

## PEER REVIEW HISTORY

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### ARTICLE DETAILS

<b>TITLE (PROVISIONAL)</b>	Abortion legislation, maternal healthcare, fertility, female literacy, sanitation, violence against women, and maternal deaths: a natural experiment in 32 Mexican states
<b>AUTHORS</b>	Koch, Elard; Chireau, Monique; Pliego, Fernando; Stanford, Joseph; Haddad, Sebastian; Calhoun, Byron; Aracena, Paula; Bravo, Miguel; Gatica, Sebastián; Thorp, John

### VERSION 1 - REVIEW

<b>REVIEWER</b>	Rene Leiva University of Ottawa Department of Family Medicine Faculty of Medicine Ottawa, ON. Canada  The article mentions a couple of my references, otherwise, no other competing interests
<b>REVIEW RETURNED</b>	16-Jul-2014

<b>GENERAL COMMENTS</b>	<p>This is a well-designed population-based analysis. At the core of their hypothesis is the interpretation of the ICD-10 classification in regards to induced abortion and mortality. They use a previous paper as reference, specifically, number 37.</p> <p>I reviewed that paper as well.</p> <p>Given the fact that they based this submission on a proposed new 'classification', I was satisfied to see that they proceeded with a sub analysis using the example of the Federal District where induced abortion has been legally allowed on demand. Given the fact, that their overall conclusions did not change within this sub analysis, it allows one to concur with their proposed protocol.</p> <p>given the controversial nature of the topic, my recommendation is that a specialist statistical review takes place.</p> <p>I would try to simplified the statistical description to make it more readable for physicians who lack a stronger epidemiological background.</p> <p>As recommended above, I would highlight the rationale of why they are using the ICD-10 classification (namely in regards to reference 37)</p>
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<b>REVIEWER</b>	Karisa Harland Assistant Research Scientist, University of Iowa, Department of Emergency Medicine, Iowa City, IA, USA
<b>REVIEW RETURNED</b>	02-Oct-2014

<b>GENERAL COMMENTS</b>	<p>This study is an ecological analysis of the effect of abortion legislation on maternal mortality. A very interesting study using administrative data to try and answer an important question and the author's recognize the limitations of the ecological design. The biggest weakness of the study is that the authors appear to have tried to circumvent the word limit by providing too many appendices.</p> <p>Introduction: Excellent review of the literature and sets up the study well</p> <p>Methods: Definitions of population, maternal mortality, abortion legislation and constitutional amendments are clear. In the analysis, excellent job examining colinearity and defining independent variables</p> <p>Results: If the purpose of the study, as I believe it was meant to be, is to see the effect of abortion on maternal morality I would suggest doing an explanatory model where you leave the variable of interest (abortion legislation or constitutional amendment) in the model even if is no longer significant. In examining the tables I am not able to see the effects of abortion because it is dropped from the model and all I am provided is the final model without the main independent variable of interest. For example, in Table 2, for the model before refinement, I would suggest showing a model with literacy, LBW, skilled attendance, abortion legislation and constitutional amendment. In addition, I would only show the model after refinement. Unfortunately there are so many results in the tables and appendices that the take home message gets lost. I would suggest creating 1 table with all the multivariable models for MMR, MMRao, iAMR so a reader can compare the models and understand how different factors contribute to each type of mortality.</p> <p>Conclusion: The conclusion ties in the results nicely and you begin to see what the take home message of the article. I think this is a potentially important article if it undergoes significant revision to make the message and results more clear.</p>
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## VERSION 1 – AUTHOR RESPONSE

Reviewer Name Rene Leiva  
Institution and Country University of Ottawa  
Department of Family Medicine  
Faculty of Medicine  
Ottawa, ON. Canada

Please state any competing interests or state 'None declared': the article mentions a couple of my references, otherwise, no other competing interests

### AUTHOR REPLY

Dear Dr. Leiva: I would like to thank you for the considerate suggestions for corrections made to our manuscript; they have been carefully considered and acknowledged. Please find the responses attached to this letter and their full elaboration highlighted in blue in the revised manuscript.

### REVIEWER COMMENT

This is a well-designed population-based analysis. At the core of their hypothesis is the interpretation of the ICD-10 classification in regards to induced abortion and mortality. They use a previous paper as reference, specifically, number 37.

