Author's response to reviews

Title: Factors associated with maternal mortality in Sub-Saharan Africa: an ecological study

Authors:

   Jose L Alvarez (joseluis.alvarez@urjc.es)
   Ruth Gil (ruth.gil@urjc.es)
   Valentin Hernandez (valentin.hernandez@urjc.es)
   Angel Gil (angel.gil@urjc.es)

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Author's response to reviews: see over
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Dear Sir/Madam:

We are very grateful for your consideration in the revision one more time of our article entitled “Factors associated with maternal mortality in Sub-Saharan Africa: an ecological study”. We appreciate your taking the time to review our manuscript. We have seen the comments forwarded by the reviewers and corrected as follows.

Reviewer 1, Joseph U Onakewhor: Thank you very much for your reviewing. The authors have addressed the comments raised previously. However, I am still not comfortable with the conclusion that "education of women reduces MMR" since this is not supported by data from this study.

We agree. We would need a prospective study to draw such a conclusion, we have written this sentence again so that it can be more accurate in regards to our design.

In addition, I feel the findings of this study are a bit difficult to interpret because one fundamental reason: WHO estimates MMRs through modeling. Among the variables used in the model, we have general fertility rate (which depends on contraceptive rate) and gross domestic product per capita. Therefore MMR has been estimated using these variables (by WHO) and it is but natural to find an association between MMR on the one hand and contraception rate and economic factors on the other (as in this study).

You are right. Currently, only about one third of all countries have reliable data available and do not need additional estimations. A statistical model is employed to predict maternal mortality levels in many countries. This model takes into account those variables you mentioned but we use much more indicators in our study than just those two. Therefore we consider it still valuable.
Reviewer 2, Eugene Justine Kongnyuy: Thank you very much for your reviewing.

“MMR=0.39*Education Factor -0.36* Health-related Factors + constant” What is this constant? To make the equation meaningful to researchers who would want to apply the formula in their research, what this constant is or what makes the constant should be stated. Is it the ‘r*’ in Table 3 or what?

That one is just the regression constant. The "constant" term simply refers to the y-intercept of the regression line. Therefore its value is of no interest for us since we want to look at the regression coefficients which will show the relation between our variables. Maybe we can give it the value or even better take it out from our results so it is clearer. Thanks.

As we are performing an ecological study cause-effective relation can not be confirm and conclusions can not be infer to individual subjects” The sentence is not very clear. I think the sentence will need a recast. For example: “As we are performing an ecological study, cause-effect relationship cannot be confirmed and conclusions cannot be inferred to individual subjects”.

Corrected as commented, thank you, it is better now.

Add “(Table 2)” in front of the “......(15-2100)” in that sentence to show the source of those figures.

Corrected as commented, thank you.
Editorial Board comments: Thank you very much for your constructive comment.

- Maternal mortality ratio should probably be maternal mortality rate (in a ratio, two rates are compared to each other).
Our study is based on the maternal mortality ratio which is different from the maternal mortality rate. In a ratio the numerator is not included in the denominator. Here are the definitions from the WHO.

<table>
<thead>
<tr>
<th>Box 2. Statistical measures of maternal mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal mortality ratio</td>
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<tr>
<td>Maternal mortality rate</td>
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</table>


We have made some mistakes before due to translation from Spanish. Now everywhere should be read Maternal Mortality Ratio.

- Re-consider ?Health-related factors?: perhaps health care system-related?
Corrected as commented, thank you, hope it is clearer now.

(a) Provide brief rationale for the variables that are correlated to the MMR (b) discuss the drawbacks and the relative arbitrariness of labeling them Health-related, Economical, or Educational.
We have added a small explanation in the methods section for the variables and the categories. We agree that the labelling of variables in groups can be relatively arbitrary and so we have commented it in the discussion section as a limitation of the study.

Out of pocket is not mentioned as a significant correlate of MMR on the top of page 10.
It was a typing error, in table 3 we can see that there is a significant correlation with MMR (P>0.05). We have corrected and added the out of pocket variable on page 10. Now there is a perfect corresponding between the table and the text.
On the other hand, one page 12 (below), out of pocket is presented as the only factor significantly related to MMR.

Our sentence is “The out of pocket expenditure on health is interesting, however, it is the only factor that presents a significant direct correlation to MMR”. We want to show that out of pocket is the only one with a direct correlation (more out of pocket expenditure more MMR) while the others show an indirect relationship. We have added an explanation so that people do not make mistakes.

- Table 1 includes per capita government expenditure on health; Table 2 does not?
  Yes, it was there on the first version of the manuscript, it seems there was a problem when writing the second version and we missed that variable in table 2. We have corrected it.

Factor analysis:
Table 3 shows that 3 economical factors are related to MMR, while Table 4 shows that the factor analysis final solution misses just these three factors. Three other economical factors are in the final solution and used in the subsequent regression analysis in which the economical factor is not related to the MMR. The factor analysis and subsequent linear analysis give the wrong impression that economical factors are not important. Please omit Table 4 and the factor analysis from the article! Other reasons for that are: the autovalues are not really informative (standardized factor scores would probably better be); it is unclear now how the factors were introduced in the linear analysis? Were they summed or were the weights of the factor analysis used? How? And in what direction should the factors be interpreted and the related regression coefficient? The higher, the better or the worse? And the -0.39 * Education, is that strong or weak (and what direction?)?

Factor analysis just uses those variables that can be group in a factor. The problem with economical factors is that they only account for 9.1% of the variance, probably due to obvious correlations between economical factors and other Sanitary and Educational variables. We have explain that we do not mean that economical factors are not important and so we have stated it in the paper. We hope it is clear now. Once factors were obtained they can just be used in the linear analysis as if variables. The regression coefficients can be interpreted as in any other multiple regression model. All regression coefficients...
have a significant value with a p<0.05 as stated (except that of economical factors as mentioned). The bigger a value is the more it can explain the MMR.

The drawback of the ecological design are not sufficiently discussed (one sentence on end of 2nd paragraph on page 11). Please tell a bit more and try to be more careful when subsequently discussing the infant mortality rate and MMR relation (2nd paragraph on page 12), where still a causal direction is suggested. We have added some references to show the limitations of the ecological study. We have been careful no to show causal-effect relationship and change that sentence.

Last sentence on page 12 is unclear, but potentially relevant. Please clarify. We hope it is clear now.

There is a strong relation with the HDI: should that be referred to too in the Discussion? How? We have commented it in the discussion and added references.

Finally we are very grateful for your constructive comments. We hope everything is better now. Let us know any aspect we should improve.

Again, thank you for your consideration and I’m looking forward to hearing back from you.

Sincerely,

Jose Luis Álvarez Morán