

OBSTETRICS & GYNECOLOGY



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- Comments from the reviewers and editors (email to author requesting revisions)
- Response from the author (cover letter submitted with revised manuscript)*

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obgyn@greenjournal.org.

Date: Oct 04, 2019
To: "Lindsay Kennedy Admon" [REDACTED]
From: "The Green Journal" em@greenjournal.org
Subject: Your Submission ONG-19-1700

RE: Manuscript Number ONG-19-1700

Severe Maternal Morbidity and Mortality Among Rural and Urban Indigenous Women in the United States

Dear Dr. Admon:

Your manuscript has been reviewed by the Editorial Board and by special expert referees. Although it is judged not acceptable for publication in Obstetrics & Gynecology in its present form, we would be willing to give further consideration to a revised version.

If you wish to consider revising your manuscript, you will first need to study carefully the enclosed reports submitted by the referees and editors. Each point raised requires a response, by either revising your manuscript or making a clear and convincing argument as to why no revision is needed. To facilitate our review, we prefer that the cover letter include the comments made by the reviewers and the editor followed by your response. The revised manuscript should indicate the position of all changes made. We suggest that you use the "track changes" feature in your word processing software to do so (rather than strikethrough or underline formatting).

Your paper will be maintained in active status for 21 days from the date of this letter. If we have not heard from you by Oct 25, 2019, we will assume you wish to withdraw the manuscript from further consideration.

REVIEWER COMMENTS:

Reviewer #1: Overall: This is an original research report using data from the National Inpatient Sample from 2012 - 2015 to examine severe maternal morbidity and mortality among rural and urban dwelling indigenous women as compared to white rural/urban women. It is well-written and demonstrates a notable and troubling health inequity, with increased risk of SMMM among indigenous women and more rural residence, further putting them at risk.

Major comments:

1. The biggest drawback for this manuscript is the timeframe studied. In light of the CDC report from 2019 (data from 2011 to 2015) the authors should better justify what this analysis adds to the understanding of the problem. There are two components to be emphasized: morbidity not mortality, and the analysis of geographic determinants. I would suggest reframing this analysis as complementary and additive.
2. I'm confused about a few issues related to access to care among indigenous women
 - a. There is different Medicaid eligibility for Native Americans and Alaska Natives. How does this contribute to the discrepancy in Medicaid coverage seen between white and indigenous women?
 - b. A major factor that would strengthen this analysis is a look at the type of hospital at which women delivered. I'm not sure if it's in the dataset. But were women delivering at Indian Health Service hospitals? Could that explain the discrepancy in SMMM rather than race/geography? Does it contribute? If it's not in the dataset, should acknowledge as a limitation.
 - c. Line 253, the authors begin a discussion of pregnancy-related categorical Medicaid eligibility. However, they have not demonstrated whether or not the women in the study have that eligibility or alternate eligibility. This is essential given the differences in coverage. Though I think the difference in categorical eligibility is important, it should not be a component of this discussion if they cannot demonstrate women have pregnancy-related Medicaid. This is particularly because a poorer, sicker population among indigenous women with more generous eligibility would seem to be more likely to have a different category of Medicaid.
3. It would be helpful to see a sensitivity analysis considering the SMMM criteria with and without transfusion to see if there is still an effect. While the authors emphasize Line 264, and 208 that transfusion is driving the trend, I cannot tell from this analysis whether the increased morbidity is fully due to discrepancy in transfusion. If that's the case, they should explore more why this would be the case.
4. Line 122: the 6% missing observations for race/ethnicity would generally not be a big issue, but in this case seems important to explore given that Indigenous women comprise a small percentage of the population. Can the authors perform sensitivity analysis to demonstrate their results remain robust?

5. Why do the authors think the discrepancy observed in SMMM is less than that reported by the CDC?

Minor comments:

6. Line 62-67 - The numbers presented in line 66 do not match the text, shouldn't they show incidence for rural vs urban, not rural and rural?

7. Line 88 - clarify wording to make this important point. Lost with current language.

8. Line 98, are 2015 data available to match this analysis?

9. Line 99-100 - could be more concise and easier to understand

10. Line 119 - why didn't the authors use ICD10 for that missing quarter?

11. Line 129 - need better justification for exclusion of short length of stay. Also line 131 "death or among" does not make sense.

12. Line 167 - repeat rural Indigenous women in text

13. Lines 195 and 196 - rates of chronic hypertension seem higher than I would expect and preexisting diabetes seem a bit lower than I would expect

14. Line 211 - this first sentence should be 3 sentences and clarified what the authors mean.

Paragraph starting line 203 and Line 215 - are these incidence rates adjusted for the disparate rates of chronic disease, Medicaid status, etc? That's not clear.

Reviewer #2: The authors aim to describe severe maternal morbidity and mortality for indigenous women compared to non-Hispanic white women. I have the following comments regarding the manuscript:

Precis

1. The Precis should be a summary of the findings. It currently just sounds like an opinion/editorialized comment.

Abstract

1. Please define SMM in the methods of your abstract. Did you use ICD9 codes? CDC definition, etc?

2. In the results of the abstract, some of the demographic data could be removed in favor of reporting the adjusted odds ratios (multivariable modeling results).

Introduction

1. Line 103. In order to claim that this is the first study would need to present search terms, date of search, search engines used, etc. Best to just claim that this has been understudied.

2. The objective at the end of the Intro differs from that in the abstract. The objective in the abstract is more clear and seems to answer a research question whereas the objective in the introduction is more descriptive.

Results

1. Line 164. The authors are not really testing for inequities. They are testing for associations between indigenous women and severe maternal morbidity.

2. Line 166. What do the authors mean by evaluating each outcome separately? Do they mean each component of the CDC definition for SMM?

3. Lines 211-215. The reported numbers of affected women should be reported with 95% CIs.

4. Figure 3. Models are adjusted for age, insurance payor, income and region. Why did the authors choose not to adjust for medical comorbidities such as diabetes and substance use disorder?

5. Figures 2 and 3. It would be helpful if the authors could present unadjusted and adjusted results. Typically multivariable modeling results are not presented as weighted frequencies. Therefore, this approach requires additional explanation.

6. Table 2. Would recommend creating a separate table for SMM and then listing the different categories of SMM based on the CDC definition so that the reader can get a sense of what morbidity is uniquely present in indigenous women.
7. Separate out mortality in the results. Would present the mortality ratio for each group separately either in the text or the table.

