Reviewer’s report

Title: Can sexual health interventions make community-based health systems more responsive to adolescents? A realist informed study in rural Zambia

Version: 0 Date: 24 Sep 2019

Reviewer: Burcu Bozkurt

Reviewer's report:

Dear Dr. Mulubwa and other esteemed authors:

I enjoyed reading this paper, as it examines a very interesting and practically important research question around the circumstances that may determine whether complex SRHR interventions targeting adolescents succeed or fail. This topic is important considering global discussions around attaining universal healthcare coverage for all by 2030, and what the next iteration of SRH-related global, regional, and local-level commitments will entail. Additionally, the use of a qualitative, iterative approach is appropriate given the authors are aiming to uncover detailed information about the context in which the RISE initiative is implemented to shed light on how, why and under what circumstances SRHR interventions can transform the CBHS. I also recognize that the authors built the dependability of the case study data in the research analysis process through meetings to get feedback from co-authors, and later, other independent researchers. I applaud that the framing of the findings through the CBHS lens is comprehensive and multi-sectoral. Lastly, the paper is generally well-written and well-structured.

Below, I discuss my main comments and suggestions, which will hopefully prove constructive as you continue to revise your manuscript.

Overall strategy
Major
1. Clarifying the goal of the paper in relation to RISE implementation. I struggled to understand, at times, how "transformation of the CBHS" was derived as the overall outcome of community-based SRH interventions, and of RISE, in particular, from the two main expected outcomes pointed out by participants. This was further exacerbated by differing explanations of the goal of the study: "to explore why, how and under what circumstances complex interventions such as the combined intervention arm of RISE succeed or fail" versus "circumstances [under which] community-based health systems are responsive to the sexual reproductive health of adolescents." Success was pre-established, it seems, as the intervention's ability to transform the CBHS (e.g. this became a programme theory), even though this may not have been an explicit goal of RISE. The discussion recognizing that interviewees may have found it difficult to discuss more abstract health system outcomes rather than the narrower RISE outcomes with which they are intimately familiar made me question, then, the fidelity of the mechanisms captured in the paper, and whether the themes that have been captured are connecting the right intervention/context/actors to the right outcomes. In other words, can RISE's intervention components be mapped to CBHS transformation as an outcome, considering its stated outcomes and who is being interviewed (those involved in RISE)? I recommend a succinct, but more robust discussion or defense at the beginning of the paper that "transformation of the CBHS" is an implicit outcome of a complex intervention like RISE, and it is thus suitable and appropriate to map to RISE's intervention components, context, and actors.
2. Anchoring in the case study approach. One of the main strengths of the paper - its deep exploration of the relationships between different parts of the RISE intervention and the context surrounding its implementation as a case study - is currently under-utilized. While the findings shed light into the rich local context of RISE, this section could be strengthened with short signals, when appropriate, to the reader about which component or aspect of the RISE intervention is being discussed or touched on by any given quote, since information about RISE as an intervention is provided only at the very beginning of the paper.

3. Acknowledging nestedness of mechanisms. The authors grouped mechanisms at the individual and collective (interrelationship) levels, and later discussed how individual mechanisms would trigger collective mechanisms. Might these mechanisms be nested, rather than sequential? Authors should consider re-visiting Figure 2, which presents the individual-level (adolescents) and collective level (parents, CBHWs, and Teachers) mechanisms as opposing forces, when authors imply that these mechanisms have a sequential (and perhaps, even nested) relationship.

Minor

4. Revising Figure 1. In line with #1 above, I would recommend amending the "outcomes" in Figure 1 to align with language in the rest of the paper and clarifying the difference between "CBHWs" and "health care workers." It is also not clear what the acronym "ARCBHS" stands for in this conceptual map.

Data

Major

5. Providing more information about participants. Readers do not know who the 16 interviewed stakeholders generally were in relation to the intervention, and thus, to what extent they were qualified to speak to different aspects of RISE or whether certain types of stakeholders are over-represented. While the study authors provide reassurance that stakeholders were selected based on their relevance to the study and involvement with RISE, adding some more detail about what aspects of RISE or the CBHS these stakeholders were involved would increase confidence in the findings.

