PEER REVIEW HISTORY

ARTICLE DETAILS

TITLE (PROVISIONAL)	Reduced prevalence of small-for-gestational-age and preterm birth for women of low socioeconomic position: a population-based cohort study comparing antenatal midwifery and physician models of care
AUTHORS	McRae, Daphne; Janssen, Patricia; Vedam, Saraswathi; Mayhew, Maureen; Mpofu, Deborah; Teucher, Ulrich; Muhajarine, Nazeem

VERSION 1 – REVIEW

REVIEWER	Hannah Rayment-Jones Kings College London, UK
REVIEW RETURNED	08-Mar-2018

GENERAL COMMENTS	Thank you for the oppurtunity to review this important paper. It is well written with clear objectives and robust research methods. The discussion highlights some important considerations and possible underlying mechanisms for future research. Please see my comments below that I hope you will find useful. With the ever increasing evidence base on the benefits of midwifery led, relationship based care, there could be more discussion around how services can be reorgansied to increase uptake. It might also be useful to briefly discuss Sandall et als (2016) cochrane review on midwifery led care vs other models of care, in relation to the finding on reduced PTB and how this paper addresses the recommendations to research the effect on vulnerable populations. Although breifly described it would be useful for the reader to have a better idea of how services are accessed in BC. For example giving percentages of how many women access midwifery led care. What is seen to be the 'default' maternity care model? When defining models of care it is unclear what is meant by 'one partial trimenster'- how many appointments does this include? Who would the primary care provider be? The discussion section suggests women are not willing to be randomly allocated to different models of care, is there any evidence to support this? What might be the ethical considerations of trials considering the evidence base for better outcomes asscioated with midwifery led care? Kind Regards

REVIEWER	Soo Downe UCLan UK
REVIEW RETURNED	03-Apr-2018

GENERAL COMMENTS	This is a well written paper in a topic area that is of current interest, in terms of the contemporary focus on the optimal model of care for childbearing women. As far as I can tell, the definitions used and analysis undertaken is appropriate and accurate, apart from two areas of detail that I would recommend are addressed in a resubmitted version prior to acceptance for publication:
	1. It would be useful to have a box or table setting out clearly the similarities and differences between the models of care, including the average number and length of anc visits, the billing mechanisms/costs, and the inter-model referral rates, if these data are available
	2. Although the focus is on women with low socioeconomic position, the demographic data in table one suggest that, on some measures, women in the midwife group were more likely to be in higher socio-economic or income brackets. I wasnt quite sure if the primary definition was by socio-demographic area, or by the socio-demographic profile of the individual. It would be helpful to have this clarified, and to have an explanation of the relevance and meaning of the various measures cited.
	Finally, I wonder if, given the model of care under examination, the conclusions are about midwifery care alone, or midwifery care with appropriate obstetric referral, versus GP care with obstetric referral, or obstetric care alone (assuming the obstetrician was not accompanied by a midwife during ANC activities)?
	I wish the authors all the best with their resubmission.

REVIEWER	Elizabeth Thom George Washington University Biostatistics Center, USA
REVIEW RETURNED	14-May-2018

GENERAL COMMENTS	This is a very well written paper, an important topic and the statistical analysis approach is methodologically appropriate. The authors do address problems with selection bias and confounding. However there is a potential flaw that is not addressed. The authors chose the cohort to be eligible for midwifery care throughout the index pregnancy (presumably meaning the current pregnancy). There is no problem with excluding women who had conditions at the start of their antenatal care that precluded them from being seen by midwives. But there is a potential problem with excluding women who develop conditions during the current pregnancy. For example, if a woman started out in midwifery care but ended up developing preeclampsia and perhaps being transferred to an OB she would be excluded from the analysis. This could unfairly bias the midwifery group towards better outcomes. An intent-to-treat approach would be better and the women should be classified as low to moderate risk based on information known when they started prenatal care. Although the actual intent may not be available, a sensitivity analysis where all women without pre-existing conditions are included and assigned to the mode of care they started with, could be done. There may be more subtle variants on that approach but something similar should be done before drawing conclusions. Adjusting for residual confounding is probably not enough. Another issue not addressed is that it appears that women may be represented in the cohort more than once. Outcomes in successive pregnancies are correlated and this is not addressed. Therefore it is

suggested that a sensitivity analysis be carried out in nulliparous women only. If the results hold for this subgroup also, they would be more convincing.

The authors appear to have estimated sample sizes assuming equal numbers in each exposure category, which is unrealistic since they knew a priori that this was not true. In addition since there are three exposure categories and they are comparing midwife care with each of the two physician models, they should at least be adjusting the type 1 error to account for the two comparisons (e.g. 2.5% type 1 error rate 2-sided would be appropriate). It is also not clear why they picked a 3% difference in prevalence as the effect size. Having said that, it looks likely that there is more than enough power for the chosen effect size.

History of more than one PTB is an exclusion – a history of a single preterm birth is a risk factor for another one . I was surprised a women with a PTB would be considered eligible for midwifery services, especially if there had only been one pregnancy.