Discussion

1. Line 228. Can the authors expand on how this paper would inform efforts to advance maternal health equity? They report a known inequity. How can these data specifically be used to design interventions to reduce these inequities?
2. There are other limitations. For example, the data are limited to the delivery hospitalization which only captures a small subset of maternal morbidity and mortality.

Reviewer #3:

The authors studied a timely topic addressing severe maternal morbidity and mortality among Indigenous women using the Nationwide Inpatient Sample (2012-2015). However, there are few issues that need to be clarified regarding the approach used.

1. The authors stated that they used diagnosis and procedure codes compiled by CDC to identify SMMM cases. However, the CDC code only identifies cases of severe maternal morbidity. Therefore, it is not clear how the authors identified cases of mortality. They did not mention using the variable "died" in the NIS.
2. One can argue that the variable blood transfusion could sometimes over estimate true cases of severe maternal morbidity. Therefore, the authors may consider conducting a sensitivity analysis by excluding cases with blood transfusion in the absence of one of the other indicators of SMM.
3. In addition to the reported SMMM (although I have a question on whether mortality was included or not included), the study would be more informative, if the authors also report racial and location (urban vs rural) differences in morbidity and mortality separately.

Minor Concern:

- Under the sub-heading "analyses", the sentence from line 166 - 170 is not clear.
- Authors may also consider reporting proportion of each of the SMM indicators by race and location (urban vs rural).

STATISTICAL EDITOR'S COMMENTS:

1. Tables 1, 2: Given the large number of comparisons in each Table, use of $p < .05$ will likely result in some spurious associations, due to multiple hypothesis testing. Suggest using a stricter inference threshold (at least $p < .01$ would be more appropriate) and should include a caveat re: multiple hypothesis testing.
2. Tables 1, 2: Although it is stated in the footnote to Table 1 "P values for overall categories ...", is there a clearer way the Authors could show which columns are being compared? It seems confusing at first glance.

EDITORIAL OFFICE COMMENTS:

1. The Editors of Obstetrics & Gynecology are seeking to increase transparency around its peer-review process, in line with efforts to do so in international biomedical peer review publishing. If your article is accepted, we will be posting this revision letter as supplemental digital content to the published article online. Additionally, unless you choose to opt out, we will also be including your point-by-point response to the revision letter. If you opt out of including your response, only the revision letter will be posted. Please reply to this letter with one of two responses:

- A. OPT-IN: Yes, please publish my point-by-point response letter.
- B. OPT-OUT: No, please do not publish my point-by-point response letter.

2. As of December 17, 2018, Obstetrics & Gynecology has implemented an "electronic Copyright Transfer Agreement" (eCTA) and will no longer be collecting author agreement forms. When you are ready to revise your manuscript, you will be prompted in Editorial Manager (EM) to click on "Revise Submission." Doing so will launch the resubmission process, and you will be walked through the various questions that comprise the eCTA. Each of your coauthors will receive an email from the system requesting that they review and electronically sign the eCTA.

Please check with your coauthors to confirm that the disclosures listed in their eCTA forms are correctly disclosed on the manuscript's title page.

3. Standard obstetric and gynecology data definitions have been developed through the reVITALize initiative, which was

convened by the American College of Obstetricians and Gynecologists and the members of the Women's Health Registry Alliance. Obstetrics & Gynecology has adopted the use of the reVITALize definitions. Please access the obstetric and gynecology data definitions at <https://www.acog.org/About-ACOG/ACOG-Departments/Patient-Safety-and-Quality-Improvement/reVITALize>. If use of the reVITALize definitions is problematic, please discuss this in your point-by-point response to this letter.

4. Because of space limitations, it is important that your revised manuscript adhere to the following length restrictions by manuscript type: Original Research reports should not exceed 22 typed, double-spaced pages (5,500 words). Stated page limits include all numbered pages in a manuscript (i.e., title page, précis, abstract, text, references, tables, boxes, figure legends, and print appendixes) but exclude references.

5. Specific rules govern the use of acknowledgments in the journal. Please note the following guidelines:

- * All financial support of the study must be acknowledged.
- * Any and all manuscript preparation assistance, including but not limited to topic development, data collection, analysis, writing, or editorial assistance, must be disclosed in the acknowledgments. Such acknowledgments must identify the entities that provided and paid for this assistance, whether directly or indirectly.
- * All persons who contributed to the work reported in the manuscript, but not sufficiently to be authors, must be acknowledged. Written permission must be obtained from all individuals named in the acknowledgments, as readers may infer their endorsement of the data and conclusions. Please note that your response in the journal's electronic author form verifies that permission has been obtained from all named persons.
- * If all or part of the paper was presented at the Annual Clinical and Scientific Meeting of the American College of Obstetricians and Gynecologists or at any other organizational meeting, that presentation should be noted (include the exact dates and location of the meeting).

6. The most common deficiency in revised manuscripts involves the abstract. Be sure there are no inconsistencies between the Abstract and the manuscript, and that the Abstract has a clear conclusion statement based on the results found in the paper. Make sure that the abstract does not contain information that does not appear in the body text. If you submit a revision, please check the abstract carefully.

In addition, the abstract length should follow journal guidelines. The word limits for different article types are as follows: Original Research articles, 300 words. Please provide a word count.

7. Only standard abbreviations and acronyms are allowed. A selected list is available online at <http://edmgr.ovid.com/ong/accounts/abbreviations.pdf>. Abbreviations and acronyms cannot be used in the title or précis. Abbreviations and acronyms must be spelled out the first time they are used in the abstract and again in the body of the manuscript.

8. The journal does not use the virgule symbol (/) in sentences with words. Please rephrase your text to avoid using "and/or," or similar constructions throughout the text. You may retain this symbol if you are using it to express data or a measurement.

9. In your Abstract, manuscript Results sections, and tables, the preferred citation should be in terms of an effect size, such as odds ratio or relative risk or the mean difference of a variable between two groups, expressed with appropriate confidence intervals. When such syntax is used, the P value has only secondary importance and often can be omitted or noted as footnotes in a Table format. Putting the results in the form of an effect size makes the result of the statistical test more clinically relevant and gives better context than citing P values alone.

