

PEER REVIEW HISTORY

BMJ Open publishes all reviews undertaken for accepted manuscripts. Reviewers are asked to complete a checklist review form (<http://bmjopen.bmj.com/site/about/resources/checklist.pdf>) and are provided with free text boxes to elaborate on their assessment. These free text comments are reproduced below.

This paper was submitted to a another journal from BMJ but declined for publication following peer review. The authors addressed the reviewers' comments and submitted the revised paper to BMJ Open. The paper was subsequently accepted for publication at BMJ Open.

ARTICLE DETAILS

TITLE (PROVISIONAL)	Investigating inequalities in HIV testing in sub-Saharan Africa: spatial analysis of cross-sectional population-based surveys in 25 countries
AUTHORS	Ante-Testard, Pearl Anne; Carrasco, Gabriel; Benmarhnia, Tarik; Temime, Laura; Jean, Kevin

VERSION 1 – REVIEW

REVIEWER	Botelho, Eliã Federal University of Para, Programa de Pós-Graduação em Enfermagem
REVIEW RETURNED	13-Feb-2023

GENERAL COMMENTS	<p>Dear authors, Congrats for this nice work! I really appreciated to read your paper. I have only few questions: Sounds to me that your sample distributions are not normal, therefore should be more plausible to employ Spearman instead of Pearson correlation analysis; I also could not see if the hot- or coldspots are significant. Did you check the the global G_i^*? I could not see in the text these results and it is important to see if clusterings are randomly or not. Other point was the fact that you employing Global Moran and GI analysis. Moran is employed only for static samples. Please, use only global GI; Also in methods define better SII and RII; I suggest you to increase the size of the figures and to improve their resolutions. We can barely read and see their details. I also suggest you to discuss more about public policies fighting HIV in SSA and the discrepancies among the countries. It is also important to include in methods the study scenery. For example, I was wondering if the accessibilities to healthcare services are different among SSA countries; Have they the same politic system? How the differential cultures (religiosity,...) can impact negatively the HIV test up taking among these countries? Congrats once again and I'm more than sure your paper you bring subsidies to improving health policies against HIV.</p>
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REVIEWER	Werle , Josiel Elisandro Universidade Federal de Mato Grosso do Sul
REVIEW RETURNED	24-Feb-2023

GENERAL COMMENTS	<p>First, I congratulate the study, of great relevance for the knowledge of the clusters of concentration of infection and to support the development of public policies.</p> <p>Regarding the choice of the survey as a data source, it is pertinent to bring another paragraph describing the way information on HIV/AIDS testing is collected.</p> <p>In the discussion, the proposition of actions that can be developed from this knowledge was lacking. The person already lives with HIV, what actions can health institutions develop through the knowledge that their study brought?</p>
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REVIEWER	Inghels, Maxime University of Lincoln
REVIEW RETURNED	11-May-2023

GENERAL COMMENTS	<p>This is an outstanding article investigating testing uptake inequalities in sub-Saharan Africa, measured at different geographical levels (i.e., national, regional, and local). I find the results to be original and important due to their potential implications for the implementation of HIV testing programs in SSA.</p> <p>The article already provides sufficient details to ensure the reproducibility of the study and the code used for the analysis is available in a public repository. I only have a few minor comments and discretionary suggestions that can could further enhance the clarity and impact of the manuscript:</p> <ol style="list-style-type: none"> 1. The results presented in some of the figures are weighted. It might be worth specifying the basis on which the weighting was done, especially for readers who are not familiar with HDSS data. 2. Due to the choice of complete case analysis, 25% of the sample has been excluded. It is important to describe the reasons for these exclusions, such as non-contacted individuals, participation refusal, or missing values, and explore if there are any differences in participation rates between countries and their potential impact on the results. 3. Although the author cites a reference to obtain the answer, it would be helpful to explain in more detail how the RII and SII, which are central to their analysis, are computed. 4. On page 19, the authors state: "[...] while HIV testing programs seemed efficient in reaching those with a high risk of acquiring HIV at the national level [...]," which is not accurate, as their results do not investigate testing uptake among high-risk groups. 5. In Figure 4, the authors showed no correlation between HIV prevalence and recent HIV testing for most countries. I am curious to know if this result still holds when stratified by the wealth index since the focus of the paper is on wealth inequalities.
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VERSION 1 – AUTHOR RESPONSE

Reviewer: 1

Dr. Eliã Botelho, Federal University of Para

Comments to the Author:

Dear authors,

Congrats for this nice work! I really appreciated to read your paper.

We are thankful to Reviewer #1 for their encouraging comments.