VERSION 1 – AUTHOR RESPONSE

Table 1: Response to Reviewers' Comments

Reviewers' Comments	Response	Changes to the Manuscript
" . . . more discussion around how services can be reorgansied to increase uptake"		Added on page 27, "This could include incentivizing midwifery outreach to vulnerable populations by compensating midwives for the extra time involved in caring for women with higher socioeconomic risk. It could also mean increasing the volume of midwives practicing in the province to meet current demand, and conducting targeted public awareness campaigns to educate low SEP women about the government-funded options available in maternity care."
" . . . discuss Sandall et als (2016) cochrane review on midwifery led care vs other models of care, in relation to the finding on reduced PTB and how this paper addresses the recommendations to research the effect on vulnerable populations"		Added to page 23, "Our results for PTB coincide with a 2016 Cochrane review synthesizing the findings of eight randomized controlled trials (RCTs) testing midwifery-led continuity models of care vs. other models, including midwifery-physician models and medical-led care. In this review, authors found a 24% reduction in risk of PTB, less than 37 weeks gestation, for midwifery patients (average risk ratio 0·76, 95% CI: 0·64 to 0·91, n=13,238).[1] This is comparable to our 26% reduction in odds

		of PTB, less than 37 weeks gestation, for midwifery vs. GP patients (aOR 0·74, 95% CI: 0·63 to 0·86, n=49,819). As recommended in the Cochrane review, our study specifically focused on vulnerable women."
" . . . how services are accessed in BC. For example giving percentages of how many women access midwifery led care. What is seen to be the 'default' maternity care model?"		Added Table 1 (page 8) for clarity.
" . . .useful to have a box or table setting out clearly the similarities and differences between the models of care, including the average number and length of anc visits, the billing mechanisms/costs, and the inter-model referral rates, if these data are available"	Agreed, this brings greater clarity.	
" . . . unclear what is meant by 'one partial trimenster'- how many appointments does this include? Who would the primary care provider be?"		Added to page 7, "midwives are compensated according to partial or full trimester of care, regardless of the number of antenatal visits provided (see Table 1)."
		Added to page 8, "MWs can bill for full care (100%) or partial care (40% or 60%) per trimester, depending on patient transfer"

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". . . suggests women are not willing to be randomly allocated to different models of care, is there any evidence to support this?"		Citation added to page 22, "As women have been shown to refuse randomization to retain choice in maternity care provision,[2] . . ."
" . . .the demographic data in table one suggest that, on some measures, women in the midwife group were more likely to be in higher socio-economic or income brackets. I wasnt quite sure if the primary definition was by socio-demographic area, or by the socio-demographic profile of the individual. It would be helpful to have this clarified, and to have an explanation of the relevance and meaning of the various measures cited"	There is a description of the family income criteria used to assess low SEP on page 11, "**the key indicator used to assess low SEP, [was] medical insurance premium assistance . . . Eligibility for this assistance is based on family, net income . . . from $24,000 to $30,000 for a family of three . . . this is comparable to Statistics Canada's before-tax, low income cut-off . . . a standard measure of poverty.[3]**"	Added to page 14/15, "Although all women were of low income at a family-level, a greater proportion of midwifery patients lived in wealthier towns/districts (LHAs) and neighbourhoods compared to GP or OB patients. This may be a reflection of health policy influencing the distribution of midwifery availability across the province. Midwifery care may be more available in desirable (i.e. wealthier, southern, urban) areas as midwives are able to choose where they will open a practice and they are not eligible for the same financial incentives offered to rural and remote physicians.[4]"
" . . . if, given the model of care under examination, the conclusions are about midwifery care alone, or midwifery care with appropriate obstetric referral, versus GP care with obstetric referral, or obstetric care alone (assuming the obstetrician was not accompanied by a midwife during ANC activities)?"	Good point, this should be mentioned.	Added to page 22/23, "It should also be noted that in some cases antenatal midwifery and GP care included discussion or consultation with OBs for complex cases, and included transfer of care to OBs during labour and delivery when indicated. Though unmeasured, the quality of collaboration between practitioners and the use of obstetric referral will have had an influence on the results."
" . . . if a woman started out in midwifery care but ended up developing preeclampsia and perhaps being transferred to an OB she would be excluded from the analysis. This could unfairly bias the midwifery group towards	To control for this type of bias we excluded all MW, GP, and OB patients who developed high risk conditions (such as preeclampsia) at any time during the antenatal period. Risk was defined according to provincial guidelines.	To clarify, we have added to page 7, "None of the GP or midwifery patients included in the study had antenatal conditions recorded in the perinatal record requiring transfer to an OB, nor did any OB patients have antenatal conditions recorded in the record rendering them ineligible for midwifery

