

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.

ARTICLE DETAILS

TITLE (PROVISIONAL)	Modelling geographical accessibility to support disaster response and rehabilitation of a health care system: An impact analysis of Cyclones Idai and Kenneth in Mozambique
AUTHORS	Hierink, Fleur; Rodrigues, Nelson; Muñiz, Maria; Panciera, Rocco; Ray, Nicolas

VERSION 1 – REVIEW

REVIEWER	Peter Macharia KEMRI Wellcome Trust Research Programme, Nairobi Kenya
REVIEW RETURNED	04-May-2020

GENERAL COMMENTS	<p>Peter Macharia KEMRI Wellcome Trust Research Programme, Nairobi Kenya 04-May-2020</p> <p>This an important and well thought study assessing post-disaster travel times to functional health facilities and analyse population coverage losses after Cyclones Idai and Kenneth that affected Mozambique in 2019. As such a have a few comments to the authors</p> <ol style="list-style-type: none">1. Table 1 -provide links (URLs) for the data sources where possible2. While Under five are the most vulnerable, when a disaster strikes everyone will be affected and will need care. The authors should include the estimates of the total population instead of under-fives. If a child would need care, it's their care givers who would accompany them to the facility. If under-fives must be included the results can be annexed in the supplementary information.3. They are many population densities maps that are open source. Was there any reason as to why?4. Line 383. I would be careful on making a recommendation on prioritizing reconstruction efforts to roads as this will vary on a case by case basis. Also, even if the roads were available and no facility it would be ambiguous. As indicated, roads could be navigated with specific vehicles.5. In addition to point 4, in Table 2, is the access presented not a function of road damage and health facility closure? If we needed access lost due to road damage only it would be (access due to road damage + facility closure) –(subtract) (access due to facility
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	<p>closure). Therefore, when comparing which had a larger effect between facility closure or road damage you may need to reconsider given what has been presented in the manuscript.</p> <p>6. Line 393. Was it evident that resilient facilities and infrastructure survived the extreme weather conditions and others did not? Would each facility not be affected in one way or the other due to the extreme conditions?</p>
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REVIEWER	Michelle M. Schmitz Centers for Disease Control and Prevention, United States of America
REVIEW RETURNED	23-May-2020

