Author's response to reviews

Title: Pregnancy, prison and perinatal outcomes in New South Wales, Australia: a retrospective cohort study using linked health data

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Author's response to reviews: see over
Dear Mr O’Donovan,

RE: Re-submission of an original research article

We wish to re-submit the following original research paper for your consideration for publication in BMC Pregnancy and Childbirth:

Pregnancy, prison and perinatal outcomes in New South Wales, Australia: a retrospective cohort study using linked health data.

We wish to express our gratitude to the reviewers for their comments, which have enabled us to clarify and strengthen the manuscript. Our detailed response to the reviewers’ comments is attached.

We look forward to your response.

Yours sincerely,

JANE R. WALKER

SENIOR RESEARCH OFFICER AND CORRESPONDING AUTHOR
Response to reviewer comments

Major Compulsory Revisions

1. **The authors are overly enamoured of the novelty of their approach, mentioning that it is the 'first' study on at least three occasions. Overlooking that, which I hope they will remedy, the paper does hold some interest although there are some areas where the manuscript could be improved.**

   The manuscript has been amended accordingly.

2. **The authors need to convince at least this reviewer that drawing a random 10% sample of births to women never in prison is an adequate comparison group. Another approach would be to group match the control group on some demographic or reproductive health characteristics in the pregnancy in prison study group. This would probably yield a more telling comparison… Group matching on year of delivery would be useful, along with maternal age, parity and some other maternal characteristics.**

   In response to the reviewer’s comments, we have made extensive changes to the manuscript in order to clarify the study methodology.

   The study has two control groups:

   (1) **Community controls**: a non-prisoner control group comprised of a randomly selected 10% sample of women in NSW who gave birth during the study period (2000-2006) and were not exposed to incarceration at any time between 1998-2006; and

   (2) **Prison controls**: women who gave birth were during the study period (2000-2006) and were incarcerated for at least 5 continuous days between 1998-2006, but not during the index pregnancy.

   The prison control group (2) effectively functions as frequency-matched controls. This group had the same incarceration history, but were not exposed to imprisonment during their pregnancy. The maternal socio-demographic characteristics of this control group were broadly similar to those of the study group, with respect to maternal age, parity, Aboriginal status and smoking during pregnancy (Table 1). These characteristics were the major confounding factors for pregnancy outcomes in this study, though Aboriginal status was the only strong confounding factor in this group. Within the narrow range of years covered by the study period, the year of birthing did not operate as a confounding factor.

   It was not possible to apply frequency matching in the conventional sense in this study, because we were constrained by data custodians at the outset to request a sample of unlinked records. This limitation was imposed because of the sensitivity of the study subject matter, and the potential for uncovering the identity of individuals if the data were to be compared, for example, with birth registration data—an alternative population source that shares several data items with the NSW Perinatal Data Collection.

   The community control group (1), based on a 10% random sample of births to the whole population, provides an unmatched control group. Confounding can be addressed, as we have done in this study, by adjusting effect estimates using multiple regression analysis. Frequency matching is intuitively easier to understand and can improve statistical efficiency in the presence of strong confounders, but otherwise has no real advantage over multivariate adjustment (Szklo and Nieto, 2007). The community control sample in this study is large and provides a representative sample of the reference population that allows the distribution of correlates for incarceration, and can be used in other analyses of these data to estimate the prevalence of risk factors and assess the burden of incarceration.

3. **Why was the comparison group selected from 1998-2006 when the prison pregnancy and prison control groups were from 2000-2006?**

   All study and control subjects were selected from women who gave birth in NSW from July 2000 to December 2006. The women identified as having a history of imprisonment were those whose
birth records were linked with a record of incarceration from 1998 to 2006. The manuscript has been amended to remove any ambiguity regarding this point.

4. Justify doing the study for 2000-2006, rather than using more recent data. NSW has good record keeping systems, surely these data are available at least through 2010, if not more recently.

Regrettably, the data used in this study represent the most contemporaneous data available. The provision of linked data for the study took almost three years to complete. Corrective Services NSW had no prior experience in the preparation of data for linkage with health records, which substantially delayed the provision of accurate and complete data to the NSW Centre for Health Record Linkage (CHeReL) and, after linkage had been completed, the provision of data incorporating the linkage key, to the research team.

Following the provision of data for the study, in 2011 NSW Health Records and Information Privacy Act (HRIPA) 2002 regulations were amended to effectively restrict the linkage of records belonging to the NSW Department of Health with those belonging to non-Health agencies.