I reviewed that paper as well.

Given the fact that they based this submission on a proposed new 'classification', I was satisfied to see that they proceeded with a sub analysis using the example of the Federal District where induced abortion has been legally allowed on demand. Given the fact, that their overall conclusions did not change within this sub analysis, it allows one to concur with their proposed protocol.

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### AUTHOR REPLY

Our manuscript has been re-organized and re-drafted in some crucial passages in order to make it more accessible for physicians who lack a stronger epidemiological background. First, in the method section we incorporated the rationale for the outcome measures in the following terms:

“Three epidemiological indicators were calculated according to the classification proposed in a recent review.[37] The first indicator is maternal mortality ratio (MMR), which considers all maternal death codes (ICD-10 codes O00-O99, A34, B20-B24, and F53) and is often referred to as overall maternal mortality. The second indicator is maternal mortality ratio with any abortive outcome (MMRAO), which considers maternal death classified following ICD-10 codes O00-O08. The third indicator is termed induced abortion mortality ratio (iAMR), which focuses only on deaths likely associated with complications of pregnancy termination.[37] Specific characteristics of this indicator allows to circumvent the problem of underreporting of deaths from illegal abortions in countries where legal restrictions hamper the assessment of induced abortion counts and rates. First, it includes the code for medical abortion [ICD-10 code O04], which is used for the classification of deaths due to legal termination of pregnancy. Second, it also includes codes for other abortion [ICD-10 code O05],

unspecified abortion [ICD-10 code O06], and failed attempted abortion [ICD-10 code O07], which are employed in Mexico and other Latin American countries for classifying deaths from induced abortion without a clear cause or when an illegal procedure is suspected. Finally, this indicator parsimoniously excludes deaths associated to well defined pathological conditions or complications that cannot be associated with a voluntary termination of pregnancy, such as ectopic pregnancy (ICD-10 code O00), hydatidiform mole (ICD-10 code O01), other abnormal products of conception (ICD-10 code O02), spontaneous abortion (ICD-10 code O03), and complications following abortion and ectopic and molar pregnancy (ICD-10 code O08).[37]”

Second, given the controversial nature of the topic we additionally addressed the problem by incorporating two paragraphs in the section of Limitations of the revised manuscript.

“This study relies on official sources of data for mortality outcomes, live births and covariates. Errors such as underreported deaths cannot be definitively ruled out. However, minimal errors are expected since 2002 because of the strengthening of the epidemiological surveillance system that year, incorporating maternal deaths audits to identify misclassifications and minimising underreport.[115] For instance, in a 2009 audit of maternal deaths conducted in Mexico identifying causes of deaths during the influenza A H1N1 epidemic, authors were able to distinguish subcategories of causes of deaths, including complications of spontaneous abortion, induced abortion, and unspecified abortion.[116] On the other hand, instrumental bias because of different methodologies used to assess the same variable in different populations is a frequent problem in studies of multiple populations. Nevertheless, each independent variable used for this study was compiled with a single instrument applied in all Mexican states, making instrumental bias unlikely.”

“A problem in countries with legal restrictions for pregnancy termination is the difficulty to obtain counts and rates of illegal abortions. Nevertheless, the problem of underreporting of illegal abortions does not translate necessarily to underreporting of deaths from complications of illegal procedures when specific codes of the ICD-10 are in use. Recent studies in Mexico [37] and Chile [117] suggest that both mortality and morbidity from complications of illegal abortions, or abortions without a known cause are registered using specific codes O05, O06 and O07 to differentiate them from complications of other types of abortions with a well-known cause. Consequently, these specific codes were considered for the construction of iAMR in the present study. Another concern is the possibility of misreporting or misclassification of deaths from induced abortion as deaths for other causes, for example, haemorrhage or sepsis. However, in Mexico this seems unlikely because of the maternal mortality audit discussed above and the parallel decreasing trend in overall maternal mortality observed in the present study. For instance, deaths from haemorrhage have decreased 17% between 2002 (10.6 deaths per 100,000 live births) and 2011 (8.8 per 100,000 live births). In addition, there is no reason to misreport deaths from a suspected illegal abortion considering the use of ICD10 codes O05, O06 and O07. Thus, iAMR appears to be an indicator that provides a reasonable method to circumvent the problem of underreporting of maternal deaths from complications of illegal procedures in subsequent epidemiological studies in Latin America.”

