Author's response to reviews

Title: Modelling strategic interventions in a population with a total fertility rate of 8.3: a cross-sectional study of Idjwi Island, DRC

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Author's response to reviews: see over
Dear Editors,

Thank you for considering our manuscript for publication in *BMC Public Health*. We have addressed the reviewers’ comments, and our responses are below. We also made three updates to our results:

**Update 1: Correction to direct estimate of TFR**

TFR is calculated from age-specific births and women-months of exposure to pregnancy. We discovered an error in our count of age-specific women-months, which led to an underestimation of Idjwi’s TFR. With the support of a computer programmer with expertise in DHS datasets, we corrected our estimate of TFR from 6.1 to 8.3. This correction does not change any conclusions in our analysis; the revised number continues to provide strong evidence that Idjwi has not yet entered a fertility transition. We continue to argue that addressing high fertility is crucial to women’s empowerment, resource depletion, and breaking a poverty trap on Idjwi.

**Update 2: Correction to Table 5 labels**

Table 5 summarizes reasons that women with an unmet need for family planning do not use contraception. Due to a labeling issue, we previously swapped two sets of response category labels in Table 5. This mistake is corrected.

**Update 3: Qualitative data from key informant interviews and focus groups**

The qualitative data that we collected in the summers of 2010, 2011, and 2012, provided much of the context and understanding on which we based our recommendations. Since the weak link between our results and recommendations was mentioned by all reviewers, we felt it was important to include information and perspectives from community members in the background and discussion sections of the paper.

Editor-in-Chief Comments:

1. **Please remove the visible vertical lines of the Tables.**

   We removed vertical lines from the tables so they comply with BMC Public Health layout guidelines.

2. … **Please note that we are unable to display vertical lines or text within tables, no display merged cells: please re-layout your table without these elements…**

   We removed a merged cell from Table 1 so it now complies with BMC Public Health layout guidelines.

Referee 1 comments:

1. **[minor] Include brief discussion/references to previous studies in LDC’s where it has been shown that TFR may not come down until infant and child death rates are diminishing, and indicate whether this might be the case in this population.**

   We added a paragraph to the background section about fertility transitions, in which we mention that reduced infant and child mortality are antecedents to fertility declines, and we cite the Khanna Study in Punjab:
“Fertility transitions are generally proceeded by a reduction in child mortality [21, 22], and are accompanied by improvements to health and economic conditions including women’s increased access to education and economic opportunities [23].”

The referee makes an excellent point about the importance of child mortality. We added the following paragraph to our discussion:

“Evidence from countries that have transitioned from high to low fertility suggest that reductions in child mortality are often a prerequisite for lowering fertility preferences [21], although this is not a necessary condition (e.g., France observed sustained reductions in fertility prior to mortality declines) [40]. We do not report child mortality statistics here because we have evidence of under-reporting of child deaths in our survey. Assuming that under-five mortality on Idjwi is at least as high as the rest of South Kivu province at 186 deaths per 1000 live births [12], the literature suggests that improving child survival is key to reducing the TFR.”

In our recommendations we acknowledge the likely link between child mortality and fertility in this population, and we suggest ways to reduce child mortality:

“Based on our results and perspectives from the literature and the field, we recommend interventions that empower women with education; increase geographic, economic, and social access to family planning for women and men; promote extended periods of breastfeeding; and reduce child mortality. Finally, we recommend the development of a community health worker program that offers basic family planning, and maternal and child health services based out of Idjwi’s health centers, ensuring that community health workers are compensated and supported with adequate resources to promote worker quality and retention [48]. In other low-resource settings, paid community health workers play an integral role in educating the public about family planning, delivering contraceptives, and providing basic child health services such as life-saving oral rehydration therapy to children with diarrhea [46,47].”

2. [minor] Include at least a reference to historical data on prolonged breast-feeding in the Congo (one recalls that the “Institute de Medicine Tropicale” in Antwerp, Belgium, did such studies). Why the decline?