6. Mitigating social desirability bias. Due to limited information about the qualitative procedures of the study, it's unclear to what extent social desirability bias may have played a role in the themes and proposed mechanisms stakeholders offered. To this end, I suggest including information about any additional procedures which assured participants that their responses would not affect their professional involvement or reputations, for example, to allay bias concerns.

Minor

7. Making quotes more informative. Quotes in the Findings section might be more informative if attributed to domains or general roles of the interviewees, keeping in mind research subject confidentiality.

Analysis/methods

Major

8. Touching on strength and level of contextual factors. In discussing the authors' theories about how contextual factors enable or inhibit the successful transformation of the CHBS through RISE, it may be important to indicate - either in the Findings or Discussion section - not only the directionality of these contextual factors (e.g. presence of policies is generally good), but the valence or strength of these four dimensions from the data and the implications of that. Was one of these four dimensions
indicated to be "stronger" forces than the others? Were they recognized as "stronger" forces, perhaps, amongst certain types of stakeholders, or for certain types of actors? Thinking about this might yield more novel theory.

9. Recognizing any divergent codes. While the authors explain their use of a retroduction approach in the final stage of analysis to develop the mechanisms that are theorized to lead to certain outcomes, it's unclear how any divergent codes or themes were managed in prior steps. Including a few more sentences on the decision to merge codes into larger themes in the second to last bullet, despite potentially losing important context or nuance, would greatly help the reader track how analysis led to programme theory development.

Minor
10. Distinguishing actors. In the Findings-Mechanisms section, it was confusing whether the mechanisms being discussed were offered from the actors in italics, or were offered about the actors in italics from all the stakeholders involved in the study. While I believe it is the latter, I recommend adding an additional sentence in the Mechanisms section introducing the reader to this format to prevent confusion in casual readers.

Conclusion and balance
Major
11. What next? Given practically important findings which may influence the decisions of those who work to implement similar complex interventions, I found myself yearning for more information about how these findings might be used to adapt or improve RISE, or what the testing of these theories might look like in the future. Given the paper's focus on contextual factors and mechanisms and its case study design, the authors should consider adding more practical take-aways/future steps for RISE in the Discussion and/or at least nodding to RISE as the intervention used as the case for this study in the Conclusion.

12. Correcting generalizability concerns. On page 28, the authors state "Soliciting for information based on rural Zambia as the context limits the generalizability of our findings to similar settings of rural CBHSs with high adolescent pregnancies and early marriages." I encourage you to read, "Generalizability in qualitative research: misunderstandings, opportunities and recommendations for the sport and exercise sciences" (Brett Smith). Though it is not in our field, it is being cited amongst qualitative researchers because it addresses the problematic implications of applying the standard of statistical-probabilistic generalizability to qualitative research, which does not look to attain the same goal. I would strongly recommend amending this sentence - generalizability is limited in this study because of its case study design only looking at the RISE intervention, not because it was implemented in Zambia.

Minor
13. Amend Figure 2. I'd suggest a final review of Figure 2 to ensure readability, alignment, and straightening of the text boxes to increase readability.

14. Re-visit "uptake." On page 26, the authors state: "From our literature search, we found no study that has reported on factors that affect uptake of the intervention in the CBHS (as defined in our study), thus making our article distinct." This highlighted an area of ongoing concern that there seems to be a lack of clarity about whether the ultimate objective is CBHS transformation or intervention uptake/acceptability (as raised in point #1). As a reader, it seems as if this study, to me, is reporting on the factors/mechanisms that affect transformation of CBHS as a result of an intervention. Additionally,
how universal is the CBHS definition used in this study? If CBHS is not generally defined in the comprehensive way it was used in this study, then this statement seems an overstatement of novelty and I suggest further amendments.

Overall, I see great potential for this study to contribute to the literature and our understanding of complex intervention implementation in different settings. Good luck!

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An article whose findings are important to those with closely related research interests

**Quality of written English**
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