I have only few questions:

Sounds to me that your sample distributions are not normal, therefore should be more plausible to employ Spearman instead of Pearson correlation analysis;

We would like to express our gratitude to Reviewer #1 for their comment. In response, we have reproduced Figure 4, Figure S3, and Figure S4 using the Spearman correlation instead of the Pearson correlation method, and we have subsequently made corresponding updates to both the Methods and Results sections of the manuscript.

I also could not see if the hot- or coldspots are significant.

We reproduced the Figure 3 and Figures S5-S8 with higher resolutions.

Did you check the the global G_i^* ? I could not see in the text these results and it is important to see if clusterings are randomly or not. Other point was the fact that you employing Global Moran and GI analysis. Moran is employed only for static samples. Please, use only global GI;

We thank Reviewer #1 with this helpful suggestion. We conducted Global G statistic and updated the Methods and Results. We reproduced Figure 3 using Global G statistic.

We edited the following:

Line 172-174: "We selected the number of nearest neighbors that gave high spatial autocorrelation based on a global G statistic for each sex and inequality indicator."

Also in methods define better SII and RII;

We are thankful to Reviewer #1 for this helpful suggestion. In response, we edited and added sentences to:

Lines 147-152: "The SII and RII are regression-based measures commonly used to quantify and compare socioeconomic gradient in absolute and relative scales [17]. It is highly recommended to report inequalities on both scales as conclusions may diverge depending on the scale used especially when monitoring changes [18]. We assessed within-country inequalities based on the participants' relative rank in the cumulative distribution of the wealth index."

We also explicitly mention SII and RII in the following paragraph:

Lines 154-160: "At the national and province levels, the SII and RII both indicators were obtained by fitting a modified Poisson regression (with robust variance) with a log link function [19] to estimate the association between recent HIV testing at each wealth level and the hierarchical ranking of wealth. Generalized estimating equations were used to account for the clustering of observations [20]. The SII represents the absolute difference in the predicted proportions between the richest and the poorest participants, whereas the RII expresses the ratio of the predicted outcomes between these two extremes."

I suggest you to increase the size of the figures and to improve their resolutions. We can barely read and see their details.

We are grateful to Reviewer #1 for this suggestion. We reproduced all figures with higher resolutions.

I also suggest you to discuss more about public policies fighting HIV in SSA and the discrepancies among the countries. It is also important to include in methods the study scenery. For example, I was wondering if the accessibilities to healthcare services are different among SSA countries; Have they the same politic system? How the differential cultures (religiosity,...) can impact negatively the HIV test up taking among these countries?

We thank Reviewer #1 for this important suggestion. We indeed tried to explore in the short piece which drives HIV testing programs more. We found that it the level of HIV testing seems to be linked with HIV prevalence (which triggers fundings and large prevention programs) more that by GDP / macroeconomic factors.

Added this in the Discussion:

Lines 327-332: “The response of HIV testing programs appears to be driven more by the level of the HIV prevalence itself rather than by the country’s Gross Domestic Product per capita or macroeconomic factor [25] which may trigger fundings and large prevention programs. This also aligns with a previous study, wherein countries characterized by a low HIV prevalence tended to exhibit lower uptake of HIV testing and higher levels of pro-rich inequalities in HIV testing [26].”

And added the reference:

Ante-Testard PA, Temime L, Jean K. Epidemiological rather than macro-economic factors correlate with socioeconomic inequalities in HIV testing in 16 sub-Saharan African countries [Internet].

HIV/AIDS; 2021 Sep [cited 2023 Sep 29]. Available from:

<http://medrxiv.org/lookup/doi/10.1101/2021.09.22.21263940>

Congrats once again and I'm more than sure your paper you bring subsidies to improving health policies against HIV.

We thank Reviewer #1 for this encouraging comment.

Reviewer: 2

Dr. Josiel Elisandro Werle , Universidade Federal de Mato Grosso do Sul, Secretaria de Estado de Saude de Mato Grosso do Sul

Comments to the Author:

First, I congratulate the study, of great relevance for the knowledge of the clusters of concentration of infection and to support the development of public policies.

We are grateful to Reviewer #2 for their motivating comments.

Regarding the choice of the survey as a data source, it is pertinent to bring another paragraph describing the way information on HIV/AIDS testing is collected.

We thank Reviewer #2 for this comment. In response, we made the sentence more explicit:

Lines 109-113: “The information and serology on HIV/ AIDS was collected in some DHS in which participants are asked for consent to be tested for HIV, which is done anonymously in most of the surveys. Individuals who consented are interviewed face-to-face by trained interviewers who use a standard questionnaire.”

In the discussion, the proposition of actions that can be developed from this knowledge was lacking. The person already lives with HIV, what actions can health institutions develop through the knowledge that their study brought?