5. Provide a convincing rationale for using congenital anomalies as an outcome, or remove it from the manuscript. It is especially problematical to lump all birth defects together, as birth defects have very different etiologies. Why would we expect to find a greater or lower risk for birth defects among the women with history of imprisonment?

The World Health Organisation states that ‘many birth anomalies can be prevented and treated’. Our analysis demonstrates that women who were pregnant in prison were four times more likely to initiate antenatal care after 20 weeks’ gestation, when compared with women in the general community. First trimester screening for congenital anomalies takes place at around 12 weeks’ gestation, so the detection rate for some congenital anomalies is likely to be lower in the study group. In NSW, termination of pregnancy is available up to 18-20 weeks of pregnancy, though surgical termination is usually carried out between 7-12 weeks.

Notwithstanding this rationale, we found no statistically significant difference between the study and control groups in the risk of congenital anomaly, and agree with the reviewer that treating all congenital anomalies as a single group is problematic. Therefore, we have removed this outcome from the manuscript.

6. The discussion is far too long in relation to the findings in this study. It is a relatively small study in terms of prison subjects, and does not warrant the detailed discussion provided. It should be shortened, ideally by 2 or more pages in the manuscript text.

The discussion section has been reduced by two pages, from 1,854 to 1,334 words.

Minor Revisions

7. Convince the reader that the broader comments are relevant to NSW in the introduction.

NSW has the largest overall population of the Australian states and territories and accounts for almost one-third of Australia’s births annually and almost one-third of the Australian female prisoner population, therefore Australian national statistics are likely to be representative of NSW. However, the broader comments referred to by the reviewer have been replaced with NSW-specific published data.

8. The last sentence in para 2 p 4 is not a fair comparison, it should compare the fertility patterns prior to age 20 among prisoners with history of childbirth prior to age 20 in the population.

Whilst we acknowledge that the figures presented are not directly comparable, they demonstrate that more than half of female prisoners in the State have given birth before the age of twenty, a figure which is dramatically disproportionate with the rate of teenage birth in NSW as a whole. Unfortunately we are constrained by the available published data, and the NSW Inmate Health Survey is the only source of data on the birthing histories of female prisoners in the State. However, the authors believe these data do illustrate that imprisoned pregnant women are younger and more likely to have given birth before the age of twenty, when compared with the general birthing population of NSW.
9. **In the methods, explain more fully how birthing prisoners and former pregnant prisoners differ. It might be interesting to classify the women based on whether their prenatal care began while in prison. Also of interest would be how many pregnancies were conceived during incarceration (i.e. conjugal visits).**

Corrective Services NSW does not permit ‘conjugal visits’; no pregnancies are conceived during incarceration. No data were available on the timing of onset of prenatal care.

For the analyses of labour and delivery outcomes, the study group was separated into two sub-groups:

(1) **Birthing prisoners** were women who were imprisoned at the time of their birth episode (n=99); and

(2) **Former pregnant prisoners** were women who were no longer incarcerated at the time of their birth episode, i.e. had been released from prison (n=203). (p6)

Socio-demographic characteristics of the study group and its two sub-groups are presented in Table 1. Labour and delivery outcomes for the two sub-groups are presented in Table 3. The rationale for presenting this information by sub-group is that the prison inmate status of the women differed at the time of the birth admission, when these data were collected. Some two-thirds of the study group were no longer prisoners at the time they gave birth. This enabled us to examine whether there were differences in the rate of intervention in labour and delivery, for prisoners and non-prisoners. The birthing prisoners had a rate of Caesarean section that was comparable with women in the general community (28% and 26% respectively), whilst those who had been released from prison by the time of giving birth had less than half this rate (12%).

The manuscript has been updated to clarify the rationale for this sub-group analysis (p6).

10. **Is five days a long enough prison stay to impart some different nature of risk? Perhaps some analyses could model the length of the prison stay either in days or related to the gestation length of the pregnancy.**

Our rationale for the five-day period is provided in the Methods section (p7) and has been expanded as follows:

A five-day threshold was selected, following consultation with prison health and corrective services service providers. Justice Health has protocols for the detection and management of pregnancy in prisoners, which require that all women undergo pregnancy testing on reception to prison and again at 28 days. Pregnant women undergo immediate assessments for mental health, self-harm risk, women’s health, and blood-borne viruses. Those with drug and alcohol issues are discussed immediately with the Drug and Alcohol Medical Officer and ongoing management plans are initiated. These immediate interventions alone could potentially offer significant health gains for women and neonates, even in the context of a brief incarceration.

