study by Benatar et al.[3] examined pregnant women who attended at least two prenatal appointments. Approximately 21% of the women were aged 19 years or younger and approximately 8% were aged 35 years or older. Eighty-five percent of the sample identified their ethnicity as black non-Hispanic, which was consistent with the population served by both the hospital and the birth centre in the urban area in which the study took place. The sample included 872 midwife births and 42,987 standard care births weighted using propensity matching. All pregnancies and births were considered low risk.

Interventions and Comparators

In midwifery model of care used in the UK study,[4] midwives were the lead professionals leading the planning, organization, and delivery of care from the initial booking of a prenatal appointment to the postnatal period. Each woman was primarily cared for by a team of two midwives, with the primary carer also acting as a liaison with other services and a key contact between care professionals. Much of the care was provided in the home setting and the place of birth was the hospital (88%) or a birth centre (12%) (home births were an option provided , however no births in this study occurred in the home). Standard care in the UK is hospital-based with prenatal and intrapartum care being given by obstetricians and midwives.

The midwifery model used in the Australian study[11] was a woman-centred, midwifery-led, interdisciplinary model of care implemented in conjunction with Aboriginal community-controlled health service. The model aimed to provide a more culturally appropriate and accessible model of care delivery. An experienced midwife led the care team that included an Aboriginal health

worker and care appointments took place in the community in which the woman lived. It was unclear where births took place. Standard care was a traditional hospital-based model of care that included appointments with doctors who may not have obstetric experience and some community midwife involvement, where midwives provided health education. Care took place in a community health clinic; however, most women had to travel via four wheel drive vehicle in order to reach it.

The American study compared the outcomes of patients who received midwife-led care at based at a birth centre versus standard hospital-based care.[3] Both the hospital and the birth centre served a primarily low-income, African-American population. The midwifery group included patients who initiated care at the birth centre and delivered there, received prenatal care at the birth centre and gave birth at a hospital with the birth centre midwives, and women who initiated care at the birth centre but were transferred for various reasons.

Outcomes

The outcomes reported in the studies included process or quality of care outcomes (e.g., number of prenatal visits,[4] prenatal care in the first trimester,[11] screening for and actual drug and alcohol use,[11] screening for sexually transmitted infection,[11] knowing the caregiver attending the delivery[4]), maternal outcomes or birth outcomes (e.g., mode of delivery,[3,4,11] use of electronic fetal monitoring,[3] occurrence of vaginal birth after previous C-section [VBAC][3]), and neonatal outcomes (e.g., term birth,[3,4,11] birth weight,[3,4,11] low birth weight,[3] fetal death,[11] low 5-minute Apgar score,[3,4] admission to the NICU[4]). The American study included a subgroup analysis of African-American patients.[3]

Additional detail regarding study and patient characteristics is included in Appendix 2, Table A1.

Summary of Critical Appraisal

One of the primary limitations of the included studies was the lack of randomization.[3,4,11] The women were not randomized to receive midwifery care versus standard care in any of the included studies. Even in a group of women with low-risk pregnancies, those who choose midwifery care may be different from those who do not in ways that are not known and could bias the results in favour of midwife care. An additional limitation of the included studies,[3,4,11] is that there was not a lot of detail regarding the care received either in the study or standard care groups. Other than the setting or type of healthcare provider, it was unclear what the differences were between the care received in the midwife or standard care settings were.

The Benatar study[3] used a propensity matched cohort in order to reduce the effect of selection bias, however it is still unlikely that all selection bias was eliminated. This study also used an intention to treat analysis by analyzing patients who were transferred out of midwifery care in order to reduce bias. The outcome measures used in the study were for the most part valid and reliable (e.g., birth weight, gestational age, method of delivery), however it is unclear if using the number of interventions occurring on weekend delivery days versus week days as a proxy for determining unneeded interventions is a valid outcome.

The patient characteristics were not well reported in the Reeve study,[11] nor was it clear whether or not all eligible records were examined and included in the analyses. It is therefore unclear, firstly, to whom the results of the study are generalizable, and secondly, whether or not there was bias that went into the selection of patients. Many of the outcomes in the study were valid

and reliable, though questions regarding alcohol and tobacco use during pregnancy may be less likely to be answered honestly due to the social stigma associated with them. Additionally, one of the results reported in the study seems unlikely to be accurate; the study compares some of the outcomes found in their regional study to the larger statistics for Northern Australia. They report a 0% rate of vaginal birth with intervention for Northern Australia, although they report low percentages in their own study (4% and 3%), it seems unlikely that the rate is 0 in the larger area.

