PEER REVIEW HISTORY

ARTICLE DETAILS

TITLE (PROVISIONAL)	Reproductive patterns, pregnancy outcomes, and parental leave practices of women physicians in Ontario, Canada: the Dr. Mom Cohort Study protocol
AUTHORS	Cusimano, Maria C.; Baxter, Nancy N.; Sutradhar, Rinku; Ray, Joel G.; Garg, Amit; McArthur, Eric; Vigod, Simone; Simpson, Andrea N.

VERSION 1 – REVIEW

REVIEWER	Jose Guilherme Cecatti Cecatti Department of Obstetrics and Gynecology School of Medical Sciences University of Campinas Campinas, Brazil
REVIEW RETURNED	10-Jul-2020

GENERAL COMMENTS	First of all my thanks for allowing me to review such an important and up to date topic through this research protocol. It is really wonderful the situation of at least some parts of Canada having so detailed routine databases on health, profession, and administrative information for the whole population, permitting crossing analysis to generate important information with interest for the health sector. Although it is a very well developed protocol, there are still some missing points that deserve to be better addressed to improve the quality of the manuscript. They are pointed out as follow: The main point refers to the classification of the study design. Although not mentioned in any part of the manuscript, this is a retrospective cohort study and so should be identified in the title, abstract, and in the whole text. Abstract: it lacks information on a general approach for data analysis for all the three aims of the study. In addition, an estimation of the sample of women probably entering the cohort would be welcome. Introduction, page 5, lines 59-70: In the first paragraph, when the authors provide arguments about the importance of approaching female physicians in association with motherhood, I think an additional point should be added, regarding the so-called "obstetric transition" that was recently described and being experienced worldwide (See Souza JP et al. BJOG 2014; 121 Suppl.1:1-4). The medical career accelerates this process. Specific aims, pages 7-8, lines 97-108: although stated elsewhere, here the time limit fo the cohort and the retrospective character of the study should be mentioned. In addition, it should be clearly stated if all female physicians and all female non-physicians will be selected, or a sample of them. If pregnancy outcomes do include maternal and perinatal outcomes, this should be said. Finally, the third objective as it is written does not give the full picture of what is being planned for the analysis according to the information from Figure 1. The comparison with women physicians without childbirths

	and with men physicians should be mentioned. Methods & Analysis: Cohort development, rationale & Overview, page 8, lines 113-117: again, here should be informed that the cohort will be retrospectively assigned for a period of 28 years, from 1990 to 2018, with women at reproductive age included in the databases. Study populations & Exposure Assessment, page 11, lines 182-194: it is not clear whether all eligible women will enter the cohort (women physicians for exposure and women non-physicians for non-exposure) or a representative sample of them. Finally, although this is a research protocol, I would recommend to include a STROBE checklist as a supplementary file. Hopefully, the full article could be available soon.

REVIEWER	Brian M Fuller Washington University in St. Louis School of Medicine USA
REVIEW RETURNED	11-Jul-2020

GENERAL COMMENTS	The authors have clearly delineated a need for this work and set the stage quite well for why the work is needed. To that end, it appears that it will fill knowledge gaps and they have very much thought this work through. I believe it will achieve its stated objectives. Two issues, which are fairly minor: There is some redundancy/repetition (pages 15-18 before sample size and power) which the authors could trim in order to shorten the work and streamline it. The limitations of the work have really been glossed over. It is mentioned in one statement in the Strengths and Limitations section, but I believe a more detailed mention of the limitations would provide the reader with the assurance that the authors have thought of these limitations and formed plans to deal with them. As this is registry data, there could indeed be significant limitations in terms of number of qualifying patients, granularity of data, data missingness, data accuracy, etc. As a summary statement though, this work seems quite important and the authors are well-positioned to carry it through

VERSION 1 – AUTHOR RESPONSE

Reviewer 1, Comment 1: The main point refers to the classification of the study design. Although not mentioned in any part of the manuscript, this is a retrospective cohort study and so should be identified in the title, abstract, and in the whole text.

*Author Response:*The study is indeed retrospective in nature, and we have made appropriate changes to the language throughout the abstract and the entirety of the manuscript. We did not change the name of the study (Dr. Mom Cohort Study) in order to maintain consistency between this manuscript and all protocols submitted and approved by our Research Ethics Board and granting agency, but otherwise have clarified that this is a retrospective cohort study.