We agree with Reviewer #2 and added the following sentences in the Discussion:

Lines 383-385: “This knowledge could help health institutions develop a well-targeted HIV testing and treatment programs. HIV testing and treatment provision is key for both primary and secondary prevention.”

Reviewer: 3

Dr. Maxime Inghels, University of Lincoln

Comments to the Author:

This is an outstanding article investigating testing uptake inequalities in sub-Saharan Africa, measured at different geographical levels (i.e., national, regional, and local). I find the results to be original and important due to their potential implications for the implementation of HIV testing programs in SSA.

We are thankful to Reviewer #3 for their encouraging comments.

The article already provides sufficient details to ensure the reproducibility of the study and the code used for the analysis is available in a public repository. I only have a few minor comments and discretionary suggestions that can could further enhance the clarity and impact of the manuscript:

1. The results presented in some of the figures are weighted. It might be worth specifying the basis on which the weighting was done, especially for readers who are not familiar with HDSS data.

We agree with Reviewer #3. We added this sentence:

Lines 141-143: “We weighted the HIV prevalence and proportion of recent HIV testing using the DHS sampling weights to account for under- or over-sampling and to account for the differences in response rates by region.”

2. Due to the choice of complete case analysis, 25% of the sample has been excluded. It is important to describe the reasons for these exclusions, such as non-contacted individuals, participation refusal, or missing values, and explore if there are any differences in participation rates between countries and their potential impact on the results.

We thank Reviewer #3 for this important comment. We excluded participants who had missing values or NAs for the socioeconomic position indicator (i.e., wealth index) and outcome (i.e., recent HIV testing). Participation rates ranged between 72%-100% at the national level. However, for the Primary Sampling Unit-level (PSU-level) or cluster-level analysis, we only included PSUs with a sample size of at least 10 participants to ensure statistical power. We added these rates and the total number of participants at the cluster level after excluding the missing values for wealth index and recent HIV testing and clusters with less than 10 sample size in Table S1, and updated Table S2 with the total number of participants at the country level after excluding the missing values for wealth index and recent HIV testing.

We added this sentence in the Method section:

Lines 183-186: ...“We excluded participants with missing values for the SEP indicator (i.e., wealth index) and outcome variable (i.e., recent HIV testing) at the national, province and PSU level analysis. For the PSU-level analysis, we only included PSUs with at least 10 sample size to ensure statistical power.”

And updated this section:

Lines 204-207: “There was a total of 473,775 participants (99%, 312,104 women and 161,671 men) at the country level (Table S1 and Table S2) with 328,283 individuals (62.3%, 241,084 women and 87,199 men) from PSUs with a sample size of at least 10 and complete data to ensure statistical power at the PSU level (Table S1).”

We added in the Discussion:

Lines 377-378: “...Additionally, it had high participation rates which ranged between 72%-100% (Table S1) at the country level.”

3. Although the author cites a reference to obtain the answer, it would be helpful to explain in more detail how the RII and SII, which are central to their analysis, are computed.

We are grateful to Reviewer #3 for this comment. As previously mentioned in response to Reviewer #1, we added the following:

Lines 147-152: “The SII and RII are regression-based measures commonly used to quantify and compare socioeconomic gradient in absolute and relative scales [17]. It is highly recommended to report inequalities on both scales as conclusions may diverge depending on the scale used especially when monitoring changes [18]. We assessed within-country inequalities based on the participants’ relative rank in the cumulative distribution of the wealth index.”

We also explicitly mention SII and RII in the following paragraph:

Lines 154-160: “At the national and province levels, the SII and RII both indicators were obtained by fitting a modified Poisson regression (with robust variance) with a log link function [19] to estimate the association between recent HIV testing at each wealth level and the hierarchical ranking of wealth. Generalized estimating equations were used to account for the clustering of observations [20]. The SII represents the absolute difference in the predicted proportions between the richest and the poorest

participants, whereas the RII expresses the ratio of the predicted outcomes between these two extremes.”

4. On page 19, the authors state: "[...] while HIV testing programs seemed efficient in reaching those with a high risk of acquiring HIV at the national level [...]," which is not accurate, as their results do not investigate testing uptake among high-risk groups.

We agree with Reviewer #3. In response, we edited the sentence to:

Lines 305-308: “Meanwhile, coldspots were rather observed in ESA. We also revealed that, while HIV testing programs seemed efficient in reaching those areas with high HIV prevalence at the national level, they seemed to be less efficient at the subnational levels in most of the countries.”

5. In Figure 4, the authors showed no correlation between HIV prevalence and recent HIV testing for most countries. I am curious to know if this result still holds when stratified by the wealth index since the focus of the paper is on wealth inequalities.