One study reported a power calculation[4] and it was the only included study with known statistical power to detect a difference in outcomes. Additionally, it was the only included study report in which the researchers assessing outcomes were blinded and was therefore at a lower risk of bias. It was unclear if the study population was representative of the greater population with sociodemographic risk; few details were reported. It was known that the study population was not comparable to the larger population (smoking status and index of multiple deprivation scores were higher than national averages), however it was unclear if it was representative of a population with sociodemographic risk factors.

Additional detail regarding the strengths and limitations of the included studies is available in Appendix 3, Table A2.

Summary of Findings

What is the clinical effectiveness of midwifery services compared with usual maternity care, for socially disadvantaged women with a low-risk pregnancy?

Process and Quality of Care Outcomes

Compared with standard care, a midwifery model of care was found to be associated with:
- a higher number of women booking their first prenatal appointment before 10 weeks gestation (24% versus 8%; $P = 0.0080$)[4] or presenting for care in the first trimester (40% versus 58%; $P = 0.01$)[11]
- a higher number of births attended by a caregiver known to the woman (90% versus 8%; $P < 0.001$)[4]
- more referrals to psychiatry, (56% versus 19%; $P < 0.01$), domestic violence advocacy (42% versus 18%; $P < 0.01$), and other support services (56% versus 31%; $P = 0.03$)[4]
- less use of electronic fetal monitoring during birth (78% versus 82%; $P < 0.01$)[3]
- more weekend deliveries (29% versus 24%; $P < 0.01$)[3]
- more alcohol screening during pregnancy (93% versus 47%; $P = 0.00$)[11]
- more screening for smoking during pregnancy (93% versus 48%, $P = 0.00$)[11]

The number of prenatal appointments attended (9 versus 7, $P = 0.229$)[4] and referrals to social services (81% versus 90%, $P = 0.399$),[4] or alcohol (46% versus 42% $P = 0.72$) or tobacco (84% versus 75%, $P = 0.25$) use during pregnancy[11] were not significantly different between the midwife and standard care groups.

In the subgroup analysis for African-American patients performed in the Benetar study,[3] the number of weekend deliveries were higher in the midwife group than the standard care group (27.1% vs. 24.4%; $P < 0.05$) and the result was statistically significant.

Maternal and Birth Outcomes

Compared with standard care, a midwifery model of care was found to be associated with:
- a higher rate of spontaneous vaginal birth (80% versus 55%; P < 0.01)[4]
- fewer C-sections (20% versus 29%; P < 0.01) in one study[3] but not a second[11]
- a higher rate of VBAC (27% versus 9%; P < 0.01)[3]
- lower rates of emergency C-section (5% versus 18%; P = 0.011)[4]
- lower rates of postpartum hemorrhage (20% versus 47%; P < 0.001)[4]
- shorter post-natal stay (1 day versus 3 days; P < 0.01)[4]

In the subgroup analysis for African American patients performed in the Benetar study,[3] the C-section (20.9% vs. 29.7%, P <0.01) and VBAC (20.0% vs. 7.9%; P < 0.01) rates were statistically significantly lower in the midwife group than the standard care group.

Neonatal Outcomes

Compared with standard care, a midwifery model of care was found to be statistically significantly associated with:
- fewer admissions to the NICU (4% versus 18%; P = 0.005)[11]
- lower rates of preterm birth (7.9% versus 11%; P < 0.01) in one study[3] but not the other two[4,11]
- higher average birth weight (3,245 g versus 3,166 g; P < 0.01) in one study[3] but not the other two[4,11]

Midwife care was not found to be associated with statistically significant decreases in the number of infants born with low birth weight,[3,4,11] with low Apgar score,[3,4] or fetal death in utero.[11]

In the subgroup analysis for African American patients performed in the Benetar study,[3] the statistically significant differences were in fewer preterm births (11.8% vs. 8.6%, P < 0.01) and higher average birth weight (3,198 g vs. 2,130 g; P < 0.01) for those in the midwifery group versus standard care. The percentage of children born with an Apgar score < 7 (3.4% vs. 3.7%), and low birth weight (9.8% vs. 11.1 %) were also lower in the midwifery group, however this was not statistically significant.