Location of Modified Text:

- Abstract, Page 3, Lines 36-37
- Abstract, Page 3, Lines 38-42
- Specific Aims, Page 6, Lines 105-107

- Cohort Development, Page 7, Lines 123-126
- Aim 1, Page 14, Lines 282-283
- Aim 2, Page 15, Lines 306-308
- Aim 3, Page 17, Lines 343-344

Modified Text:

- "The Dr. Mom Cohort Study encompasses a series of retrospective observational studies of women physicians in Ontario, Canada."
- "By linking a dataset of physicians from the CPSO to existing provincial administrative databases, which hold health data and physician billing records, we will be able to retrospectively assess the healthcare utilization, work practices, and pregnancy outcomes of women physicians at the population-level."
- "We will then conduct retrospective analyses within specific subgroups of this larger cohort and a representative sample of non-physicians (Figure 1)."
- "We will address this limitation by developing and retrospectively studying a cohort of practicing physicians who registered with the College of Physicians and Surgeons of Ontario (CPSO) from 1990 to 2018, linked to existing Ontario population-based administrative databases."
- "We will retrospectively evaluate reproductive patterns among Ontario women physicians and non-physicians of reproductive age (15-50 years)."
- "We will retrospectively evaluate adverse pregnancy outcomes among Ontario women physicians and non-physicians of reproductive age who have experienced at least one childbirth $\geq$20 weeks GA."
- "We will retrospectively evaluate practice patterns and earnings of men and women physicians in Ontario of reproductive age."

Reviewer 1, Comment 2: The abstract lacks information on a general approach for data analysis for all the three aims of the study. In addition, an estimation of the sample of women probably entering the cohort would be welcome.

*Author Response:*We have added: (1) information on the general approach to data analysis, and (2) an estimation of the sample of women physicians entering the cohort, to the abstract. Due to word limitations placed on the abstract, we were not able to elaborate in-depth on analytic points specific to each of the three individual aim.

Location of Modified Text:

- Abstract, Page 3, Lines 42-45

Modified Text:

- "Specific outcomes of interest include: (1) rates and timing of pregnancy; (2) pregnancy-related care and complications; and (3) duration of parental leave and subsequent earnings, each of which will be evaluated with regression methods appropriate to the form of the outcome. We estimate that, at minimum, 5,000 women physicians will be eligible for inclusion."

Reviewer 1, Comment 3: Introduction, page 5, lines 59-70: In the first paragraph, when the authors provide arguments about the importance of approaching female physicians in association with motherhood, I think an additional point should be added, regarding the so-called "obstetric transition" that was recently described and being experienced worldwide (See Souza JP et al. BJOG 2014; 121 Suppl.1:1-4). The medical career accelerates this process.

Author Response: We have read the commentary by Souza et al. and interpreted the obstetric transition as an ecologic phenomenon, in which "countries gradually shift from a pattern of high maternal mortality to low maternal mortality; from predominance of direct obstetric causes of maternal mortality to an increasing proportion of indirect causes, non-communicable causes, aging of the maternal population, and moving from the natural history of pregnancy and childbirth towards institutionalization of maternity care."

The main point in this commentary that we feel may be relevant to the issues faced by women physicians in Canada is perhaps a trend of delaying pregnancy to more advanced maternal ages, even more so than the general population is already doing in Canada as a whole. This hypothesis will be explored in Aim 1. We have emphasized the point on maternal age, and added a citation for the commentary recommended by the reviewer.

Location of Modified Text:

- Introduction, Page 5, Lines72-75

Modified Text:

- "In part because of these issues, it is thought that women physicians may delay childbearing to more advanced maternal ages, or have fewer or no children more often than non-physician women in the general population (3, 17-22)."

Reviewer 1, Comment 4: Specific aims, pages 7-8, lines 97-108: Although stated elsewhere, the time limit for the cohort and the retrospective character of the study should be mentioned here. In addition, it should be clearly stated whether all female physicians and all female non-physicians will be selected, or a sample of them.

Author Response: We have added these points to the Specific Aims section.We will include all women physicians, and a representative sample of non-physicians (given that non-physicians far outnumber physicians in Ontario).

Location of Modified Text

- Specific Aims, Page 6, Lines 103-107

Modified Text:

- "We will first develop a cohort of all physicians who registered to practice in Ontario from 1990 to 2018 by linking physician registration data to existing provincial health administrative data. We will then conduct retrospective analyses within specific subgroups of this larger cohort and a representative sample of non-physicians
  (Figure 1) to address the following objectives."

Reviewer 1, Comment 5: Specific aims, pages 7-8, lines 97-108: If pregnancy outcomes do include maternal and perinatal outcomes, this should be said.

Author Response: We have made this change to Aim 2.

Location of Modified Text:

- Specific Aims, Page 7, Lines 110-112

Modified Text:

- "Compare maternal outcomes, perinatal outcomes, and processes of obstetrical care between women physicians and non-physicians, and determine if physician work characteristics are associated with adverse pregnancy outcomes"

Reviewer 1, Comment 7: Specific aims, pages 7-8, lines 97-108: Finally, the third objective as it is written does not give the full picture of what is being planned for the analysis according to the information from Figure 1. The comparison with women physicians without childbirths and with men physicians should be mentioned.

Author Response: We have made this change to Aim 3, in order to better clarify what is being planned for the analysis.

Location of Modified Text:

- Specific Aims, Page 7, Lines 113-116

Modified Text:

- "Describe the pregnancy and postpartum work practices of women physicians who experience childbirth, and determine the impact of childbirth on practice patterns and earnings relative to men physicians and women physicians who do not experience childbirth"

Reviewer 1, Comment 8: Cohort development, rationale & Overview, page 8, lines 113-117: Again, here should be informed that the cohort will be retrospectively assigned for a period of 28 years, from 1990 to 2018, with women at reproductive age included in the databases.