We thank Reviewer #3 for this interesting suggestion. As a response, we took the time to stratify the correlation between HIV prevalence and recent HIV testing by wealth quintiles at the PSU level (please see figure on the attached PDF version of the response to reviewers). However, there were no striking results and considering that the draft is already dense in terms of results, we did not include these new results in the main text.

Reviewer: 1

Competing interests of Reviewer: None

Reviewer: 2

Competing interests of Reviewer: has no conflict of interest

Reviewer: 3

Competing interests of Reviewer: none

Thank you for considering our manuscript.

VERSION 2 – REVIEW

REVIEWER	Botelho, Eliã Federal University of Para, Programa de Pós-Graduação em Enfermagem
REVIEW RETURNED	12-Oct-2023

GENERAL COMMENTS	<p>Dear authors, Congratulations by this beautiful paper! It really enjoyed reading it! I have some suggestions to you listed bellow:</p> <ol style="list-style-type: none"> 1) In abstract bring the total of participant in your study; 2) In the introduction, the objective II is already included in the objective I. Therefore, I suggested you to remove it; 3) In methods you should clarify better the interpretation of the results obtained with SII and RII. It will help readers to comprehend even more; 4) In Methods you should emphasize that G stastic is appropriated to samples with non-normal distribution; 4) Let us know the p-value of global G. it is not in the text. If all of them were statically significant, mention it; 5) Please, rebuild conclusion answering the paper's main goal. <p>Congrats once again!</p>
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REVIEWER	Inghels, Maxime University of Lincoln
REVIEW RETURNED	05-Oct-2023
GENERAL COMMENTS	The authors have well addressed my previous comments. I congrat them again for their very interesting and useful work!

VERSION 2 – AUTHOR RESPONSE

Reviewer: 3

Dr. Maxime Inghels, University of Lincoln

Comments to the Author:

The authors have well addressed my previous comments. I congrat them again for their very interesting and useful work!

We are grateful to Reviewer #3 for their encouraging comment and support.

Reviewer: 1

Dr. Eliã Botelho, Federal University of Para

Comments to the Author:

Dear authors,

Congratulations by this beautiful paper! It really enjoyed reading it!

We are grateful to Reviewer #1 for their encouraging and kind comment.

I have some suggestions to you listed bellow:

1) In abstract bring the total of participant in your study;

We added the total number of participants at the country and cluster levels in the Abstract.

Lines 38-39: "Country-level analysis included 473,775 participants (312,104 women and 161,671 men) and cluster-level analysis included 328,283 individuals (241,084 women and 87,199 men)."

2) In the introduction, the objective II is already included in the objective I. Therefore, I suggested you to remove it;

We agree with Reviewer #1. In response, we've deleted objective 2 in the Introduction.

3) In methods you should clarify better the interpretation of the results obtained with SII and RII. It will help readers to comprehend even more;

We added the following sentences in the Methods to help in the interpretation of the SII and RII:

Lines 166-170: "For instance, an SII of 0.10 estimates the absolute difference of 10 percentage points of getting tested for HIV between the wealthiest and poorest participants. An RII of 3 estimates the relative probability of getting tested between the wealthiest and the poorest participants – the wealthiest were 3 times more likely to get tested than the poorest participants."

4) In Methods you should emphasize that G stastic is appropriated to samples with non-normal distribution;

We thank Reviewer #1 for this suggestion. We added this component to the sentence below:

Lines 177-180: "We selected the number of nearest neighbors that gave high spatial autocorrelation based on a global G statistic, which is suitable for samples with non-normal distribution, for each sex and inequality indicator."

4) Let us know the p-value of global G. it is not in the text. If all of them were statically significant, mention it;

We used the global G statistic to determine the number of nearest neighbors (i.e., k) that gave the highest spatial autocorrelation that we would then use in the local Getis-Ord G^* statistic analysis. The Global G statistic showed that using 1 nearest neighbor (i.e., $k=1$) gave the highest spatial autocorrelation for both females and males with p-values > 0.001 .

We modified the sentence below to mention the p-values:

Lines 255-256: "Global G statistic showed that using 1 nearest neighbor gave the highest spatial autocorrelation for both sexes (p-value > 0.001 for both sexes) and inequality indicators (Figure S2)."

5) Please, rebuild conclusion answering the paper's main goal.

We thank Reviewer #1 for this suggestion. We added this sentence in the Conclusion:

Lines 395-396: "This study highlighted the spatial heterogeneity in socioeconomic inequalities in HIV testing whilst also identifying hotspots of inequalities across several sub-Saharan African countries."

Congrats once again!

We are grateful to Reviewer #1 for their encouraging comment.

Reviewer: 3

Competing interests of Reviewer: none

Reviewer: 1

Competing interests of Reviewer: None

Thank you for considering our manuscript.