Additional information regarding the results of the included studies is available in Appendix 4, Table A3.

What are the evidence-based guidelines regarding the implementation of midwifery services into communities with socially disadvantaged populations?

No relevant evidence-based guidelines regarding the implementation of midwifery services into communities with socially disadvantaged populations were identified.

Limitations

One of the limitations of this review is the number of studies identified for inclusion and the number of women analyzed in the studies. Two of the studies included just under and just over 200 women receiving pre- and postnatal care either through a midwife-led or standard model. The third study was significantly larger (more than 40,000 standard care births and more than

800 midwife-led births) and may be more likely to have produced reliable results. Furthermore, the midwife-led care was not necessarily the same in each study. There was little detail provided regarding both the midwife and standard care provided. It is likely that the care was somewhat similar: education regarding pregnancy, fetal development, birth, and postpartum care, but how similar or different they were is unclear. Additionally, the UK standard model of hospital-based prenatal care does include midwives as part of the multidisciplinary team. It is unclear, however, how different the involvement of the midwife is in that model of care versus the midwife-led care being evaluated in the study. The standard care in the Australian study also included some midwife care. Although it wasn't clear what was provided by the midwives in the standard care group, it appeared to be health education.

With respect to the populations being examined in the study, it is likely that not all vulnerable groups are well represented in the current review. The populations included Aboriginal Australians living in remote communities, those of various ethnicities and social standing in the UK, and those of low socioeconomic status who were primarily African-American in the USA.

The care needs and cultural challenges of the Aboriginal population in Australia may be somewhat similar to some of the needs or challenges faced by the Canadian Aboriginal population, but the results are likely not fully generalizable to the Canadian population. Each group has their own cultural history and beliefs that may be important to health care and in particular, the pregnancy and birth process. Additionally, the remote communities in Canada face different challenges with respect to environmental considerations (i.e. lengthy travel in the winter) than in Australia. While the UK and American studies included women of various ethnicities who tend to face challenges with respect to the social determinants of health, it is unclear whether the challenges are the same as those faced by individuals the same ethnic groups in Canada.

It is unclear whether or not the results of this review generalize to teenaged pregnancies. One of the studies clearly included patients 19 years and younger, however, there was no data specific to this potentially vulnerable population presented. It is also unclear whether or not the results generalize to the Lesbian Bisexual Transsexual Queer (LGBTQ) community.

It is also important to note that the results are applicable only to low risk, singleton births.

CONCLUSIONS AND IMPLICATIONS FOR DECISION OR POLICY MAKING

Based on data from non-randomized, primarily retrospective studies, it seems that midwifery-led care may have more of an effect on process, maternal, and birth outcomes than on neonatal outcomes. Midwifery-led care seems to provide a better continuity of care (e.g., knowing the healthcare provider attending the birth), that tends to be more individualized and culturally relevant than standard care.[3] It may also provide better and earlier access to prenatal care and result in higher rates of VBAC and lower rates of C-section. A birth centre based model may also provide a more comfortable environment for care than a hospital.[3]

The largest of the three studies found that midwifery care was associated with lower rates of preterm birth and higher birth weights, however the other two studies found no significant differences. There was no reported negative effect of midwife care on neonatal outcomes. The authors of one study concluded that the midwifery-led model was "as good" as a standard model with respect to neonatal outcomes.

The multidisciplinary midwifery-led model increased access to prenatal care for Aboriginal women in a remote Australian region, however, providing year-round access to remote Canadian communities, may be more challenging, unless there is a midwife living within the remote community.

Canadian studies that include low-risk pregnant women and teenagers from rural, remote, and socially vulnerable groups (including the LGBTQ community) would be valuable in determining the true effect of midwifery care in the Canadian population. However, midwife-led care seems unlikely to have negative outcomes and likely to have positive outcomes on women during the prenatal, intrapartum, and postpartum periods of a low-risk pregnancy and may be beneficial to neonates as well. As no relevant evidence-based guidelines were identified, the development of a Canadian guideline regarding the implementation of midwifery services into communities with socially disadvantaged populations may be useful.

