Reviewer's report

**Title:** Distributions and trends in sexual behaviors and HIV incidence among men who have sex with men in China

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**Reviewer:** Travis Sanchez

**Reviewer's report:**

**Overall Comments:**

The topic is important to the field and this paper is generally of sound scientific quality. The study questions are well defined and the methods are appropriate for the questions posed. There are some deficiencies in the method description that should be resolved by the authors. The meta-analysis uses previously published data that are presumed to be sound, but I did not review the individual studies utilized in this analysis. The authors’ selection criteria for study inclusion appear appropriate. Additional information on how studies reported partner and act numbers are needed for readers to be able to properly determine the validity of the method – see detailed comments below. The data are interpreted judiciously, but I think there may be a deficiency in their practical interpretations. For instance, the authors assert that the lower bound of mean number commercial sex partners in a six month period is approximately 1. How likely is it that on a population-level estimate that most MSM have at least 1 commercial sex partner? Is this the proper interpretation? It then brings up questions about the way in which the authors analyzed the partner number/act data from the studies. How were averages for the studies derived? Were averages only calculated for those who reported that type of partner (i.e., no “O” partners were included in the averages)? Having this additional detail in the methods and discussing the potential practical interpretation of the data would be important. The authors also claim that the increasing incidence in their study is due to increasing HIV prevalence, but this data is not presented anywhere in the paper. It is also unclear how variations in HIV prevalence among those MSM with different partner types was (or was not) accounted for in the incidence modeling process. Another practical interpretation issue for HIV incidence calculation is that their overall estimate of incidence is greater than that from all of the partner categories combined. Though one can assume that this is due to additive effects of partner number and sex acts, this is not clearly interpreted. Finally, though the authors appropriately acknowledge their limitations regarding imputation using very sparse data points, I think the scientific validity of creating a precise partner/act number from no actual real data is of different scientific validity than modeling data based on empiric findings. This data should not be presented with the same level of certainty as those modeling results which have some empiric data on which to rest. I think with additions to the method section and more being said about practical interpretations of the data in the discussion, this paper would contribute well to this field of study and our understanding of MSM sexual risk for
Detailed comments (Major Revisions needed):

Abstract:
1. Methods should have some information about how incidence rates were calculated.
2. Results should have a total number of studies used in the meta-analysis.

Methods:
I think there needs to be more information about the meta-analysis itself.
3. Was there any weighting done based on sample sizes?
4. Were any design-effects taken into consideration?
5. How were confidence intervals reported in studies and how were these used in the calculations?
6. What was done to verify normal distribution of partner number/acts, especially given that normal distribution of this data is not a standard assumption?
7. It’s fairly unclear how the model imputes missing data, especially given that there is a lot of it. For instance, only 4 studies had empiric data on regular and casual partner numbers, and only 2 studies on commercial partners. No study had empiric data on sex acts specifically for regular/casual partners. Though this is addressed in the limitations, I think the importance of this limitation is under-emphasized. It may be more scientifically sound to treat this as pure modeling data rather than to treat it the same way as other information based on empiric data.
8. It’s also unclear how the modeling process results in an average number of sex acts that exceeded any of the empiric study data – bringing into question the validity of the model to properly impute missing data.
9. What was the source of data for the per-act transmission probabilities and what CI was used? I see where you refer to using lognormal distributions of the number of acts based on the frequency of different partner types from the other modeling, but I would wonder when you compare your findings for number of sex acts to those from other settings, why you find such huge discrepancies (5-10 fold less acts). I think the interpretation you made was that Chinese MSM may be more sexually conservative than men in these comparison studies, but I would wonder whether another interpretation may be that either the few empiric data you have may be faulty or the model itself may be producing an underestimate.
10. There are also some questions regarding how the individual data elements used in the incidence calculation were derived. What were the partner- and time-specific HIV prevalence and CI used? Presumably, the HIV prevalence of MSM with different partner types would vary, but it seems that the model assumes equal prevalence among all MSM? How do all of these CI’s factor into the modeling of HIV incidence, especially given the very narrow CI on the HIV incidence estimates?
11. What exactly is significant about an incidence cut-point of 20 cases per 1000 years?

12. What calculation was used to generate the % of new infections attributable to a certain partner type?

Results:

13. A practical interpretation issue, but also something that brings into question the validity of the modeling process is that your overall estimated average number of sex partners was higher than 52/55 of your included empiric data.

14. Though modeling results and empiric data can differ, it seems that most of your findings are consistently higher than what would be assumed from just summarization from the existing literature. This either brings into question the validity of the model itself or leaves the reader wondering whether there is some hidden process in the modeling that results in this increase in the estimated partner number. A similar issue applies to the overall number of sex acts. It’s unclear how the total number derived from the model is higher than the empiric data, especially given the paucity of data points. The calculation of the average number of sex acts per regular partner (less than 5 in a six month period) brings into question the validity of this calculation – should be discussed.

Discussion:

15. I think practical interpretation of your findings needs to be strengthened. Otherwise readers will make their own interpretations. For instance, you say that the average Chinese MSM has 1.6 commercial sex partners (with a lower bound of about 1). Does that mean that the average Chinese MSM has commercial sex? The numbers also imply that this same “average Chinese MSM” also has at least 1 regular partner, and multiple non-commercial casual sex partners. How do you reconcile this with the statement that the median number of sex partners in a 6 month period is relatively low (about 1 for regular and casual)?

16. You make a comparison to US data on partner number to illustrate that your data appear to be different, but I’m wondering whether 1/3 partners per 12 months is really that different from .6/.7 partners per 6 months.

17. I think there are some other practical interpretation points raised in the other detailed comments that can/should be addressed in the discussion.

Level of interest: An article of importance in its field

Quality of written English: Needs some language corrections before being published

Statistical review: Yes, but I do not feel adequately qualified to assess the statistics.

Declaration of competing interests:
I declare that I have no competing interests.