GENERAL COMMENTS	<p>This manuscript uses a novel approach by using the AccessMod platform to estimate travel time accessibility pre- and post-disaster in lesser-developed settings, to better quantify the scope of a disaster upon the impact on healthcare accessibility. To my knowledge, this topic is not adequately covered in the literature, and this manuscript is timely. However, I first feel that this manuscript needs edits in terms of its scope, analytical methods, and grammar.</p> <p>The most pressing matters, to me, are the use of resampling to assess higher-resolution data when some data cannot be assessed in this way. Additionally, I am concerned at the use of the paired T-test, in lieu of comparing Z-scores, as populations (not samples) are being assessed. The authors also need to be more explicit about how calculations were performed, complete with formulas – they seem to be brought up, without a clear definition.</p> <p>That said, I applaud the work of the authors, and their attempts at quantifying a very messy issue. I look forward to revising any revisions that may be - and I will note that I added quite a few editorial revisions as well in my comments, so please don't be alarmed!</p> <p>Title Page Affiliation #4: add comma between "Nairobi" and "Kenya" (missing comma) Affiliation #5: "Health Section, The United Nations Children's Fund, New York, United States of America" (may want to think about switching "Health Section" and "The United Nations Children's Fund", to make affiliation "The United Nations Children's Fund, Health Section". The sentence structure is different than the other affiliations.)</p> <p>Abstract</p> <p>Objectives Line 5: are you assessing or estimating post-disaster travel times? To me, this review is estimating - we don't actually KNOW post-analysis how the travel times changed. Line 6: remove "that" Setting: Line 12: Hyphenate "high resolution" if reducing word count Line 13: Population coverage statistics or population coverage estimates?</p>
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	<p>Lines 21, 23, 25: can hyphenate with affected (e.g., "Idai-affected", "Kenneth-affected").</p> <p>Conclusions (must make title plural)</p> <p>Strengths and Limitations of the Study</p> <p>Lines 46-47: Saying, "To account for uncertainty of the assumed travel speeds, we considered multiple possible scenarios," seems a little unreasonable as a statement. It could be quantified with a short description of how these scenarios were quantified.</p> <p>Line 48-49: May need authors to describe that various sources can be at different levels (global, local)?</p> <p>INTRODUCTION</p> <p>Line 57 (and *all* subsequent references in the paper): remove space between end of sentence and reference. This will help keep your word count significantly down.</p> <p>Lines 69-74: would have been useful to revise Figure 1 to include path of cyclone trajectory.</p> <p>Line 75: May not be necessary to break both death tolls down into a parenthetical statement? Might want to just use dependent clause instead, i.e., "The two cyclones combined had a death toll of 648, with 603 fatalities due to Idai and 45 deaths caused by Kenneth, and left over..."</p> <p>Lines 78-79: Rework sentence to say, "..., inability in accessing safe water and sanitation,"</p> <p>Line 82: Rework sentence to read, "...and restricting the population's access to adequate health care".</p> <p>Line 84: "but" would be a better conjunction than "however"</p> <p>Line 89: I would have liked to see more information about how geographic inaccessibility (or breaking up of parts of health systems) would impact overall.</p> <p>Lines 102-103: Do the authors know why these response guidelines don't cover post-disaster assessments? This is not my field of expertise, but it could be helpful for the authors to mention what IS done after a disaster.</p> <p>Line 110: Not sure if "population coverage losses" is the correct term. Maybe "loss in accessibility coverage"?</p> <p>METHODS</p> <p>Line 119: May want to italicize words being defined (accessibility, coverage). I also have an issue with how coverage is defined, in that these are ESTIMATED coverage. So it would be better to say, "the ESTIMATED number or percentage of people..."</p> <p>Line 125: Can write, "between April-September 2019" if need to reduce space.</p> <p>Line 126: May want to quantify approximate times for each of these scenarios as well, just because the "post-Idai" scenario could be pre- or post-Kenneth as well.</p> <p>Table 1</p> <p>In general, authors should be citing sources within the table, not just including acronyms.</p> <p>Flood extent – Should put comma after flood extent (e.g., "Flood extent, Idai", "Flood extent, Kenneth".</p> <p>Also, why are there two separate data sources used for Idai and Kenneth? I'm under the impression that Sentinel-1 (include the hyphen) is global, as is Copernicus.</p> <p>May want to include in maps locations of road damages</p>
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	<p>For “health facility damages”, the source date is unclear – it says “48 h – 1 week post-cyclone” Is this saying that it was 48 hours after one of the cyclones, and 1 week after the other cyclone? If so, explicitly mention this.</p> <p>For “population density”, are we assuming a static population density for the year mentioned? Since there’s such a lapse between source date and download date, is it fair to assume that population density change patterns may have changed because of the change in population movement due to the hurricane(s)?</p> <p>Data sources and preparation</p> <p>Line 142: “All rasters and shapefiles...” (don’t need hyphen)</p> <p>Line 144 (and all subsequent uses of “Supplementary”) – the term should be either “Supplement #”, “Supplementary Materials”, or “Appendix #” (with # = number). Supplementary is an adverb and is confusing to a native English speaker.</p> <p>Line 146: tiles or mosaics?</p> <p>Lines 152-153: Was there a specific rationale that the authors decided to resample? I’m concerned about the use of resampling to get down to 30 meter resolution. While resampling works in terms of getting the job done, but is not always suggested because it adds in artifacts and raster cells can potentially be misaligned. I usually would suggest using the lowest resolution data source as your first step, and go from there.</p> <p>Line 159: Capitalize PDF</p> <p>Line 161: Put “1)... ..closed”) into a parenthetical statement, since using i.e.,</p> <p>Line 162: Comma after May 3</p> <p>Line 164: Is there a table of the road type – damage combinations?</p> <p>Line 169: Is there an assumption of bridges or something like that when crossing rivers and/or if the river is passable by a population? (Do you know what the width of said river may be as well, or if a trail normally passed through it?) Furthermore, what was the definition of a "primary river"?</p> <p>Line 171: Need to cite Sentinel-1 and Copernicus Sources</p> <p>Line 179: Capitalize “network”</p> <p>Line 180: Ideally, should clearly define how calculation for grid * population is done to calculate the people that are not covered. It’s somewhat clear, reading between the lines, but not completely clear.</p> <p>Lines 184-185: If I’m reading this sentence correctly, the analyses for Cyclone Idai insinuates that similar analyses were NOT done for Cyclone Kenneth. Did I understand this correctly? If so, were there plans to do anything similar for Cyclone Kenneth? If not, why was this not performed?</p> <p>Line 190: “Health facilities” at the end of the line</p> <p>Line 202: Should cite as “Figures 1a & 1b”</p> <p>Geographic Accessibility Modelling</p> <p>Line 212: May want to say which module(s) were specifically used in AccessMod</p> <p>Line 222 (at the semicolon): Was this where flood waters were not ... inundating roads? Might want to rethink word choice here.</p> <p>Line 229: Don’t need “(2018)” after “Ouma et al.” here.</p> <p>Line 232: Simply can cite study instead of adding parenthetical statement for “Ebener et al., 2019”</p> <p>Line 232: Why is a paired T-test being used to compare between the groups? Are you attempting to use sampled data (i.e., the correct usage of the T_test)? I would be cautious about this,</p>
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because the raster that's assumed here would be using z-scores since you're comparing across the entire population (of raster cells). GHSP should have an article performed by Schmitz et al, which describes the calculation used between rasters.