PREPARED BY:
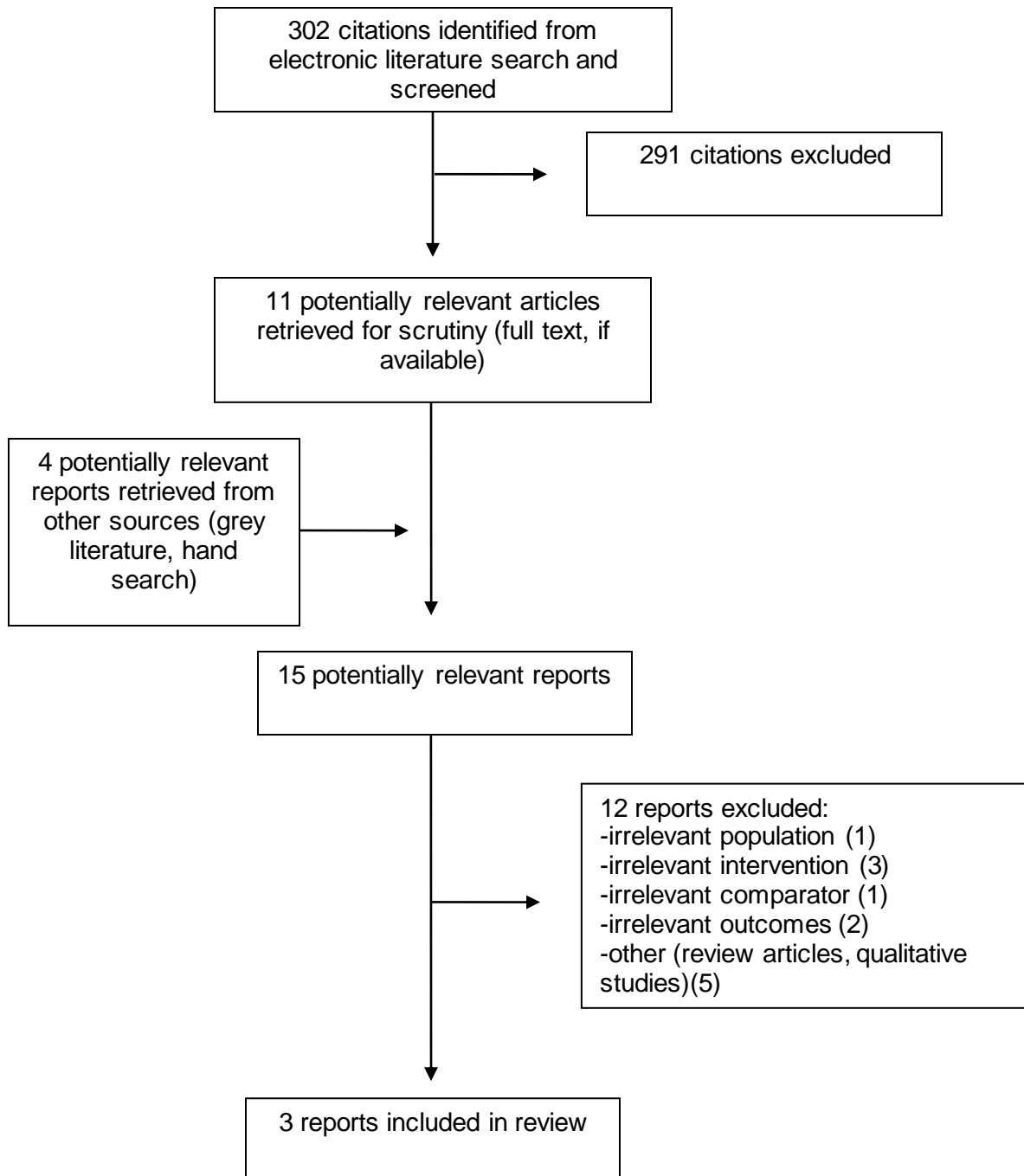Canadian Agency for Drugs and Technologies in Health
Tel: 1-866-898-8439
www.cadth.ca

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APPENDIX 1: Selection of Included Studies

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APPENDIX 2: Characteristics of Included Publications