We deeply appreciate this question and recommended reading; it introduced us to a literature about the historical context of breastfeeding in the DRC that we had not been aware of. We learned that in central and western DRC, fertility levels fell in the early and mid-1900s due to increased transmission of sterility-causing STIs. In these areas, polygyny was common, women practiced abstinence for two to three years after a birth, and tended to breastfeed for two or more years largely because there were no animal sources of milk, all of which acted to space and limit births. It is argued that fertility in these regions began to rise after ‘re-education’ campaigns by European women promoted monogamy, return to sexual activity soon after birth, and replacement of breast milk with imported milk power or animal milk1. It is not clear this sequence of events unfolded in eastern DRC where Idjwi is located. In the east, polygyny is less common, animal milk has long been available and fed to infants, and fertility was not impacted by sterility-causing STIs.2 Therefore we do not speculate if and how there was a decline in breastfeeding on Idjwi.


3. [minor] Add more references that would show how to reach mothers with information that can affect behavioral change.

In our recommendations we describe the venues and programs in which information, training, and support can reach mothers to breastfeed for extended periods, with reference to a World Bank working paper and review article discussing the structures and successes of breastfeeding programs around the world.

“Extended breastfeeding education campaigns empower women who wish to control their birth spacing but who are unable to access, or prefer not to use, modern contraception, with the important additional benefit of improving child nutrition and survival [26]. New and expecting mothers can be reached during antenatal care visits, via public campaigns, and at facility-based deliveries with information about the effects of extended breastfeeding on birth spacing and child health. [45]”

4. [minor] The role of men in affecting needed behavioral change is implied; which are the references that show effective programs for such? In Haiti, women produced small dramas about how they are beaten and “treated like donkeys”, and invited men to watch their dramas. They reported that men had ceased some of the beatings.

This was an important point. We added the following text to the background and cited a review article by Sternberg and Hubley evaluating men’s involvement in reproductive health programs.

“Where violence against women is widespread, programs that educate men about reproductive health, and engage men in conversations about gender equity have made headway in promoting women’s reproductive health and empowerment [27].”

In the discussion section, we suggest that groups engage men with reproductive health information and services, and recommend “creating safe spaces for men to investigate masculinity and to practice respectful behaviors toward women; and integrating gender justice programs into classrooms and afterschool activities” based on a successful program run by HEAL Africa in mainland eastern DRC, which we cite. Unfortunately, however, we do not feel there is sufficient space to give further specific examples since we shorted our recommendations to make space to discuss the recommendations offered by community leaders to improve women’s empowerment and reduce fertility.

Referee 2 comments:

5. p. 10. MEASURE DHS, not Measure DHS. MEASURE is actually an acronym.

We changed “Measure DHS” to “MEASURE DHS” throughout the manuscript.

6. p. 11. What you are giving in (1) and (2) are probabilities of selection. The weights should be inversely proportional to the probabilities of selection. This is very important. If your software package is treating (1) and (2) as weights, then you must replace them with their reciprocals.

We thank the referee for identifying that we reported household probability of selection, rather than household sampling weight. We have corrected the equation in the paper. The women weight equation was correct. Sampling weights were correctly calculated in the analysis.

7. p. 14. (3) is not intended to be a device for estimating the TFR, although it is sometimes incorrectly used that way. The TFR, measured in a survey such as yours, is one of the terms required to estimate the C’s. Your PF (TF in the original Bongaarts framework) is much too
high at 21. That’s why you are getting an impossibly (literally) high value of the TFR. I suggest you go to http://www.measuredhs.com/publications/publication-AS23-Analytical-Studies.cfm and use the Bongaarts framework as given there, rather than the Stover modification.

We took a closer look at our calculation of TFR and discovered a mistake in our calculation; the corrected direct estimate of TFR (8.3) is closer to the TFR modeled with Stover’s framework (9.9). We also calculated TFR with Bongaarts’ proximate determinants framework, and it yields a nearly identical TFR (9.8). Here are our results in both frameworks.