RESULTS

The results, in general, should be clear that this is estimated coverage in terms of the amount of children covered.

Pre-cyclone accessibility

Lines 245-246: "2 hour catchment limit" (not "hours")

Lines 260-261: can say "cyclone-affected districts"

Lines 263-268: The authors may want to better standardize how figures are being cited. They're either being cited as parenthetical statements, or within the text itself. It's a stylistic matter.

Table 2: See previous notes about using a paired T-test. Since two samples are not being compared against, but two estimated populations, this is not a correct use of analysis.

P-value is better assessed at the right-hand side of the table.

Adding commas or periods for numbers under each "Children <4 covered (nr.)" category improves legibility.

Line 281: "most affected district", not "heaviest affected district"

Lines 283-284: Why did the authors pick 20% faster/slower speeds for uncertainty modeling? Was there a specific rationale for this?

Line 287: How can uncertainty modeling guide resource allocation for decreasing this uncertainty? (That's how the sentence reads.)

This seems to be a point better for discussion, not results.

Line 292: "previously-covered"?

Line 293: "heaviest-affected"?

Line 298: Can put analysis about floods in another paragraph

Lines 304-305: "2 hour catchment areas".

Travel time in affected communities

Lines 309-310: "Buzi and Muanza district in Sofala province"

Line 310: "The Mucinenemo community in Buzi district..." (can also say, "Mucinenemo, in Buzi District,...")

Line 312: "Supplementary Appendices 5 & 6)

Line 313: Idai-affected

Lines 316-317: Can say, "...community of Chipota in Muanza district", or can say, "with the highest travel time found in Chipota, in Muanza District".

Health facility closures

Lots of wording that can be modified. See suggestions below:

Line 323: "The effects of non-functioning health facilities were isolated..."

Line 325: "a post-cyclone scenario where modified functionality status was considered"

Line 326: "comparing these pre-cyclone and post-cyclone scenarios,"

Line 327: "transportation-specific disruptions"

Lines 330-331: Were the flood waters passable or impassable?