Table A1: Characteristics of Included Clinical Studies					
First Author, Publication Year, Country, Study Name	Study Design	Patient Characteristics	Intervention(s)	Comparator(s)	Clinical Outcomes
Rayment-Jones, 2015,[4] United Kingdom	Retrospective review of medical records	216 records selected; missing data in 21 files, total analyzed: 98 in caseload care group; 96 in standard care. mean age: 28 (SD 6.5) ethnicity other than "white British": 75% (3% unknown) Number of vulnerability factors[a]: 1: Midwife: 27 (25%); Standard: 29 (36%) 2: Midwife: 45 (42%); Standard: 42 (39%) 3: Midwife: 22 (21%); Standard: 16 (15%) ≥4: Midwife: 13 (12%); Standard: 11 (10%)	Caseload model of midwifery care defined as "named midwife as the lead professional in the planning, organisation and delivery of care given to a woman from initial booking to the postnatal period"	Standard maternity care	Prenatal care outcomes (number of prenatal care appointments, knowing the midwife attending the birth) Birth outcomes (type of birth, place of birth, interventions, pain relief) Neonatal outcomes (birthweight, gestational age, Apgar score, NICU admission)
Reeve, 2015, Australia[11]	Before and after study – retrospective review of medical records. Cohort 0 (collected April 2007 to June 2009) provided	213 Indigenous women (cohort 0: 92; cohort 1: 121) pregnant (not with a multiple pregnancy) median age 23 (IQR 20–28) Living in small aboriginal communities: cohort 0: 43 cohort 1: 73	Woman-centered, midwifery-led, interdisciplinary model of care implemented in conjunction with Aboriginal community-controlled health service.	Traditional hospital-based model of care that included appointments with doctors who may not have obstetric experience and some midwife care in the	Quality care indicators: presentation for care in the first trimester, occurrence of screening for alcohol use and smoking, actual alcohol use or smoking, ultrasound during pregnancy, screening for syphilis

First Author, Publication Year, Country, Study Name	Study Design	Patient Characteristics	Intervention(s)	Comparator(s)	Clinical Outcomes
			Midwifery model aimed to provide a more culturally acceptable and accessible model of care delivery.	community. Most of the care required travel.	and hepatitis B. Outcome indicators: birth weight, term delivery, fetal death, mode of delivery.
Benatar, 2013, USA[3]	Non-randomized with a propensity matched cohort	Women with at least two prenatal visits, a singleton birth, and a gestational age ≥24 weeks. 872 midwife births, 42,987 usual care births. Usual care group results were weighted based on propensity scores – weighted analysis is reported in this review. Aged 19 and younger: 21.9% in midwife, 21.3% in usual care Aged 35 and over: 7.7% in midwife, 7.9% in usual care Samples did not differ with respect to rate of diabetes, cardiac disease, lung disease, ethnicity.	Midwife-led care at based at a birth centre serving a primarily low-income, African American population. Included patients who initiated care at the birth centre and delivered there, received prenatal care at the birth centre and gave birth at a hospital with the birth centre midwives, women who initiated care at the birth centre but were transferred for various reasons.	Standard care at a hospital serving a similar demographic	Maternal: method of birth, whether vacuum or forceps were used, use of electronic fetal monitoring, occurrence of VBAC, weekend birth.[b] Neonatal: preterm birth (<37 weeks), ≤7 5 minute Apgar score, low birth weight (2,500 g), average birth weight.

IQR = interquartile range; NICU = neonatal care unit; SD = standard deviation.
[a]Included domestic violence, drug or alcohol abuse, safeguarding issues, asylum seeker or refugee, homeless, traveller, physical disability, learning disability, common mental health condition, severe mental health condition.
[b] Used as a proxy for unnecessary interventions – intervention rates should be the same on weekends as weekdays if they are necessary.