The issue of how the timing and duration of incarceration impacts upon maternal and neonatal outcomes is indeed an interesting one, and this will be explored for a subsequent paper.

11. **In the methods, why were more direct measures of disadvantage (income, education, marital status) not used? Presumably some of these variables are available in vital statistics or elsewhere?**

The measures of disadvantage used are outlined in the Methods section (p8). The authors agree and acknowledge that more direct measures of disadvantage would be beneficial (p17). Unfortunately, the only additional measure of disadvantage available to the research team was the Australian Bureau of Statistics’ Socioeconomic Index For Areas (SEIFA), a composite, area-based measure of relative disadvantage that is based on a person’s postcode of usual residence. After careful consideration, this measure was not used in the study due to an inherent bias: for women who were imprisoned at the time of their birth episode (one-third of the study group), the postcode of usual residence recorded is that of the prison.

Data on maternal marital status are not collected in the NSW Perinatal Data Collection. These data are collected in the NSW Births Registration Collection but are not routinely made available
for record linkage via the NSW Centre for Health Record Linkage (CHeReL). Inclusion of an additional data set in the linkage to obtain this variable would have been disproportionately costly to the project. Information about maternal education and occupation are not collected in either the NSW Births Registration Collection or the NSW Perinatal Data Collection. Indeed, these data are not collected in any routine State or national data collection that could have been included in the study. The authors have previously conducted a detailed investigation into the availability of maternity data in NSW and Australia as a whole, which can be found at http://npeesu.com.au/maternityinformation/index.php.

12. In the results, p. 11, is the age comparison valid, especially considering the differences in years included in the study? A better approach is to group match on age for the community controls.

Age, as a continuous variable, is used in each model in the study, as part of a multivariate adjustment that deals with any residual confounding. Please see the response to point 3; there is no difference in the years included in the study for each group and the manuscript has been updated to remove any ambiguity regarding this point.

13. As mentioned in methods, how many of the women started prenatal care in prison - it could indeed be that availability of health services as inmates had some beneficial effect.

This is not known as no data on the timing of onset of prenatal care are available.

14. In Table 1, are the categories opioid substitution therapy, hosp adm with MH dx, and MH disorder and opioid substitution therapy mutually exclusive categories? They seem to be analyzed as such, but are likely to overlap. If so, perhaps a composite variable would be more useful.

The three categories presented in Table 1 are mutually exclusive, but a composite variable for any mental health admission and/or opioid substitution therapy was used in the multivariate analysis. Table 1 has been updated to display this composite variable.

15. Also in Table 1, consider showing number of days incarcerated during pregnancy, and for the prison pregnancy group, show how many became pregnant in prison, and started prenatal care in prison.

No women became pregnant in prison and no data are available on the timing of onset of prenatal care. The authors agree that duration of incarceration is an important issue, and will address this in a subsequent analysis, along with gestation at incarceration.

16. In Table 2, recheck all odds ratios and confidence intervals, as at least one is presented to three decimal places.

The authors agree and do not wish to place emphasis on this finding, having included it only for completeness. It is conceivable that birthing prisoners would have restricted access to monitoring and interventions for breech presentation prior to term, however no data are available.

Reviewer 2

1. What do the authors think accounts for the dramatic increase of Aboriginal and Torres Strait Islander women who are incarcerated?

This is a very important and highly complex issue, which is the subject of a separate paper using
data from this study and an associated qualitative study. The authors are also actively engaged in a subsequent study with input from the Aboriginal Health and Medical Research Council of NSW and funding from the National Health and Medical Research Council (NHMRC) of Australia. This latter study examines the aetiology of Aboriginal women’s incarceration in NSW and aims to develop culturally appropriate models of care for women with children who are transitioning from prison into the community.

2. Data indicating how many days the women were incarcerated before delivery is extremely important when addressing birth outcomes of incarcerated women. If the authors do not have this data they need to address this as a limitation in the discussion. This is a significant factor in the US when examining the impact of prenatal care for incarcerated women and birth outcomes.

The authors entirely agree that examination of the timing and duration of incarceration during pregnancy will yield important information about the conditions under which prison-based health interventions could potentially improve maternal and neonatal outcomes. However, this requires a specific time-to-event analysis, which was outside the scope of the current study. It also requires careful consideration of the differential services and interventions that are available to pregnant women depending upon their length of stay in prison.

Our study provides important preliminary findings to contradict existing studies from the US and UK, which conclude that pregnant prisoners have better health outcomes than disadvantaged controls. An analysis of the impact of timing and duration of incarceration on our study group will be undertaken subsequently and submitted for publication.