This seems to be discordant with other analyses previously described. Why was this decision made? Possibly needs to be better described in methods as well.

Lines 336-337: Causally speaking, does this statement make sense though? I could see that patients wouldn't be able to access hospitals/facilities because of reduced accessibility, but facilities

also would be shut down because of the weather, affecting patients...

Line 341: Description of coverage loss is not clear. Authors need to describe how calculations are created in the method section.

Lines 345-347: Was there any particular reason that Cyclone Idai was focused upon, and not Cyclone Kenneth? I notice that "health facility closures did not have an additional effect on post-cyclone accessibility...", which I'd expect given timing – but isn't it true that different districts were affected between Cyclone Idai and Cyclone Kenneth? The authors should think about a causal mechanism for why this may be the case (and bring it up in discussion).

DISCUSSION

Line 350: Comma after "($p < 0.05$)"

Line 351: Comma after "increased".

Line 358: Can revise to, "decreased population coverage directly after the cyclones,"

Line 361: In the first sentence, do the authors conclude that their methodology will help identify underserved districts early? How can this be methodologically implemented, given how long it takes to understand the full scope of a disaster after it has occurred?

Line 365: cyclone-affected

Lines 371-373: The transition between paragraphs here is a little confusing. I understand the observations found here, but I'm having a hard time understanding why the reader may care about this specifically.

Line 387: Comma after "population distribution", and then revise to "suggest this FIGURE is an understatement"

Lines 391-392: Was this statement, "Fourteen percent of all health facilities in cyclone-affected districts...", based on the results for Cyclone Idai and Kenneth, or generally? Authors may want to revise statement to, "facilities in Cyclone Idai- and Kenneth-affected districts" to be clearer.

Line 399: Write "four" as "4"

Lines 402-403: Revise to "subsequent health losses"

Lines 408-410: Move this sentence to be first in this paragraph.

Line 409: Revise to "where deployment of CHWs"

Line 410: Think about structure of citing supplementary material (previous comment)

Line 413: Commas between statements, to be, "The districts that were most affected by Cyclone Idai and Kenneth were historically, and are in the future, also prone to disasters"

Lines 413-414: Logical conclusion for statement needs to be better quantified

Lines 423-424: May want to revise to, "While the occurrence of natural disasters generally accelerates data... there also are challenges of data quality..."

Lines 434-436: Authors need to make long sentence into two smaller sentences.

Line 435: Authors may want to consider that this conclusion also could happen because river paths may change with occurrence of cyclone (e.g., river -> flooding -> new paths developed).

Lines 438-440: Wording is awkward, may need to revise.

Line 448: Authors say that the accessibility model was run for walking alone on closed roads. They may want to clearly define how they would expect results to change if using multiple forms of transport.

Lines 458-461: Through what use case would people see this occurring? Throughout the country? Subnationally? May need to clearly define what outputs are expected from this.