**Bongaarts**

- $C_m$: proportion of women who are married or living as married
- $C_c$: proportion of married women currently using contraception
- $C_a$: induced abortion rate among married women [assumed]
- $C_i$: mean duration of postpartum infecundability
- $TF$: total fecundity among married women

$$\text{Modeled TFR} = C_m \times C_c \times C_a \times C_i \times TF$$

- **Corrected direct estimate of TFR**: 8.3
- **TFR modeled with Bongaarts’ framework**: 9.8
- **TFR modeled with Stover’s framework**: 9.9

**Stover**

- $C_x$: proportion of women 15-49 who are sexually active
- $C_f$: proportion of sexually active women who are infecund
- $C_u$: proportion of sexually active, fecund women using contraception
- $C_a$: induced abortion rate [assumed]
- $C_i$: mean duration of postpartum insusceptibility
- $PF$: potential fertility among women who are sexually active and fecund from 15 to 49

$$\text{Modeled TFR} = C_x \times C_f \times C_u \times C_a \times C_i \times PF$$

- **Modeled TFR using Bongaarts’ framework**: 9.8
- **Modeled TFR using Stover’s framework**: 9.9

We choose to use Stover’s updates to Bongaarts’ framework because:

- We asked women about sexual activity regardless of marriage/union status. On Idjwi, 95.6% of women between 18 and 50 reported being married or in a union, and an additional 3.7% of women reported sexual activity outside of marriage/union. $C_x$ is a better measure of exposure to pregnancy than $C_m$, and we believe our data are complete enough (e.g. sex outside of marriage is sufficiently reported) to leverage Stover’s updated framework.

- Bongaarts’ framework does not account for the overlap of infecundity and sterilization. This overlap has become more important as the convention for women’s reproductive period changed from age 15-44, at the time when Bongaarts’ framework was developed, to age 15-49 today. In settings where sterilization is common, Bongaarts original equation has been shown to overstate the effect of contraception on fertility due to a large portion of mostly older women who have become infecund and previously undergone sterilization. Although sterilization is rarely practiced on Idjwi, we believe that a strength of Stover’s framework is the addition of $C_f$, an index accounting for the percent of sexually active women who are infecund.

- Stover’s potential fertility (PF) constant is related to, but different from, Bongaarts’ total fecundity (TF) constant. Stover’s PF is the maximum number of children a woman could bear if she remained sexually active and fecund from age 15 through 49 without any constraints on

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her fertility, while Bongaarts’ TF is the maximum number of children an average married woman bears during her reproductive career given her potential for infecundability. A PF of 21 is plausible among the narrowly defined sub-group of women.

We used a proximate fertility framework to decompose the contributions of different proximate determinates, specifically use of contraception and breastfeeding, on total fertility. Based on the relative contributions of breastfeeding and contraception on fertility, we modeled how current (measured) fertility would be expected to change under different scenarios of family planning interventions.

In conclusion, we believe that Stover’s update to Bongaarts’ framework provides a useful decomposition of proximate determinates of total fertility among all women (not just married women). We try to clarify our language so readers understand that we used the proximate determinants framework to distinguish the current effect of contraception and breastfeeding on total fertility, and not to estimate the total fertility rate.

8. p. 17. The measurement of unmet need has recently been revised. You do not need to change your calculations, but it could be worth noting http://www.measuredhs.com/publications/publication-AS25-Analytical-Studies.cfm.

We appreciate this resource. Since the specific definition of unmet need is rather convoluted and publically available, we decided to shorten the description of unmet need to: “A woman is considered to have an unmet need for family planning if she wishes to space or limit her births now or in the near future but is unable [33].” We cited the 2006 DHS Guide to Statistics which explains how we calculated the indicator using the “old” algorithm. While the 2012 revision to the algorithm is interesting, we struggled to see a way to incorporate it. Since the differences between the algorithms have little impact on the estimate of unmet need, we decided against adding this reference.