If appropriate, please include number needed to treat for benefits (NNTb) or harm (NNT_h). When comparing two procedures, please express the outcome of the comparison in U.S. dollar amounts.

Please standardize the presentation of your data throughout the manuscript submission. For P values, do not exceed three decimal places (for example, "P = .001"). For percentages, do not exceed one decimal place (for example, 11.1%).

10. We discourage claims of first reports since they are often difficult to prove. How do you know this is the first report? If this is based on a systematic search of the literature, that search should be described in the text (search engine, search terms, date range of search, and languages encompassed by the search). If on the other hand, it is not based on a systematic search but only on your level of awareness, it is not a claim we permit.

11. Please review the journal's Table Checklist to make sure that your tables conform to journal style. The Table Checklist is available online here: http://edmgr.ovid.com/ong/accounts/table_checklist.pdf.

12. The American College of Obstetricians and Gynecologists' (ACOG) documents are frequently updated. These documents may be withdrawn and replaced with newer, revised versions. If you cite ACOG documents in your manuscript, be sure the reference you are citing is still current and available. If the reference you are citing has been updated (ie, replaced by a newer version), please ensure that the new version supports whatever statement you are making in your manuscript and then update your reference list accordingly (exceptions could include manuscripts that address items of historical interest). If the reference you are citing has been withdrawn with no clear replacement, please contact the

editorial office for assistance (obgyn@greenjournal.org). In most cases, if an ACOG document has been withdrawn, it should not be referenced in your manuscript (exceptions could include manuscripts that address items of historical interest). All ACOG documents (eg, Committee Opinions and Practice Bulletins) may be found via the Clinical Guidance & Publications page at <https://www.acog.org/Clinical-Guidance-and-Publications/Search-Clinical-Guidance>.

13. Authors whose manuscripts have been accepted for publication have the option to pay an article processing charge and publish open access. With this choice, articles are made freely available online immediately upon publication. An information sheet is available at <http://links.lww.com/LWW-ES/A48>. The cost for publishing an article as open access can be found at <http://edmgr.ovid.com/acd/accounts/ifaauth.htm>.

Please note that if your article is accepted, you will receive an email from the editorial office asking you to choose a publication route (traditional or open access). Please keep an eye out for that future email and be sure to respond to it promptly.

If you choose to revise your manuscript, please submit your revision through Editorial Manager at <http://ong.editorialmanager.com>. Your manuscript should be uploaded in a word processing format such as Microsoft Word. Your revision's cover letter should include the following:

- * A confirmation that you have read the Instructions for Authors (<http://edmgr.ovid.com/ong/accounts/authors.pdf>), and
- * A point-by-point response to each of the received comments in this letter.

If you submit a revision, we will assume that it has been developed in consultation with your co-authors and that each author has given approval to the final form of the revision.

Again, your paper will be maintained in active status for 21 days from the date of this letter. If we have not heard from you by Oct 25, 2019, we will assume you wish to withdraw the manuscript from further consideration.

Sincerely,

The Editors of Obstetrics & Gynecology

2018 IMPACT FACTOR: 4.965

2018 IMPACT FACTOR RANKING: 7th out of 83 ob/gyn journals

In compliance with data protection regulations, you may request that we remove your personal registration details at any time. (Use the following URL: <https://www.editorialmanager.com/ong/login.asp?a=r>). Please contact the publication office if you have any questions.

RESPONSE TO REVIEWERS

Reviewer #1:

Overall: This is an original research report using data from the National Inpatient Sample from 2012-2015 to examine severe maternal morbidity and mortality among rural and urban dwelling indigenous women as compared to white rural/urban women. It is well-written and demonstrates a notable and troubling health inequity, with increased risk of SMMM among indigenous women and more rural residence, further putting them at risk.

Authors' response: Thank you for these comments. We appreciate your input, which we believe has greatly enhanced this manuscript. Please see our responses to each point below.

Major comments:

1. The biggest drawback for this manuscript is the timeframe studied. In light of the CDC report from 2019 (data from 2011 to 2015) the authors should better justify what this analysis adds to the understanding of the problem. There are two components to be emphasized: morbidity not mortality, and the analysis of geographic determinants. I would suggest reframing this analysis as complementary and additive.

Authors' response: Thank you for this suggestion. We have revised the introduction section of the manuscript to emphasize the additional information that this analysis provides, offering nuance (e.g., morbidity data in addition to mortality, geographic lens) to the recent CDC data identifying increased risk for maternal mortality among Indigenous women.

Changes to the Manuscript: Added "This analysis provides detailed data on maternal morbidity, in addition to mortality, and explores the geographic aspects of maternal health inequities occurring among Indigenous women." p.5, lines 96-98

2. I'm confused about a few issues related to access to care among indigenous women

- a. There is different Medicaid eligibility for Native Americans and Alaska Natives. How does this contribute to the discrepancy in Medicaid coverage seen between white and indigenous women?

Authors' response: Differences in Medicaid eligibility do apply to Native American and Alaska Native people. Enrolled tribal members who are eligible for IHS and tribal health services do not pay premiums, enrollment fees, or out of pocket costs for Medicaid or CHIP coverage; however tribal membership does not affect eligibility for categorical pregnancy-related Medicaid coverage, and therefore does not likely explain the discrepancy in Medicaid coverage seen in our analysis. (Please see <https://www.healthcare.gov/american-indians-alaska-natives/medicaid-chip/>). As such, we believe the higher proportions of Indigenous compared to non-Hispanic white women enrolled in Medicaid during pregnancy reflect largely economic differences (rather than differences in eligibility).

Changes to the Manuscript: N/A

- b. A major factor that would strengthen this analysis is a look at the type of hospital at which women delivered. I'm not sure if it's in the dataset. But were women delivering at Indian Health Service hospitals? Could that explain the discrepancy in SMMM rather than race/geography? Does it contribute? If it's not in the dataset, should acknowledge as a limitation.

Authors' response: Thank you for bringing up this important limitation. We agree that it would be interesting to explore differences between IHS hospitals and other hospitals, but this information is not available in the dataset we used. We have added this as a limitation, consistent with the reviewer's suggestion, and believe this is an important direction for future work.