	<p>Lines 468-471: Authors should break up long sentence into smaller ones.</p> <p>REFERENCES:</p> <p>#5: Write out reference author: "United Nations Office of Coordinated Humanitarian Affairs".</p> <p>#15: Check citation. Do the authors want to write out "UNICEF" as "UNICEF", or as its full name? Also, punctuation seems questionable.</p> <p>#32: Write out reference author: "World Health Organization"</p> <p>#43 See note about #15</p> <p>Figure 1: Should probably have flood extent and/or cyclone tracts shown here. Also, should probably have information in footnote about how districts affected, as it is hard to tell based on map alone since areal units (districts) are shown alone.</p> <p>Figure 2: Data presentation is not that easy to follow. Graphic is relatively small, which is possibly not fault of authors. However, it's hard to tell the reasoning behind the ordering of the districts. Have the authors considered other types of data presentation/visualization here?</p> <p>Figure 3: Flood extent not easy to spot here. Should probably darken it, or make easier to see. Looks like uncertainty intervals are partially driven by the fact that road network speeds are much higher than other types of land cover. Is this assumption correct? If so, quantify in text.</p> <p>Figure 4: River/flood extent very hard to spot. (See comments for Figure 3)</p> <p>S1: Authors should clearly be citing all sources used (with URLs).</p> <p>Elevation – authors should explain why they mosaiced first before analyzing, for purposes of reader comprehension.</p> <p>Road network - When was this data collected, specifically? This seems a little bit of an odd statement to say. Say, "up-to-date" Authors could make these paragraph a little more succinct; it's currently hard to follow. Capitalize "PDF" Table, with road speeds, can be easier to follow than prose if included in appendix</p> <p>Barriers to movement Source DNGRH Authors need to mention which satellite imagery was used (Copernicus/Sentinel assumed, but should mention nonetheless), as well as collection date and scaling.</p> <p>Population Data Authors need to be more explicit about the raster calculator calculation used to re-interpolate the lost population into the raster cells equally.</p>
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	<p>Health facilities Authors should be citing all sources used, and the dates used. (Or, just reference to Table 1)!</p> <p>Is the “Neonatal Inventory Survey” the NIS from UNICEF? Also, if UNICEF is being described up here, write the full name of UNICEF up here, and not in the next paragraph.</p> <p>S2 Is it fair to assume that if an area was flooded and not on a road, there was a reduction in speed taken?</p> <p>S3 No major comments</p> <p>S4 No major comments</p> <p>S5 Authors should think about revising title - should probably give heading on this page (i.e., "Difference between...")</p> <p>S6 Why was this (very well done) map only created for Idai and not for Kenneth, given that the same areas hit twice with two cyclones in a very constricted time period?</p>
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VERSION 1 – AUTHOR RESPONSE

Reviewer: 1

Reviewer Name: Peter Macharia

Institution and Country: KEMRI Wellcome Trust Research Programme, Nairobi Kenya

This an important and well thought study assessing post-disaster travel times to functional health facilities and analyse population coverage losses after Cyclones Idai and Kenneth that affected Mozambique in 2019. As such a have a few comments to the authors

Thank you for the thorough and helpful feedback on our manuscript. We have integrated most of your suggestions and provide feedback to each of your comments in the sections below.

Table 1 -provide links (URLs) for the data sources where possible

Thank you for pointing this out. Table 1 has been updated to include all URLs and references to the corresponding data sources.

While Under five are the most vulnerable, when a disaster strikes everyone will be affected and will need care. The authors should include the estimates of the total population instead of under-fives. If a child would need care, it’s their care givers who would accompany them to the facility. If under-fives must be included the results can be annexed in the supplementary information.

Although disasters impact entire populations, children under 5 represent the age group used as benchmark for child survival targets in both the Millennium Development Goals (MDGs) and the Sustainable Development Goals (SDGs), as such this cohort is frequently used as baseline. In this context and through the collaborative work with UNICEF, this analysis aimed at informing the impact of the disasters on the burden for specific child health services that target children under 5, (e.g. immunization). We have added a more elaborated explanation of this in lines 177-183.

They are many population densities maps that are open source. Was there any reason as to why?

Although several gridded populations datasets are available, the Facebook/CIESIN data set was assumed to have the most realistic reallocation of population to settlements. In addition, other frequently used high resolution gridded population datasets, such as WorldPop, use distances from roads and villages as covariates, and this can produce collinearity when used in conjunction with accessibility models. We have explained this in more detail in lines 187-191.

Line 383. I would be careful on making a recommendation on prioritizing reconstruction efforts to roads as this will vary on a case by case basis. Also, even if the roads were available and no facility it would be ambiguous. As indicated, roads could be navigated with specific vehicles.

We agree on this comment and have reconsidered our statement carefully to read: "Our results indicate that road damages are responsible for a relatively large loss of accessibility" [lines 398-399]. We have also added more information on rebuilding health facilities in lines 412-419.