9. I have to point out that your recommendations do not emerge from your findings. Your survey provides a helpful description of the setting but the recommendations should be buttressed by additional evidence that the kinds of services you propose have been effective in bringing about change in other comparable settings. Such evidence may not be so easy to find, because economic development and education are typically important antecedents for increases in contraceptive prevalence.

I would consider it essential for you to identify at least one comparable setting, as of perhaps 20 years ago, in which the introduction of the kinds of services you describe have clearly led to increases in contraceptive prevalence, in the absence of parallel economic development. The setting should be in sub-Saharan Africa, NOT in South Asia, for example.

I believe your proposed interventions are desirable but in a journal article you should be required to provide more of a rationale for your recommendations. That’s putting aside the fact that such specific policy recommendations are not typically included in a journal article.

As an applied research piece, we feel it is appropriate to offer actionable recommendations, however, we fully agree that this piece previously lacked a strong conceptual framework and sufficient evidence to link our results with our recommendations. Since our recommendations derived from interviews and focus groups in eastern DRC (as well as survey results and the scientific literature), we added a description of our qualitative work to the methods section, and give more context to the dynamics of family planning provision on Idjwi using information gathered in interviews and focus groups.
We hope that by adding a paragraph to the background about fertility transitions, more context from our qualitative work, and clearer structure to the manuscript, that the referees feel we sufficiently link our results to recommendations and provide ample evidence to support our recommendations.

In the background we mention Abdel Omran’s seminal article outlining the epidemiologic-demographic transition theory, and add:

“Evidence of high fertility and high mortality on Idjwi indicates that this population has not yet entered a fertility transition. Fertility transitions are generally proceeded by a reduction in child mortality [21, 22], and are accompanied by improvements to health and economic conditions including women’s increased access to education and economic opportunities [23]. Access to contraception, especially among young women, is critical for women to be able to control fertility and leverage educational and economic opportunities [24]. In this case, access to contraception is not only a geographic and economic challenge, but also a social one; effective family planning programs put women solely in charge of their own fertility decisions which may have previously been influenced by husbands and extended family [25]. In societies where women have limited control over their own fertility, practicing extended periods of breastfeeding can help to lower fertility levels [26]. Where violence against women is widespread, programs that educate men about reproductive health, and engage men in conversations about gender equity have made headway in promoting women’s reproductive health and empowerment [27].”

We pick these points back up in the discussion:

“From a public health perspective, there is a strong imperative to translate findings to practical solutions [39]. Here, we discuss several ways in which individual women’s needs for family planning can be met to achieve personal fertility preferences and reduce fertility rate at a population level. We use perspectives from key informant interviews and focus groups on Idjwi, as well as the scientific literature, to formulate specific recommendations in the areas of women’s empowerment and improved health services.”

We updated background information about violence against women and women’s empowerment based largely on interviews and focus groups:

“Many factors limit the provision of family planning services on Idjwi. The island’s health personnel, infrastructure, supplies, financing, and outreach programs are insufficient to meet local needs. The health system receives no support from the Congolese government and relies entirely on user fees and foreign assistance. In interview, local health practitioners acknowledge the need for family planning, but are reluctant to discuss the topic with patients if their practice has no regular supply of contraceptives. Additionally, most women visit health centers only for perinatal or emergent care, and many rely entirely on traditional and home remedies. As a result, the health system provides few women with options or information (Table 2).

Sociopolitical factors also limit access to family planning. In focus groups, women argued that poverty, limited education, geographic isolation, patrilineal inheritance, normalization of violence, lack of formal justice systems, and absence of women in government all buttress social conservatism and suppress women’s reproductive rights. In other similar settings, women’s disempowerment in terms of limited decision making power within intimate relationships [17,18], violence against women [19], and low education [20] limited access to reproductive health services, and promoted high fertility. Furthermore, half of the island’s population is devout Catholic, and local priests maintain that condoms, injections, and other "unnatural" forms of contraception are forbidden.”
Ultimately, we are very grateful for this and related comments (below) because they helped us to better structure the manuscript.

