Title: Factors Influencing Unmet Need for Family Planning among Ghanaian Married/Union Women: A Multinomial Mixed Effects Logistic Regression Modelling Approach

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Reviewer: Micaela Comendeiro Maaløe

Reviewer’s report:

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Title: Factors influencing Unmet Need for Family Planning among Ghanaian Women: A Multinomial Mixed Effects Logistic Regression Modelling Approach

This paper aims at identifying which factors could act as determinants influencing the existence of unmet need for family planning in Ghanaian married/union women at their reproductive age (15 to 49 years) by using the variables included in the Ghana Demographic and Health Survey (year 2014).

The paper deals with a relevant issue, since family planning services have shown to reduce unintended pregnancies, unsafe abortions, and consequently maternal and neonatal morbidity and mortality in many countries. Getting to know those multidimensional factors which influence unmet need for family planning could help decision makers authorities to reorient policies, maybe not only scaling up the uptake of family planning, but also transcending the borders of strictly focusing on sanitary measures.

In general terms, it is an interesting topic, even though there is already a lot of international literature addressing it. Therefore, I think that authors should use some space in the background section to point out which are the specificities of Ghanaian population, as well as giving some brief information about the Ghanaian health system context, that justify addressing the study. Otherwise it gets difficult to fully understand to common readers the contribution of this paper to the already existing evidence.

On the other hand, I think that the authors must give some insight about various aspects of their analyses. I pose my comments following the page numbering of the manuscript when needed:

1. Since family planning services are meant to counsel all kind of individuals, including single women without stable relationship whom even more deeply suffer the consequences of unintended pregnancies, readers would appreciate the authors briefly explaining why they only focus on married/union women. Any rationale you could provide? In that sense, the title should also specify "married women" to avoid confusion.
2. Since the source of data comes from a survey, responses are a subjective source of information (survey biases), so it seems convenient to deal with responses in terms of what the respondents "refer to ... (meet, feel, and so on)" and not in terms of "having", which could seem a very strong language.

3. Background section, page 5, 1st paragraph, lines 12-14. Authors point out the considerably variability that in The 2014 Demographic and Health Survey is shown regarding women's knowledge of contraceptive methods across different population demographics. What does the expression "population demographics" precisely stands for in this case? Which survey variable or variables do the authors refer to? Have the authors considered to assess if this/these variable/s could act as clusters in the regression models?

4. Methods section, Sampling Approach and Study Population subsection. This subsection is confusing and would need rephrasing. Although it is not necessary to deeply explain all the details of the multistage sampling process of the survey, and therefore is referenced "elsewhere", it is necessary to inform about which are the clusters, mostly if these will be subsequently used for designing the multilevel regression models. On the other hand, the reported sample size, extracted to run the analysis, refers to the total of "women" (aged 15-49), without specifying which of them are the married women, the ones the authors finally assess, as reader must guess looking at table 1 or wait until he/she gets to the Results section. May be, the inclusion of a flowchart describing the main composition of the sample could easier readers follow-up. Consider including in the aforementioned flowchart the inclusion and exclusion criteria, given that they are not specified in the following sub-section, which is curiously titled as such.

5. Methods section, Study Outcome, Inclusion and Exclusion Criteria. As mentioned before, no inclusion nor exclusion criteria are shown in this paragraph and yet nothing is mentioned about which are the variables of the survey used in the analysis. I would suggest renaming the subsection, and include information about the variables that will act as regressors in the models, their characteristics and meaning, specifying the group they will be in (socio-economic, socio-cultural, psychosocial, …)

6. Methods section, Statistical Analysis. This sub-section seems unnecessarily long with some sentences containing obvious information, while in contrast there is still a lack of detailed information about which and what kind of variables are being used for the analysis and which of them is acting as cluster. For instance, suffice it to say that bivariate analysis was used to discard non-significant variables, since the precise degree of association would only be obtained from multivariable models, once optimized, as you propose afterwards in the sub-section of "Model Building", otherwise one could be underestimating the issue of omitting relevant variables.

Page 7, lines 27 to 33. Why only these four variables? Any rational the authors could provide?

7. To better understand how the building-up model strategy works and if it significantly improves its effects on the outcome (explained at the Methods section, Model Building with Potential Risk Factors subsection), consider redesigning table 1 from the Results
section to also include estimated parameters information of the three models prior to Model 4 showing the variation in the remaining unexplained variance.

At the same time, it is not clear in which stages of the analyses were clusters considered by using multilevel modelling. Was the multilevel approach also used in the building-up model strategy? Which criterion have the authors used to observe the cluster effect and consequently, finally discard the multilevel modelling?

8. Results section. Consider rephrasing expressions when explaining the results, to easier comprehension, avoiding obviousness and sticking to just one decimal.

Results section, page 10, 1st line. First two sentences should be clearer explained. What does unobserved effects of clusters stand for? Which are those clusters if previously, in the first lines of page 8, it has been said that "In absence of any significant unobserved cluster effect, our model represents an ordinary multinomial logistic regression?"

9. Consider re-editing labels of legends in figure 2 to directly show information more precisely, mainly about outcome variable. Also give more space between axis titles and their labels.

10. Finally, consider including in the Conclusion section a brief explanation about which variable or type of variables (socio-demographic, socio-economic, socio-cultural and psychosocial) better predict the unmet need for family planning and if it differs in the unmet need for limiting from the unmet need for spacing

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