In addition to point 4, in Table 2, is the access presented not a function of road damage and health facility closure? If we needed access lost due to road damage only it would be (access due to road damage + facility closure) –(subtract) (access due to facility closure). Therefore, when comparing which had a larger effect between facility closure or road damage you may need to reconsider given what has been presented in the manuscript.

Yes, in Table 2 we present the results of our accessibility model by means of road damage, health facility functionality and flood extent. The isolated effects of road damages on accessibility are only presented in-text.

Line 393. Was it evident that resilient facilities and infrastructure survived the extreme weather conditions and others did not? Would each facility not be affected in one way or the other due to the extreme conditions?

Unfortunately, we had no information on health facility resilience at the time of study conduction, but this would be an interesting case-study. We changed the sentence to read: "Fourteen percent of all health facilities in Cyclone Idai- and Kenneth-affected cyclone- districts have been damaged or fully destroyed, although more health facilities were temporarily impacted in service provisioning due to flooding, electricity constraints or damage to equipment." [lines 409-412].

Reviewer: 2

Reviewer Name: Michelle M. Schmitz

Institution and Country: Centers for Disease Control and Prevention, United States of America

This manuscript uses a novel approach by using the AccessMod platform to estimate travel time accessibility pre- and post-disaster in lesser-developed settings, to better quantify the scope of a disaster upon the impact on healthcare accessibility. To my knowledge, this topic is not adequately covered in the literature, and this manuscript is timely. However, I first feel that this manuscript needs edits in terms of its scope, analytical methods, and grammar.

Thank you for the thorough and helpful feedback on our manuscript we have integrated most of your suggestions and provide feedback to each of your comments in the sections below.

The most pressing matters, to me, are the use of resampling to assess higher-resolution data when some data cannot be assessed in this way. Additionally, I am concerned at the use of the paired T-test, in lieu of comparing Z-scores, as populations (not samples) are being assessed. The authors also need to be more explicit about how calculations were performed, complete with formulas – they seem to be brought up, without a clear definition.

That said, I applaud the work of the authors, and their attempts at quantifying a very messy issue. I look forward to revising any revisions that may be - and I will note that I added quite a few editorial revisions as well in my comments, so please don't be alarmed!

We have considered your feedback and suggestions carefully and have made changes throughout the manuscript to improve the structure and methodological explanations. Because we strongly agree on your comment on the t-test, we decided to not do any statistical tests on the accessibility coverage estimates. We also rewrote the introduction to integrate information on current humanitarian responses in the context of accessibility.

Title Page

Affiliation #4: add comma between "Nairobi" and "Kenya" (missing comma)

Affiliation #5: "Health Section, The United Nations Children's Fund, New York, United States of America" (may want to think about switching "Health Section" and "The United Nations Children's Fund", to make affiliation "The United Nations Children's Fund, Health Section". The sentence structure is different than the other affiliations.)

All suggestions and edits were integrated accordingly.

Abstract

Objectives

Line 5: are you assessing or estimating post-disaster travel times? To me, this review is estimating - we don't actually KNOW post-analysis how the travel times changed.

We have changed this to read: "The aim of this study was therefore to estimate post-disaster travel times to functional health facilities and analyze losses in accessibility coverage after Cyclones Idai and Kenneth in Mozambique in 2019." [lines 4-6]

Line 6: remove "that"

Setting:

Line 12: Hyphenate "high resolution" if reducing word count

Line 13: Population coverage statistics or population coverage estimates?

Lines 21, 23, 25: can hyphenate with affected (e.g., "Idai-affected", "Kenneth-affected").

Conclusions (must make title plural)

All suggestions and edits were integrated accordingly

Strengths and Limitations of the Study

Lines 46-47: Saying, "To account for uncertainty of the assumed travel speeds, we considered multiple possible scenarios," seems a little unreasonable as a statement. It could be quantified with a short description of how these scenarios were quantified.

Line 48-49: May need authors to describe that various sources can be at different levels (global, local)?

All suggestions and edits were integrated accordingly.