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better outcomes."	Women with low to moderate perinatal risk, having conditions which are treated within the scope of MW practice in BC, were included in the study as these patients were eligible for all three models of care.	care."
"An intent-to-treat approach would be better and the women should be classified as low to moderate risk based on information known when they started prenatal care."	We did not conduct an intent-to-treat analysis because the data did not contain information about risk status at the start of antenatal care. Instead of using intent-to-treat for classification, we classified patients into the three groups of care with the information available, reflecting the actual care that was received. We only including patients who were eligible for midwifery care, thereby minimizing potential differences in perinatal risk between cohorts.	Added to page 7, "Women may have had an initial appointment with a GP if this was their preferred type of maternity provider, or because they were waitlisted for midwifery care, required an OB referral, or were unaware of the options for OB or midwifery care until the first prenatal appointment. Therefore, we did not classify patients' model of care by initial practitioner contact (intent-to-treat). Rather, patients were classified according to the type of practitioner providing all of their routine antenatal care, with allowance for one routine visit with another practitioner-type."
"Although the actual intent may not be available, a sensitivity analysis where all women without pre-existing conditions are included and assigned to the mode of care they started with, could be done. There may be more subtle variants on that approach but something similar should be done before drawing conclusions. Adjusting for residual confounding is	We conducted a sensitivity analysis examining outcomes for all women without recorded antepartum morbidity (healthy throughout pregnancy). Compared to the main results, effect estimates were attenuated but remained statistically significant (see results in Appendix C: Table 1).	As suggested, we conducted a second sensitivity analysis excluding women with pre-existing medical or obstetric conditions (results are included in Appendix C: Table 2). Results are nearly identical to our original results, suggesting the methods used to control for potential differences in perinatal risk between cohorts are adequate.

probably not enough."		
"Another issue not addressed is that it appears that women may be represented in the cohort more than once. Outcomes in successive pregnancies are correlated and this is not addressed. Therefore it is suggested that a sensitivity analysis be carried out in nulliparous women only. If the results hold for this subgroup also, they would be more convincing."	**From page 12, "To assess the association of model of care and SGA, PTB, and LBW, we developed logistic regression models using a Generalized Estimating Equation approach.[5] This method allowed for adjustment of variance estimates to accommodate potential correlation for women delivering multiple infants during the study period and for clustering of effects by community.[5]"** **From page 22 "**In addition, GEE logistic regression modelling allowed us to account for correlation in outcomes at a family and community level, a more rigours modelling approach than the methods used in previous studies."	
"The authors appear to have estimated sample sizes assuming equal numbers in each exposure category, which is unrealistic since they knew a priori that this was not true. In addition since there are three exposure categories and they are comparing midwife care with each of the two physician models, they should at least be adjusting the type 1 error to account for the two comparisons (e.g. 2.5% type 1 error rate 2-sided would be appropriate). Having said that, it looks likely that	Agreed, this is a stronger statement. Thank you for pointing out the need to adjust the type 1 error. Study power is not affected by these changes.	Added to page 11, "**To detect an absolute difference in prevalence of 3% (similar to estimates of prevalence in the general population) from a baseline of 9·9% we required a minimum of 1,249 MW patients, 2,497 OB patients, and 4,861 GP patients."** **Added to page 11, "Type I error was set at p=0·025 two sided, and type II error set at 0·20."**

there is more than enough power for the chosen effect size."		
"It is also not clear why they picked a 3% difference in prevalence as the effect size."		
"I was surprised a women with a PTB would be considered eligible for midwifery services, especially if there had only been one pregnancy."	As outlined in the BC College of Midwives' guidelines, a history of PTB does not make a women ineligible for midwifery care.[6]	

References

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2.   Allen J, Stapleton H, Tracy S, Kildea S. Is a randomised controlled trial of a maternity care intervention for pregnant adolescents possible? An Australian feasibility study. BMC Med Res Methodol. 2013;13:138.
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4.   Government of B.C. Rural practice programs: Government of B.C.; 2018 [cited 2018 May 24]. Available from: https://www2.gov.bc.ca/gov/content/health/practitioner-professional-resources/physician-compensation/rural-practice-programs.
5.   SAS Institute Inc. SAS/STAT® 14.3 User's Guide: The GEE procedure Cary, NC: SAS Institute Inc.; 2017 [cited 2016 Dec 1]. Available from: http://support.sas.com/documentation/onlinedoc/stat/143/gee.pdf.
6.   College of Midwives of British Columbia (CMBC). Indications for Discussion, Consultation and Transfer of Care: CMBC; 2014 [cited 2017 May 2]. Available from: http://www.cmbc.bc.ca/Registrants-Handbook-12-01-Indications-for-Discussion-Consultation-and-Transfer-of-Care.pdf.

VERSION 2 – REVIEW

| REVIEWER | Hannah Rayment-Jones
King's College London, United Kingdom |
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| REVIEW RETURNED | 07-Jun-2018 |

| GENERAL COMMENTS | Thank you for the oppurtunity to review this revised manuscript. It is an interesting and timely study with important outcomes. The manuscript meets all of the checklist requirements.

Kind Regards |
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REVIEWER	Elizabeth Thom

	George Washington University, USA
REVIEW RETURNED	28-Jun-2018

GENERAL COMMENTS	Thank you for the responses and revisions, which have strengthened the paper as well as making it more accessible to readers outside of the Canadian system.