APPENDIX 3: Critical Appraisal of Included Publications

Table A2: Strengths and Limitations of Non-Randomized Controlled Trials using Downs and Black[10]	
Strengths	**Limitations**
Rayment-Jones[4]	
- Aims and objectives clearly described. - Power calculation provided – 180 participants needed to see a 33% increase in health outcomes (which was calculated as statistical significance). - Researcher analyzing the data was blinded to the type of care received – therefore, it is less likely that the analysis is biased toward a certain model of care. - The two study groups were comparable in terms of sociodemographic factors that may influence outcomes. - Records for the same time period were reviewed, therefore differences in other environmental or health system factors were likely not contributors to outcomes.	- Standard care is not clearly described. As it is the UK system, it is possible that midwives are involved in standard care, however it is not well reported. - It is unclear if the study population is indicative of the greater population with sociodemographic risk – the population is not comparable to the larger population (smoking status and index of multiple deprivation scores were higher than national averages). - Unclear if there was good compliance with the interventions.
Reeve[11]	
- Aim and objectives clearly described – to audit prenatal care after the midwifery model was introduced and to determine if access to care, screening, and outcomes for babies and mothers had improved. - Actual *P* values are reported – both significant and non-significant. - Outcomes measured are likely reliable – however some require that patients were honest (regarding alcohol intake and smoking status) regarding potentially stigmatized behaviours.	- Patient characteristics were not well reported – limited information beyond age and region of living were reported. - Full detail of the intervention and comparators were not reported – it is not clear exactly the type of care was received in the pre-midwife or the midwife-led care. - Unclear if all of the records of eligible women were included in the analysis. - There was no blinding of the patients or caregivers – this would have been difficult – however it is also unclear whether or not those performing the analysis were blinded or if blinding was attempted (which would have been possible). - Some of the indicators were not well reported in the patient files (e.g. if a brief intervention for alcohol or smoking cessation occurred). - There was no randomization of subjects. - Change in outcomes may be reflective of socioeconomic circumstances, changes in other factors and not necessarily the change in care.

Table A2: Strengths and Limitations of Non-Randomized Controlled Trials using Downs and Black[10]	
Strengths	**Limitations**
Benatar[3]	
- Used propensity matching in order to overcome selection bias. Justification and details of propensity matching provided in detail. - By including those who transferred out of midwifery care, used an intention to treat analysis. - Most outcome measures are valid and reliable. - Adverse events were reported.	- Type of care received not described in detail. - Randomization did not occur (however propensity matching was used to minimize bias) - Blinding of patients or caregivers did not occur, unclear (seems unlikely) if those performing outcome analysis were blinded to the intervention group. - Using 'weekend delivery' as a proxy outcome for fewer unneeded interventions may not be valid.

APPENDIX 4: Main Study Findings and Author's Conclusions

Table A3: Summary of Findings of Included Studies	
Main Study Findings	**Author's Conclusions**
Rayment-Jones, 2015[4]	

Process outcomes
• First prenatal appointment booked before 10 weeks
   ○ Midwifery: 24%
   ○ Standard: 8%
   ○ RR 1.61 95% CI 1.24 to 2.10, P = 0.008
• Mean number of prenatal appointments
   ○ Midwifery: 9 (SD 3)
   ○ Standard: 7 (SD 9.8)
   ○ P = 0.229
• Mean postnatal stay in the hospital (days)
   ○ Midwifery: 1 (SD 1.2)
   ○ Standard: 3 (SD 2.2)
   ○ P < 0.001
• Known carer attending delivery:
   ○ Midwifery: 90%
   ○ Standard: 8%
   ○ RR = 8.98, 95% CI 4.97 to 16.2, P < 0.001
• Referrals to Social Services
   ○ Midwifery: 81%
   ○ Standard: 90%
   ○ RR = 0.85, 95% CI 0.63 to 1.15, P = 0.399
• Referrals to Psychiatry
   ○ Midwifery: 56%
   ○ Standard: 19%
   ○ RR = 2.06, 95% CI 1.59 to 2.65, P < 0.001
• Referrals to domestic violence advocacy
   ○ Midwifery: 42%
   ○ Standard: 18%
   ○ RR = 1.68, 95% CI 1.31 to 2.15, P < 0.001
• Referrals to other support services
   ○ Midwifery: 56%
   ○ Standard: 31%
	• Results show many benefits for offering the caseload midwifery model with no negative outcomes.
	• Caseload care was associated with a high level of "known carer at delivery,"[a] lower caesarian section rate, less admission to the NICU, and a shorter length of stay in the hospital following delivery.
	• Suggest a randomized study in disadvantaged groups.