Changes to the Manuscript: Added "Additionally, hospitals administered by the Indian Health Service cannot be distinguished in these data." p.15, lines 347-348

- c. Line 253, the authors begin a discussion of pregnancy-related categorical Medicaid eligibility. However, they have not demonstrated whether or not the women in the study have that eligibility or alternate eligibility. This is essential given the differences in coverage. Though I think the difference in categorical eligibility is important, it should not be a component of this discussion if they cannot demonstrate women have pregnancy-related Medicaid. This is particularly because a poorer, sicker

population among indigenous women with more generous eligibility would seem to be more likely to have a different category of Medicaid.

Authors' response: We have modified text in the location indicted by the reviewer to clarify that pregnancy-related eligibility for Medicaid does not differ by tribal membership status (consistent with response #2a above).

Changes to the Manuscript: Edited "Additionally, pregnancy-related categorical eligibility for Medicaid – the primary type of Medicaid coverage for women included in this analysis - lasts from conception until 60 days postpartum." p.14, lines 305-306

3. It would be helpful to see a sensitivity analysis considering the SMMM criteria with and without transfusion to see if there is still an effect. While the authors emphasize Line 264, and 208 that transfusion is driving the trend, I cannot tell from this analysis whether the increased morbidity is fully due to discrepancy in transfusion. If that's the case, they should explore more why this would be the case.

Authors' response: Thank you for this suggestion. We now include a sensitivity analysis examining a composite measure of SMMM excluding cases in which blood transfusion was the only indicator of SMMM. The results reveal that Indigenous women (0.6%, 95% CI 0.5–0.8) maintained higher incidence of SMMM compared to White women (0.3%, 95% CI 0.3–0.4; $P < .001$). The rural/urban differences were no longer significant; however, we believe this was influenced by low sample size. For instance, there were only 32 unweighted cases of SMMM excluding cases in which blood transfusion was the only indicator identified among rural Indigenous women.

Changes to the Manuscript:

- Added to methods: "We also conducted a sensitivity analysis that excluded cases in which blood transfusion was the only indicator of SMMM, as including these may constitute an overestimate of truly severe morbidity." p.8, lines 161-163
 - Added to results: "When cases in which blood transfusion was the only indicator of SMMM were excluded in our sensitivity analysis, Indigenous women (0.6%, 95% CI 0.5–0.8) continued to incur higher rates of SMMM compared to White women (0.3%, 95% CI 0.3–0.4; $P < .001$). Rural and urban differences were no longer significant, but sample size was very limited among Indigenous women, particularly rural Indigenous women for whom only 32 unweighted cases of SMMM were identified." p.11, lines 246-252
 - Added these findings to Table 2
4. Line 122: the 6% missing observations for race/ethnicity would generally not be a big issue, but in this case seems important to explore given that Indigenous women comprise a small percentage of the population. Can the authors perform sensitivity analysis to demonstrate their results remain robust?

Authors' response: We agree that missing data on race/ethnicity are an important consideration in a study that focuses on the health of Indigenous women. Observations with missing data for race/ethnicity are not included in our analytic sample. In making this decision, we reviewed detailed AHRQ documentation and a recent report published by HCUP on missing data methods for the NIS. The NIS has a low proportion of missing data compared to other major administrative databases. In our sample of delivery hospitalizations 6.4% of observations had missing data for race ethnicity (N= 179,048). Race/ethnicity data that are missing are not missing at random. According to HCUP, in some years, race is not reported for entire states and within states may be suppressed for sensitive conditions (in California for discharges in which HIV/AIDS is coded--a condition explicitly examined in our analyses). Complicating matters, state-level identifiers, which would be helpful for imputation, were dropped from the NIS in 2012. Therefore, specific states cannot be singled out for special treatment of the race variable.

In response to the reviewer's point, we have examined descriptive demographics for observations with missing data for race/ethnicity. Our findings reveal that observations with missing data for race/ethnicity largely reflect women who are privately insured [62.4% (95% CI 61.1-63.7) private insurance, 33.8% (95% CI 31.2-36.4) Medicaid, 5.7% (95% CI 5.2-6.3) uninsured] and higher income [only 18.1% (95% CI 16.8-19.4) in the bottom national income quartile]. These characteristics are far more closely aligned (almost matching) with the demographic characteristics of White compared to Indigenous women. We also conducted a sensitivity analysis including those with missing race as a part of the White group, and the

results were robust to this alternate specification, with very minor differences in rates of SMMM and no statistically significant differences.

Changes to the Manuscript: In addition to conducting the sensitivity analyses described above, we emphasized the challenge of missing data in the limitations section of the manuscript, “Data on race or ethnicity were missing in 6% of cases included in in this analysis.” p. 15, lines 346-348.

5. Why do the authors think the discrepancy observed in SMMM is less than that reported by the CDC?
Authors’ response: SMMM occurs more frequently than mortality alone; the data from the CDC focus on maternal mortality, not morbidity, and may represent the more extreme manifestations of racial inequities. Additionally, small sample sizes among Indigenous women may complicate the statistical precision of estimates both provided by the CDC and in our analyses. That is, there are large confidence intervals around the point estimates reported by the CDC and found in the present analysis, which may in fact mean that the disparities detected in mortality and in SMMM may be closer or even statistically equivalent. Without access to the raw data from CDC, this is difficult to ascertain. It is, however, a very important point, and we modified text in the discussion section to acknowledge the importance of focusing on both morbidity and mortality in policy efforts to improve maternal health.
Changes to the Manuscript: Added “Additionally, including attention to severe maternal morbidity in mortality review proceedings may improve prevention efforts.” p.15, lines 334-335.