Referee 3 comments:

10. [major] The question posed by the authors does not seem to be well defined. The survey is described, as is the calculation for the unmet need for family planning, however the recommendations are related to implementation rather than what is described in methods and results.

We revised and condensed language in background section, and stated our research aim more explicitly. The last paragraph in the background now reads:

“\textit{In this context of poverty, high fertility, and social marginalization, we investigated women’s needs and desires for family planning, and modeled scenarios to meet these needs based on proximate determinants of fertility. We discuss results and make evidence-based, actionable recommendations drawing on the literature as well as key informant interviews and focus-groups conducted in Idjwi communities.}”

This comment seemed similar to Referee 2’s comment 9, and helped us to more tightly structure the manuscript. Kindly see our responses to comment 9 about how we did this.

11. [major] Elements of Background, Methods, and Results are misplaced within the article, i.e. much of the information on methods for determining unmet need for family planning seems more appropriately placed in the background.

We moved several sections of text and added subheadings to give more structure to the text. For example, we added the sub-section “Primary Outcomes” to the methods section and described the calculations of “unmet need” and “preference for contraception” here. We moved proximate determinates of fertility index values from the methods to the results section. We also reorganized the results section so sub-headers followed our stated outcomes. We extensively restructured the paper, and believe all of the elements have been properly reorganized.

12. [major] The data appear to be sound, but that which is presented is not well referenced in the results, discussion or conclusion. Much of the discussion references issues which are not addressed by the methods. The authors suggest engaging NGOs, etc. but this was not part of the background, methodology, or results.

We hope that by structuring the manuscript, ideas introduced in the background are reported on and discussed later in the manuscript. We also hope that by adding more information in the background about the dynamics between government/health system officials, NGOs, church officials, and community members, that our discussion of NGO engagement is better placed. Kindly see response 9 for more detail.

13. [major] There needs to be better distinction (perhaps separate papers) made between the methods and results related to conducting the survey vs. estimating the unmet need for family planning.
Since our survey was not described elsewhere, we felt it necessary to mention how we obtained our data. However, to be clear that the focus of this paper is on modeling proximate determinates of fertility and not a survey methodology, we changed the first sub-header in the methods section from “Survey Method” to “Household Survey Data”.

14. [major] While limitations of the work are clearly stated, they are not complete. A major limitation to consider would seemingly be that men were not involved in the survey, given the male-dominated society described in the article.

We agree. We added the following to the limitations:

“Additionally, this study did not interview men about their fertility preferences, or their sexual health attitudes, knowledge, and behaviour which is important for designing interventions that include men.”

15. [major] There is no reference to work upon which the authors state they are building, both published and unpublished. It seems as if perhaps the methods of the survey were previously described given the incomplete description in this article.

We hope we have clearly indicated the literature we are referring to and building on with the addition of more than a dozen new citations to the background and discussion sections.

We do not describe our survey methodology elsewhere because we closely followed the protocols of the Demographic and Health Survey (DHS), a well-established survey. We explain our questionnaire, sampling strategy, and age range of respondents because these deviated from the DHS protocol.

16. [minor] The title does not accurately convey what has been found, as it describes the process and not the result

We added Idjwi’s high TFR value to the title. It now reads: “Modelling strategic interventions in a population with a total fertility rate of 8.3: a cross-sectional study of Idjwi Island, DRC”.

Sincerely,
Dana Thomson, MSc, on behalf of the authors of “Modelling strategic interventions in a population with a total fertility rate of 8.3: a cross-sectional study of Idjwi Island, DRC”. [Formerly: “Modelling strategic interventions in high fertility, low resource populations: a cross-sectional study of Idjwi Island, DRC”]