Table A3: Summary of Findings of Included Studies	
Main Study Findings	**Author's Conclusions**

o RR = 1.58, 95% CI 1.15 to 2.16, P = 0.03
Maternal outcomes
 • Spontaneous vaginal birth
  o Midwifery: 80%
  o Standard: 55%
  o RR = 1.88, 95% CI 1.27 to 2.77, P < 0.001
 • Emergency C-section
  o Midwifery: 5%
  o Standard: 18%
  o RR = 0.42, 95% CI 0.19 to 0.92 P = 0.011
 • Postpartum hemorrhage > 500 mL
  o Midwifery: 20%
  o Standard: 47%
  o RR = 0.29, 95%CI 0.15 to 0.54, P < 0.001
 • Non-interventional birth
  o Midwifery: 52%
  o Standard: 32%
  o RR = 1.34, 95% CI 0.65 to 2.75, P = 0.423
Neonatal outcomes
 • Admission to NICU
  o Midwifery: 4%
  o Standard: 18%
  o RR = 0.35 95% CI 0.15 to 0.85 P = 0.005
 • Preterm birth (<37 weeks)
  o Midwifery: 3%
  o Standard: 8%
  o RR = 0.53, 95% CI 0.19 to 1.39, P = 0.203
 • Low birthweight (<2500 g)
  o Midwifery: 1%
  o Standard: 6%
  o RR = 0.26, 95% CI 0.45 to 1.69, P = 0.051
 • Apgar <8 at 5 minutes
  o Midwifery: 2%
  o Standard: 1%
  o RR = 0.66, 95% CI 0.13 to 3.27, P = 0.986	

Table A3: Summary of Findings of Included Studies	
Main Study Findings	**Author's Conclusions**
Reeve, 2015[11]	

Quality of Care
• Presenting for care during the 1st trimester
   o Standard: 40% (n = 37)
   o Midwifery: 58% (n = 70)
   o Data from Northern Australia: 42%
   o *P* = 0.01
• Alcohol screening
   o Standard: 47% (n = 43)
   o Midwifery: 93% (n = 112)
   o Data from Northern Australia: NR
   o *P* = 0.00
• Any alcohol use during the pregnancy
   o Standard: 42% (n = 18/43)
   o Midwifery: 46% (n = 52/112)
   o Data from Northern Australia: 22%
   o *P* = 0.72
• Screening for cigarette smoking
   o Standard: 48% (n = 44/92)
   o Midwifery: 93% (n = 113/121)
   o Data from Northern Australia: NA
   o *P* = 0.00
• Any cigarette smoking during the pregnancy
   o Standard: 75% (n = 33/44)
   o Midwifery: 84% (n = 95/113)
   o Data from Northern Australia: 43%
   o *P* = 0.25
• Ultrasound performed during the pregnancy
   o Standard: 59% (n = 54)
   o Midwifery: 94% (n = 112)
   o Data from Northern Australia: 42%
   o *P* = 0.00
• Syphilis testing performed
   o Standard: 99% (n = 91)
   o Midwifery: 96% (n = 116)
	• Multidisciplinary midwifery-led model increased access to prenatal care for aboriginal women in the remote region.
	• There was limited data on the details of the services provided.
	• No change in outcomes was seen; authors suggested this may reflect long-standing risk factors in the social determinants of health and the long time frame usually required to see changes in health outcomes.
	• Provision of increased quality and access to prenatal care may be a first step to help close the gap between the disparity between indigenous and non-indigenous groups in Australia.

Table A3: Summary of Findings of Included Studies	
Main Study Findings	**Author's Conclusions**
- o Data from Northern Australia: 72% - o *P* = 0.24 • Hepatitis B testing performed - o Standard: 85% (n = 78) - o Midwifery: 87% (n = 105) - o Data from Northern Australia: 78% - o *P* = 0.70 - Maternal Outcomes • Vaginal delivery - o Standard: 74% (n = 67/91) - o Midwifery: 68% (n = 79/117) - o Data from Northern Australia: 67% - o *P* = 0.507 • Vaginal delivery with intervention - o Standard: 4% (n = 4/91) - o Midwifery: 3% (n = 4/117) - o Data from Northern Australia: 0% - o *P* = 0.507 • C-section - o Standard: 22% (n = 20/91) - o Midwifery: 29% (n = 34/117) - o Data from Northern Australia: 22% - o *P* = 0.507 - Neonatal Outcomes • Average birth weight - o Standard: 3,172.5 g (IQR 2,692 to 3,435) - o Midwifery: 3,060 (IQR 2,620 to 3,500) - o Data from Northern Australia: 3,198 - o *P* = 0.6837 • Low birth weight (<2,500 g) - o Standard: 17% (n = 15/88) - o Midwifery: 18% (n = 21/115) - o Data from Northern Australia: 10% - o *P* = 0.855	