Minor comments:

6. Line 62-67 - The numbers presented in line 66 do not match the text, shouldn't they show incidence for rural vs urban, not rural and rural?
Authors’ response: Thank you for catching this. We have edited the text as suggested for clarity and consistency.
Changes to the Manuscript: Edited to read “Within each group, incidence was higher among rural compared with urban residents (2.3%, 95% CI 1.9–2.8 for rural Indigenous women vs. 1.8%, 95% CI 1.5–2.1 for urban Indigenous women; 1.3%,95% CI 1.3–1.4 for rural White women vs. 1.2%, 95% CI 1.1-1.2 for urban White women).” pp. 3-4, lines 70-73
7. Line 88 - clarify wording to make this important point. Lost with current language.
Authors’ response: This language has been modified for clarity.
Changes to the Manuscript: Edited to read “Indigenous people therefore have a larger proportion of rural residents than other racial or ethnic groups in the US, for whom rural residents represent 20% or less of the population.” p.5, lines 101-103
8. Line 98, are 2015 data available to match this analysis
Authors’ response: Unfortunately, data more recent than 2014¹ are not available on the proportion of rural counties that have lost obstetric services.
Changes to the Manuscript: N/A
9. Line 99-100 - could be more concise and easier to understand
Authors’ response: We agree and have modified this language for brevity and clarity.
Changes to the Manuscript: Edited to read “In rural counties located far from urban areas, residents experienced increased rates of preterm birth, out-of-hospital birth, and births in hospitals without obstetric units after losing hospital-based obstetric services.¹⁷” p.6, lines 111-114
10. Line 119 - why didn't the authors use ICD10 for that missing quarter?
Authors’ response: A cross-walk for equivalent ICD 10 codes to identify obstetric deliveries and SMMM are still being developed by CDC researchers, but have not yet been validated for use in research or analyses. Further, either higher or lower incidence of SMMM occurring in the 4th quarter of 2015 (when ICD-9 to ICD-10 transition occurred) could be driven by changes in coding alone, which could introduce bias to our estimates. When further years of data become available for the National Inpatient Sample, it will

¹Hung P, Henning-Smith CE, Casey MM, Kozhimannil KB. Access to obstetric services in rural counties still declining, with 9 percent losing services, 2004-14. Health Aff 2017;36(9):1663–71.

be easier to address these challenges by allowing for a wash-out period to account for the time during which this coding transition occurred.

Changes to the Manuscript: N/A

11. Line 129 - need better justification for exclusion of short length of stay. Also line 131 "death or among" does not make sense.

Authors' response: The suggested changes have been made.

Changes to the Manuscript: Edited to read "Consistent with prior studies, childbirth hospitalizations with a diagnosis code indicating severe maternal morbidity and an implausibly short length of stay (less than the 90th percentile calculated separately for vaginal, primary, and repeat cesarean deliveries) were reclassified as hospitalizations without SMMM in order to obtain the most valid estimates. Reclassification based on length of stay was not applied to cases of in-hospital death or among those identified by procedure codes (blood transfusion, hysterectomy, mechanical ventilation, temporary tracheostomy, and cardiac conversion).²⁴" p.7, lines 149-156

12. Line 167 - repeat rural Indigenous women in text

Authors' response: We have done so.

Changes to the Manuscript: clarify "rural Indigenous" women as the comparator.

13. Lines 195 and 196 - rates of chronic hypertension seem higher than I would expect, and preexisting diabetes seem a bit lower than I would expect

Authors' response: These prevalence estimates are similar to those previously reported by members of our team² and others using the National Inpatient Sample. A limitation of this study is that the use of claims data for identifying codes that do not generate a specific payment, such as ICD-9-CM codes for chronic conditions, may be associated with low sensitivity. As such, we are only able to estimate prevalence in instances where co-morbid conditions are coded in the chart, and co-morbid conditions are less likely to be coded compared to a blood transfusion, for example, which will be associated with a charge. As such, these estimates are imprecise.

Changes to the Manuscript: Added "Further, as with the use of any claims database, codes that do not generate a specific payment, such as codes for co-morbid conditions or non-procedure SMMM codes, may be associated with low sensitivity. Such coding irregularity can differentially impact different groups of women." p. 15, lines 338-341

14. Line 211 - this first sentence should be 3 sentences and clarified what the authors mean.

Authors' response: This language has been edited for clarity as suggested.

Changes to the Manuscript: This paragraph has been edited to read "Based on population statistics, these differences represent 3,200 (95% CI 2,626–3,967) total women who otherwise would not have experienced morbidity or mortality if they had been White or living in an urban area. This translates to 2,756 (95% CI 2,321–3,191) cases of SMMM among rural women who would not have experienced morbidity or mortality if they had been urban residents. Also, an estimated 931 (95% CI 710–1,147) Indigenous women experienced SMMM who would not have had this outcome if they had been White. Further, if rural Indigenous women experienced SMMM at the same rate as urban White women, this would result in a reduction of 49.1% (95% CI 38.9–57.5; 381 cases, 95% CI 245–547) of SMMM among Indigenous women." p.12, lines 255-260

15. Paragraph starting line 203 and Line 215 - are these incidence rates adjusted for the disparate rates of chronic disease, Medicaid status, etc? That's not clear.

Authors' response: All models were adjusted for age, insurance payer, income, and hospital region. In response to the reviewer, we have now performed sensitivity analyses additionally adjusting for the co-morbid conditions examined in our paper, which did not substantively alter our findings. If the reviewer/editors would like, we are happy to add these analyses to the paper either in place of the current models or as an appendix.

Changes to the Manuscript: Please see p.10, line 206

²Admon LK, Winkelman TN, Zivin K, Terplan M, Mhyre JM, Dalton VK. Racial and ethnic disparities in the incidence of severe maternal morbidity in the United States, 2012–2015. *Obstetrics & Gynecology*. 2018 Nov 1;132(5):1158-66.

Reviewer #2: The authors aim to describe severe maternal morbidity and mortality for indigenous women compared to non-Hispanic white women. I have the following comments regarding the manuscript:

Precis

1. The Precis should be a summary of the findings. It currently just sounds like an opinion/editorialized comment.

Authors' response: The precis statement has been modified as suggested.

Changes to the Manuscript: Edited to read "Indigenous women who give birth experience increased risk for severe maternal morbidity and mortality, particularly rural Indigenous women" p.2, lines 46-47

Abstract

1. Please define SMM in the methods of your abstract. Did you use ICD9 codes? CDC definition, etc?

Authors' response: The abstract has been modified to reflect the SMMM definition used.

Changes to the Manuscript: Edited to read "We used weighted multivariable logistic regression and predictive population margins to measure health conditions and SMMM (identified using International Classification of Diseases, Ninth Revision, Clinical Modification diagnosis and procedure codes) among Indigenous and White patients, to test for differences across both groups, and to test for differences between rural and urban residents within each racial category." p.3, lines 56-60

2. In the results of the abstract, some of the demographic data could be removed in favor of reporting the adjusted odds ratios (multivariable modeling results).