Finally, in order to ease interpretation of the results by physicians who lack a stronger epidemiological background we drafted the section of the result of the revised manuscript trying to simplify our wording and/or incorporating some explanatory sentences. For example:

“Table 2 summarises the linear trends of all three mortality outcomes in each group of states and the entire Mexican country for the study period, by residence and occurrence, respectively. In each group, the  $\beta$ -coefficient represents the average change per year of the mortality outcome and the p for trend indicates the statistical significance of the overall trend.”

Reviewer Name Karisa Harland  
Institution and Country Assistant Research Scientist,  
University of Iowa, Department of Emergency Medicine,  
Iowa City, IA, USA  
Please state any competing interests or state 'None declared': None Declared

#### AUTHOR REPLY

Dear Dr. Harland:

I would like to thank you for the considerate and thorough suggestions for corrections made to our manuscript; they have all been carefully acknowledged and considered. Please find a list of responses attached to this letter and their full elaboration highlighted in blue in the revised manuscript.

#### REVIEWER COMMENT

This study is an ecological analysis of the effect of abortion legislation on maternal mortality. A very interesting study using administrative data to try and answer an important question and the author's recognize the limitations of the ecological design. The biggest weakness of the study is that the authors appear to have tried to circumvent the word limit by providing too many appendices.

#### AUTHOR REPLY

In line with your comment and editorial suggestion, in the revised manuscript we translated most of the results from the appendix to the main body of the manuscript. We appreciate your enlightening suggestions to make a more coherent and comprehensive section of results and discussion on our manuscript for the readers.

#### REVIEWER COMMENT

Introduction:

Excellent review of the literature and sets up the study well

#### AUTHOR REPLY

Thank you. This section was revised and few grammar modifications were made to facilitate the reading.

#### REVIEWER COMMENT

Methods:

Definitions of population, maternal mortality, abortion legislation and constitutional amendments are clear.

In the analysis, excellent job examining collinearity and defining independent variables

Results:

If the purpose of the study, as I believe it was meant to be, is to see the effect of abortion on maternal mortality I would suggest doing an explanatory model where you leave the variable of interest (abortion legislation or constitutional amendment) in the model even if is no longer significant. In examining the tables I am not able to see the effects of abortion because it is dropped from the model and all I am provided is the final model without the main independent variable of interest. For example, in Table 2, for the model before refinement, I would suggest showing a model with literacy, LBW, skilled attendance, abortion legislation and constitutional amendment.

In addition, I would only show the model after refinement. Unfortunately there are so many results in the tables and appendices that the take home message gets lost. I would suggest creating 1 table with all the multivariable models for MMR, MMRao, iAMR so a reader can compare the models and understand how different factors contribute to each type of mortality.

#### AUTHOR REPLY

We agree with the reviewer and the results section has been thoroughly rearranged according your recommendations. Further to translate several tables summarising important results to provide a complete picture to the readers, we rewrote several paragraph simplifying the description of statistical results. In the revised manuscript, now the results of the primary refined models are depicted in Table 7 including the effect size of all the independent variables analysed. In addition, the figures are presented for every outcome in the same table so a reader can compare the models and understand how different factors contribute to each type of mortality outcome. In addition, in the revised manuscript we have summarised all three alternative models for each mortality outcome in a new Table (Table 8). Finally, we include a new Figure (Figure 8) that depicts the proportional effects obtained in both primary and alternative models as pie charts.

#### REVIEWER COMMENT

Conclusion:

The conclusion ties in the results nicely and you begin to see what the take home message of the article.

I think this is a potentially important article if it undergoes significant revision to make the message and results more clear.

#### AUTHOR REPLY

A major issue is related to the take home messages. To strengthen the discussion and conclusion of this study, we have included a new Table (Table 9) comparing the independent variables between states with less and more permissive abortion legislation after weighted analysis. In addition, we now include a Box (Box 1) summarising what we think are key public health interventions aimed to improve maternal health in Mexico, based on the evidence of the present study.