Table A3: Summary of Findings of Included Studies	
Main Study Findings	**Author's Conclusions**

• Fetal death in utero (> 20/40 parity and >400 g)
   o Standard: 1% (n = 1/92)
   o Midwifery: 3% (n = 4/121)
   o Data from Northern Australia: NA
   o *P* = 0.489
• Preterm delivery (delivery <37 weeks)
   o Standard: 13% (n = 12)
   o Midwifery: 17% (n = 21)
   o Data from Northern Australia: 11%
   o *P* = 0.448	

Benatar, 2013[3]	

Neonatal Outcomes
• Apgar score < 7
   o Standard: 3.7%
   o Midwifery: 3.4%
   o OR 0.92; *P* = NS (exact value not reported)
• Low birth weight (<2,500 g)
   o Standard: 10%
   o Midwife: 8%
   o OR 0.81; *P* = NS (exact value not reported)
• Preterm birth (≤ 36 weeks)
   o Standard: 11.0%
   o Midwifery: 7.9%
   o OR 0.71; *P* < 0.01
• Average birth weight
   o Standard: 3,166 g
   o Midwifery: 3,245 g
   o Marginal effect 79; *P* < 0.01
Maternal outcomes
• C-section
   o Standard: 29.4%
   o Midwifery: 19.7%
   o OR 0.59; *P* < 0.01
	• Reduction of C-sections, increase in birth weight, and prolonged gestation associated with midwifery care at the birth centre show that the centre care improved or was "as good" as the standard hospital care for the socially disadvantaged population served by both centres.
	• Authors suggested that the individualized, culturally relevant care in a 'comfortable' environment was beneficial to both mothers and their babies when compared with standard care.
	• An alternative model of care can be safe and effective in encouraging births with fewer interventions, which is health promoting and potentially cost-saving.

Table A3: Summary of Findings of Included Studies	
Main Study Findings	**Author's Conclusions**

• VBAC
    ○ Standard: 9.4%
    ○ Midwifery: 26.7%
    ○ OR 3.50; *P* < 0.01
Process outcomes
• Use of electronic fetal monitoring
    ○ Standard: 82.2%
    ○ Midwifery: 78.1%
    ○ OR 0.77; *P* < 0.01
• Weekend delivery
    ○ Standard: 23.9%
    ○ Midwifery: 28.6%
    ○ OR 1.28; *P* < 0.01
Subgroup analysis for African American women
• C-section rates (20.9% vs. 29.7%, *P* <0.01) and preterm births (11.8% vs. 8.6%, *P* < 0.01) were statistically significantly lower for those receiving midwifery care versus standard care
• The percentage of children born with an Apgar score < 7 (3.4% vs. 3.7%), and low birth weight (9.8% vs. 11.1 %) were also lower in the midwifery group, however this was not statistically significant.
• VBAC rates (20.0% vs. 7.9%; *P* < 0.01), weekend deliveries (27.1% vs. 24.4%; *P* <0.05), and average birth weight (3,198 g vs. 2,130 g; *P* < 0.01) were statistically significantly higher in the midwife group versus the standard care group.	

CI = confidence interval; C-section = caesarian section; g = grams; IQR = interquartile range; NA = not available; NS = not significant; OR = odds ratio; RR = relative risk; VBAC = vaginal birth after C-section
[a]Measure of continuity of care

APPENDIX 5: Additional References of Potential Interest

Implementation issues related to the delivery or introduction of Midwifery care

Protocol (project due for completion 2018)
NIHR Evaluation, Trials and Studies [website]. Factors influencing the utilisation of alongside and free-standing midwifery units in England: a mixed methods research study [protocol]; National Institute for Health Research (NIHR) Evaluation, Trials and Studies. Southampton, England: NIHR; 2014. http://www.nets.nihr.ac.uk/__data/assets/pdf_file/0005/152285/PRO-14-04-28.pdf

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