Authors' response: Thank you for this suggestion; we have modified the abstract accordingly.

Changes to the Manuscript: In summary, we deleted the descriptive data about the prevalence of chronic conditions across both groups. Please refer to Results section of Abstract, pp.3-4, lines 65-73.

Introduction

1. Line 103. In order to claim that this is the first study would need to present search terms, date of search, search engines used, etc. Best to just claim that this has been understudied.

Authors' response: Thank you. We agree and have edited the text accordingly.

Changes to the Manuscript: Edited to read "The intersection of rural inequities and maternal health outcomes among Indigenous women is understudied." p.6, lines 118-119.

2. The objective at the end of the Intro differs from that in the abstract. The objective in the abstract is more clear and seems to answer a research question whereas the objective in the introduction is more descriptive.

Authors' response: Thank you for catching this. We have modified the description in the introduction to mirror the language used in the abstract to describe the study objective.

Changes to the Manuscript: Edited to read "The objective of this analysis was to describe delivery-related SMMM for Indigenous women compared to White women, distinguishing rural and urban residents." p.6 lines 119-122

Results

1. Line 164. The authors are not really testing for inequities. They are testing for associations between indigenous women and severe maternal morbidity.

Authors' response: We have modified the text to reflect the reviewer's suggestion.

Changes to the Manuscript: We have replaced the word "inequities" with "statistical differences in study outcomes." p.9, lines 194

2. Line 166. What do the authors mean by evaluating each outcome separately? Do they mean each component of the CDC definition for SMM?

Authors' response: Thank you for this suggested, we have clarified this language.

Changes to the Manuscript: "We used multivariate models to test for statistical differences in study outcomes between Indigenous and White women and conducted stratified analyses between rural and urban residents within each racial category (comparing rural and urban Indigenous women, for example)." p.9, lines 197-200

3. Lines 211-215. The reported numbers of affected women should be reported with 95% CIs.

Authors' response: The suggested changes have been made.

Changes to the Manuscript: Please see p.12, lines 255-265.

4. Figure 3. Models are adjusted for age, insurance payer, income and region. Why did the authors choose not to adjust for medical comorbidities such as diabetes and substance use disorder?

Authors' response: Please see response #15 to Reviewer #1.

Changes to the Manuscript: Please see response #15 to Reviewer #1.

5. Figures 2 and 3. It would be helpful if the authors could present unadjusted and adjusted results. Typically, multivariable modeling results are not presented as weighted frequencies. Therefore, this approach requires additional explanation.

Authors' response: Thank you for raising this important point. Weighted proportions were used for descriptive statistics, consistent with recommendations for the use of these data for nationally-representative findings. All other table/Figure titles and axes have been edited to reflect the appropriate measures.

Changes to the Manuscript: See updated Tables/Figures. We would be happy add additional unweighted data either in main tables or appendices, should the reviewer or editors request so.

6. Table 2. Would recommend creating a separate table for SMM and then listing the different categories of SMM based on the CDC definition so that the reader can get a sense of what morbidity is uniquely present in indigenous women.

Authors' response: We appreciate the reviewer's suggestion, but presenting these data is difficult given sample size limitations and constraints of the data use agreement. Using Healthcare Cost and Utilization Project (HCUP) data, such as the National Inpatient Sample, we are unable to report sample sizes <10.³ Beyond the two individual indicators that we currently list (blood transfusion and hysterectomy), disseminated intravascular coagulation is the only other category of SMMM with an unweighted number of cases that is large enough to analyze separately for each group of women. These results have been added to Table 2.

Changes to the Manuscript:

- Added "The incidence of blood transfusion, disseminated intravascular coagulation, and hysterectomy were also estimated for each group. These were the only individual indicators of SMMM with a large enough unweighted sample size to present data for each group of women" p.9, lines 194-197
- Please also see Table 2.

7. Separate out mortality in the results. Would present the mortality ratio for each group separately either in the text or the table.

Authors' response: The data use agreement for the data in this analysis requires that we not report any results with an unweighted sample size <10. The total number of instances of maternal death identified among our sample of Indigenous women is only n=1 (weighted n=5). This is reasonable number, given that 700 women per year die from maternal mortality in the United States, only approximately 1/3 of maternal deaths occur at the time of delivery hospitalization. Also, NIS is a 20% sample of all hospitalizations, and does not perform oversampling for specific conditions (childbirth) or for particular population groups (Indigenous people). As such, unfortunately, it is not possible for us to separately report mortality in this analysis.

Changes to the Manuscript: N/A

Discussion

1. Line 228. Can the authors expand on how this paper would inform efforts to advance maternal health equity? They report a known inequity. How can these data specifically be used to design interventions to reduce these inequities?

Authors' response: Thank you for this suggestion. We appreciate the opportunity to expand the discussion section to focus more attention on the ways these data may inform clinical and policy efforts to improve equity.

Changes to the Manuscript: We added to and modified the following text in the discussion, "Addressing the intersection of risks based on both race- and place-based inequities requires 1) inclusion of rural and Indigenous people in planning and implementation of maternity care improvement, 2) measuring maternal health outcomes based on race and geography, and 3) recognizing that Indigenous populations are

³Khera R, Angraal S, Couch T, Welsh JW, Nallamotheu BK, Girotra S, Chan PS, Krumholz HM. Adherence to methodological standards in research using the national inpatient sample. *Jama*. 2017;318(20):2011-8.

heterogeneous groups with salient individual characteristics. Profound disadvantage was identified among Indigenous women residing in rural counties, with two-thirds living in counties with median incomes in the bottom national income quartile. Concordantly, three quarters of these women had childbirth hospitalizations paid for by Medicaid. Indigenous women residing in rural counties also incurred the greatest risk for pre-existing, chronic conditions complicating childbirth, including diabetes and substance use disorders. Improving maternal outcomes for Indigenous women requires engagement with medical and social determinants of health in both clinical and policy efforts aimed at addressing these inequities. In many ways, these findings shed light on the perfect storm of conditions creating difficulty for both patients and clinicians who aim to meaningfully improve maternal health outcomes.” p.13, lines 280-293.

2. There are other limitations. For example, the data are limited to the delivery hospitalization which only captures a small subset of maternal morbidity and mortality.

Authors’ response: We agree. Indeed, only about 1/3 of maternal deaths occur during childbirth hospitalization. We have added acknowledgement of this important limitation to the manuscript.