Author Response: We have added specific mention of the retrospective nature of the cohort, and the cohort inception from 1990-2018. However, we have not specifically mentioned women physicians in this broad overview, because we will obtain information on men physicians as well (for completion of Aim 3 specifically).

Location of Modified Text:
- Specific Aims, Page 7, Lines 123-126

Modified Text:
- "We will address this limitation by developing and retrospectively studying a cohort of practicing physicians who registered with the College of Physicians and Surgeons of Ontario (CPSO) from 1990 to 2018, linked to existing Ontario population-based administrative databases."

Reviewer 1, Comment 9: Study populations & Exposure Assessment, page 11, lines 182-194: it is not clear whether all eligible women will enter the cohort (women physicians for exposure and women non-physicians for non-exposure) or a representative sample of them.

*Author Response:*As mentioned above, we will include all women physicians, and a representative sample of non-physicians (given that non-physicians far outnumber physicians in Ontario). This has been clarified directly in the text.

Location of Modified Text:
- Study Populations & Exposure Assessment, Page 10, Lines 194-196

Modified Text:
- "In both Aims 1 and 2, physician occupation will be the main exposure of interest; we will compare all women physicians (exposed) to a representative sample of non-physicians (comparator)."

Reviewer 1, Comment 10: Finally, although this is a research protocol, I would recommend to include a STROBE checklist as a supplementary file.

Author Response: We have completed a STROBE checklist as a supplementary file, and have referenced this in the main text of the manuscript.

Location of Modified Text:
- Ethics & Dissemination, Page 20, Lines 411-413
- Supplemental Information, Page 10-12

Modified Text:
- "All manuscripts will adhere to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (Supplemental Table 4)."
- Addition of STROBE checklist to Supplemental Information

Reviewer 2, Comment 1: There is some redundancy/repetition (pages 15-18 before sample size and power) which the authors could trim in order to shorten the work and streamline it.

*Author Response:*As recommended by the reviewer, we have deleted several sentences which we felt were redundant through pages 15-18.

Location of Modified Text:
- Methods & Analysis, Pages 15-18

Modified Text:

- Redundant sentences deleted in the Tracked Changes version of manuscript

Reviewer 2, Comment 2: The limitations of the work have really been glossed over. It is mentioned in one statement in the Strengths and Limitations section, but I believe a more detailed mention of the limitations would provide the reader with the assurance that the authors have thought of these limitations and formed plans to deal with them. As this is registry data, there could indeed be significant limitations in terms of number of qualifying patients, granularity of data, data missingness, data accuracy, etc.

*Author Response:*We agree that there are certainly limitations associated with the use of retrospective registry data. We direct the reviewer to our section on "Anticipated Challenges & Mitigation Strategies". In this section, we highlight limitations that are specific to this particular retrospective cohort and relate to the granularity and missingness of data, including: (1) variable follow-up for physicians and non-physicians; (2) a lack ofdata on physician trainee status, and when the transition to independent practice occurs; and (3) missing data on physician specialty.We believe this section demonstrates to readers that we have anticipated the potential limitations associated with studying physicians using the administrativedatasources currently available in Ontario, and formed detailed plans to deal with them. We have also added a new paragraph in this section, entitled "Use of Administrative Data Sources", which expands more broadly on the challenges that can arise when using data collected for administrative rather than research purposes, as requested by the reviewer.

Location of Modified Text:

- Existing text: Methods & Analysis, Anticipated Challenges & Mitigation Strategies, Pages 11-13, Lines 218-259
- Added text: Methods & Analysis, Anticipated Challenges & Mitigation Strategies, Pages 13-14, Lines 261-270

Modified Text:

- Existing text under headings: "Variable Follow-Up", "Determining Transition to Independent Practice", and "Determining Physician Specialty"
- Added text: "Use of ICES administrative data enables access to a large population-based sample of physicians and non-physicians, with comprehensive follow-up of all health encounters over the reproductive lifespan. However, ICES administrative data lacks granular variables that would be of interest in this study, such as relationship status and intentions with respect to family planning, and is susceptible to misclassification due to coding errors. We cannot account for unmeasured variables; however, we can mitigate the possibility of information bias. We have purposefully selected main exposures, covariates, and outcomes that can be ascertained using established methodology and/or Ontario-specific algorithms to ensure accuracy (46-54); and have used databases that are validated (55, 56) or periodically re-abstracted (57)."

VERSION 2 – REVIEW

REVIEWER	Jose Guilherme Cecatti University of Campinas, Brazil
REVIEW RETURNED	19-Aug-2020

GENERAL COMMENTS	The authors have properly addressed all points raised not only for me but also for the other reviewer. The manuscript protocol was then improved and in conditions to be published as it is now. Congratulations to the authors for the elegant proposal.