Changes to the Manuscript: Added “These data derive from the childbirth hospitalization, and SMMM may occur up to one year following childbirth” p.15, line 336-337

Reviewer #3:

The authors studied a timely topic addressing severe maternal morbidity and mortality among Indigenous women using the Nationwide Inpatient Sample (2012-2015). However, there are few issues that need to be clarified regarding the approach used.

1. The authors stated that they used diagnosis and procedure codes compiled by CDC to identify SMMM cases. However, the CDC code only identifies cases of severe maternal morbidity. Therefore, it is not clear how the authors identified cases of mortality. They did not mention using the variable "died" in the NIS.

Authors’ response: Thank you for highlighting this omission; we now refer to the use of the variable on discharge status as a component of our measure of SMMM.

Changes to the Manuscript: Edited methods to read “SMMM was the primary outcome of this study, identified using ICD-9-CM diagnosis and procedure codes compiled by Centers for Disease Control and Prevention (CDC) or by a discharge disposition of “died”.³” p.7, lines 147-149

2. One can argue that the variable blood transfusion could sometimes overestimate true cases of severe maternal morbidity. Therefore, the authors may consider conducting a sensitivity analysis by excluding cases with blood transfusion in the absence of one of the other indicators of SMM

Authors’ response: Thank you for this comment, we have conducted the suggested sensitivity analysis. Please see response #3 to Reviewer #1.

Changes to the Manuscript: Please see response #3 to Reviewer #1. The changes to the text are summarized here:

- Added to methods: “We also conducted a sensitivity analysis that excluded cases in which blood transfusion was the only indicator of SMMM, as including these may constitute an overestimate of truly severe morbidity.” p.8, lines 161-163
- Added to results: “When cases in which blood transfusion was the only indicator of SMMM were excluded in our sensitivity analysis, Indigenous women (0.6%, 95% CI 0.5–0.8) continued to incur higher rates of SMMM compared to White women (0.3%, 95% CI 0.3–0.4; $P < .001$). Rural and urban differences were no longer significant, but sample size was very limited among Indigenous women, particularly rural Indigenous women for whom only 32 unweighted cases of SMMM were identified.” p.11, lines 246-252
- Added these findings to Table 2

3. In addition to the reported SMMM (although I have question on whether mortality was included or not included), the study would be more informative, if the authors also report racial and location (urban vs rural) differences in morbidity and mortality separately.

Authors’ response: Unfortunately, we are unable to report differences in mortality across groups due to the low frequency with which cases of maternal death are captured in this dataset (i.e. unweighted numbers too low to report). Please see Response #7 to Reviewer #2.

Changes to the Manuscript: Please see Response #7 to Reviewer #2.

Minor Concerns:

4. Under the sub-heading "analyses", the sentence from line 166 - 170 is not clear.

Authors' response: We have broken this into two sentences and edited for clarity as suggested.

Changes to the Manuscript: The sentences now read as follows: "Finally, we estimated the excess incidence of SMMM among rural, Indigenous, and rural Indigenous women. We did so by multiplying the total number of weighted cases for each group by that group's adjusted incidence rate of SMMM and subtracting the number of cases calculated when instead using the adjusted incidence rate for the appropriate referent group." pp. 9-10, lines 202-206.

5. Authors may also consider reporting proportion of each of the SMM indicators by race and location (urban vs rural).

Authors' response: Please see response #6 to Reviewer #2.

Changes to the Manuscript: Please see response #6 to Reviewer #2.

STATISTICAL EDITOR'S COMMENTS:

1. Tables 1, 2: Given the large number of comparisons in each Table, used of $p < .05$ will likely result in some spurious associations, due to multiple hypothesis testing. Suggest using a stricter inference threshold (at least $p < .01$ would be more appropriate) and should include a caveat re: multiple hypothesis testing.

Authors' response: We have appreciate the statistical editor's input and have made the suggested changes.

Changes to the Manuscript:

- Added to the methods " P values less than .01 were considered statistically significant." P.10, lines 208-210
- Tables and Figures were edited appropriately to remove references to $P < .05$

2. Tables 1, 2: Although it is stated in the footnote to Table 1 "P values for overall categories ...", is there a clearer way the Authors could show which columns are being compared? It seems confusing at first glance.

Authors' response: We appreciate the opportunity to clarify the comparators in the Table footnote and have edited the text accordingly.

Changes to the Manuscript: The footnote now includes the text " P values for the "Overall" column are Rao-Scott chi-square tests or two-sample t-tests for Indigenous versus White women. P values for "Rural Residence" and "Urban Residence" columns are Rao-Scott chi-square tests or two-sample t-tests for rural versus urban residence among Indigenous or among White women."

EDITORIAL OFFICE COMMENTS:

1. The Editors of Obstetrics & Gynecology are seeking to increase transparency around its peer-review process, in line with efforts to do so in international biomedical peer review publishing. If your article is accepted, we will be posting this revision letter as supplemental digital content to the published article online. Additionally, unless you choose to opt out, we will also be including your point-by-point response to the revision letter. If you opt out of including the Authors' response, only the revision letter will be posted. Please reply to this letter with one of two responses:

- A. OPT-IN: Yes, please publish my point-by-point response letter.
- B. OPT-OUT: No, please do not publish my point-by-point response letter.

Authors' response: OPT-IN; Yes, you may publish the response letter.

Changes to the Manuscript: N/A

2. As of December 17, 2018, Obstetrics & Gynecology has implemented an "electronic Copyright Transfer Agreement" (eCTA) and will no longer be collecting author agreement forms. When you are ready to revise your manuscript, you will be prompted in Editorial Manager (EM) to click on "Revise Submission." Doing so will launch the resubmission process, and you will be walked through the various questions that comprise the eCTA. Each of your coauthors will receive an email from the system requesting that they review and electronically sign the eCTA.

Please check with your coauthors to confirm that the disclosures listed in their eCTA forms are correctly disclosed on the manuscript's title page.

Authors' response: We confirm that all authors have submitted eCTA forms.

Changes to the Manuscript: N/A

3. Standard obstetric and gynecology data definitions have been developed through the reVITALize initiative, which was convened by the American College of Obstetricians and Gynecologists and the members of the Women's Health Registry Alliance. Obstetrics & Gynecology has adopted the use of the reVITALize definitions. Please access the obstetric and gynecology data definitions at <https://www.acog.org/About-ACOG/ACOG-Departments/Patient-Safety-and-Quality-Improvement/reVITALize>. If use of the reVITALize definitions is problematic, please discuss this in your point-by-point response to this letter.

Authors' response: Thank you. The revitalize definitions do not present any challenges for our manuscript.

Changes to the Manuscript: N/A

4. Because of space limitations, it is important that your revised manuscript adhere to the following length restrictions by manuscript type: Original Research reports should not exceed 22 typed, double-spaced pages (5,500 words). Stated page limits include all numbered pages in a manuscript (i.e., title page, précis, abstract, text, references, tables, boxes, figure legends, and print appendixes) but exclude references.

Authors' response: We confirm that our revision conforms to these expectations.

Changes to the Manuscript: N/A

5. Specific rules govern the use of acknowledgments in the journal. Please note the following guidelines:

- * All financial support of the study must be acknowledged.

- * Any and all manuscript preparation assistance, including but not limited to topic development, data collection, analysis, writing, or editorial assistance, must be disclosed in the acknowledgments. Such acknowledgments must identify the entities that provided and paid for this assistance, whether directly or indirectly.

- * All persons who contributed to the work reported in the manuscript, but not sufficiently to be authors, must be acknowledged. Written permission must be obtained from all individuals named in the acknowledgments, as readers may infer their endorsement of the data and conclusions. Please note that your response in the journal's electronic author form verifies that permission has been obtained from all named persons.

- * If all or part of the paper was presented at the Annual Clinical and Scientific Meeting of the American College of Obstetricians and Gynecologists or at any other organizational meeting, that presentation should be noted (include the exact dates and location of the meeting).

Authors' response: We acknowledge and will comply with these guidelines.

Changes to the Manuscript: N/A

6. The most common deficiency in revised manuscripts involves the abstract. Be sure there are no inconsistencies between the Abstract and the manuscript, and that the Abstract has a clear conclusion statement based on the results found in the paper. Make sure that the abstract does not contain information that does not appear in the body text. If you submit a revision, please check the abstract carefully. In addition, the abstract length should follow journal guidelines. The word limits for different article types are as follows: Original Research articles, 300 words. Please provide a word count.

Authors' response: Thank you. We have ensured that the revised manuscript and abstract comply with journal requirements. The revised abstract is 300 words.

Changes to the Manuscript: Please see revised abstract, which is 300 words.

7. Only standard abbreviations and acronyms are allowed. A selected list is available online at <http://edmgr.ovid.com/ong/accounts/abbreviations.pdf>. Abbreviations and acronyms cannot be used in the title or précis. Abbreviations and acronyms must be spelled out the first time they are used in the abstract and again in the body of the manuscript.

Authors' response: Our use of abbreviations and acronyms complies with journal policy.

Changes to the Manuscript: N/A

8. The journal does not use the virgule symbol (/) in sentences with words. Please rephrase your text to avoid

using "and/or," or similar constructions throughout the text. You may retain this symbol if you are using it to express data or a measurement.

Authors' response: All instances that use this symbol have been addressed and modified in the revised version of the manuscript.

Changes to the Manuscript: The virgule symbol has been removed throughout the manuscript.

9. In your Abstract, manuscript Results sections, and tables, the preferred citation should be in terms of an effect size, such as odds ratio or relative risk or the mean difference of a variable between two groups, expressed with appropriate confidence intervals. When such syntax is used, the P value has only secondary importance and often can be omitted or noted as footnotes in a Table format. Putting the results in the form of an effect size makes the result of the statistical test more clinically relevant and gives better context than citing P values alone. If appropriate, please include number needed to treat for benefits (NNTb) or harm (NNTh). When comparing two procedures, please express the outcome of the comparison in U.S. dollar amounts. Please standardize the presentation of your data throughout the manuscript submission. For P values, do not exceed three decimal places (for example, "P = .001"). For percentages, do not exceed one decimal place (for example, 11.1%).

Authors' response: We have reviewed the manuscript and report results as request.

Changes to the Manuscript: N/A

10. We discourage claims of first reports since they are often difficult to prove. How do you know this is the first report? If this is based on a systematic search of the literature, that search should be described in the text (search engine, search terms, date range of search, and languages encompassed by the search). If on the other hand, it is not based on a systematic search but only on your level of awareness, it is not a claim we permit.

Authors' response: We have modified the text in the manuscript to reflect this.

Changes to the Manuscript: Page 6, lines 118-119 have been edited. These edits are described in response to Reviewer #2 (Introduction #1).

11. Please review the journal's Table Checklist to make sure that your tables conform to journal style. The Table Checklist is available online here: http://edmgr.ovid.com/ong/accounts/table_checklist.pdf.

Authors' response: We have reviewed the checklist to ensure compliance.

Changes to the Manuscript: N/A

12. The American College of Obstetricians and Gynecologists' (ACOG) documents are frequently updated. These documents may be withdrawn and replaced with newer, revised versions. If you cite ACOG documents in your manuscript, be sure the reference you are citing is still current and available. If the reference you are citing has been updated (ie, replaced by a newer version), please ensure that the new version supports whatever statement you are making in your manuscript and then update your reference list accordingly (exceptions could include manuscripts that address items of historical interest). If the reference you are citing has been withdrawn with no clear replacement, please contact the editorial office for assistance (obgyn@greenjournal.org). In most cases, if an ACOG document has been withdrawn, it should not be referenced in your manuscript (exceptions could include manuscripts that address items of historical interest). All ACOG documents (eg, Committee Opinions and Practice Bulletins) may be found via the Clinical Guidance & Publications page at <https://www.acog.org/Clinical-Guidance-and-Publications/Search-Clinical-Guidance>.

Authors' response: We confirm this.

Changes to the Manuscript: N/A

13. Authors whose manuscripts have been accepted for publication have the option to pay an article processing charge and publish open access. With this choice, articles are made freely available online immediately upon publication. An information sheet is available at <http://links.lww.com/LWW-ES/A48>. The cost for publishing an article as open access can be found at <http://edmgr.ovid.com/acd/accounts/ifaauth.htm>.

Authors' response: We acknowledge that we have this information available.

Changes to the Manuscript: N/A