INTRODUCTION

Line 57 (and *all* subsequent references in the paper): remove space between end of sentence and reference. This will help keep your word count significantly down.

Thank you for putting this forward, we have changed this throughout the paper.

Lines 69-74: would have been useful to revise Figure 1 to include path of cyclone trajectory.

Figure 1 has been updated to include the cyclone trajectory (Figure 1c & 1d) and road damages (Figure 1e & f).

Line 75: May not be necessary to break both death tolls down into a parenthetical statement? Might want to just use dependent clause instead, i.e., “The two cyclones combined had a death toll of 648, with 603 fatalities due to Idai and 45 deaths caused by Kenneth, and left over...”

Lines 78-79: Rework sentence to say, “..., inability in accessing safe water and sanitation,”

Line 82: Rework sentence to read, “...and restricting the population’s access to adequate health care”.

Line 84: “but” would be a better conjunction than “however”

All suggestions and edits were integrated accordingly.

Line 89: I would have liked to see more information about how geographic inaccessibility (or breaking up of parts of health systems) would impact overall.

We have restructured the introduction and explain more generally why accessibility measures are important during a disaster response.

Lines 102-103: Do the authors know why these response guidelines don’t cover post-disaster assessments? This is not my field of expertise, but it could be helpful for the authors to mention what IS done after a disaster.

We really valued this feedback and have added a paragraph on how humanitarian management in light of accessibility is currently assessed [lines 83-101]. This considerably improves the statement that geographic accessibility measures should be part of humanitarian response cycles.

Line 110: Not sure if “population coverage losses” is the correct term. Maybe “loss in accessibility coverage”?

Thank you for addressing this. We decided to change “population coverage” to “accessibility coverage” throughout the entire paper.

METHODS

Line 119: May want to italicize words being defined (accessibility, coverage). I also have an issue with how coverage is defined, in that these are ESTIMATED coverage. So it would be better to say, “the ESTIMATED number or percentage of people...”

We integrated "estimated" as requested [lines 112-114].

Line 125: Can write, “between April-September 2019” if need to reduce space.

This was changed accordingly in line 118.

Line 126: May want to quantify approximate times for each of these scenarios as well, just because the “post-Idai” scenario could be pre- or post-Kenneth as well.

We have added time indications for both cyclones in lines 119-121, exact cyclone dates are described in the introduction line 68 and line 71.

Table 1

In general, authors should be citing sources within the table, not just including acronyms.

Thank you for pointing this out. Table 1 has been updated to include all URLs and references to the according data sources.

Flood extent – Should put comma after flood extent (e.g., “Flood extent, Idai”, “Flood extent, Kenneth”.

Integrated.

Also, why are there two separate data sources used for Idai and Kenneth? I’m under the impression that Sentinel-1 (include the hyphen) is global, as is Copernicus.

All post-cyclone data was made available through humanitarian data exchange and the geonode platform in Mozambique. The flood layers we chose were the only ones represented at the time of initial accessibility assessment.

May want to include in maps locations of road damages

Figure 1 was updated to include this. Figure 1e and 1f represent road damages in the cyclone-affected regions.

For “health facility damages”, the source date is unclear – it says “48 h – 1 week post-cyclone” Is this saying that it was 48 hours after one of the cyclones, and 1 week after the other cyclone? If so, explicitly mention this.

We changed the data description in table 1 to read: “Represents health facility status 48h until 1 week post cyclone”.

For “population density”, are we assuming a static population density for the year mentioned? Since there’s such a lapse between source date and download date, is it fair to assume that population density change patterns may have changed because of the change in population movement due to the hurricane(s)?

Unfortunately, this was the only high-resolution gridded population dataset available and fit for the use at the time of study conduction. Reasoning behind the exact decision-making has been included in lines 185-191.

Data sources and preparation

Line 142: “All rasters and shapefiles...” (don’t need hyphen)

Line 144 (and all subsequent uses of “Supplementary”) – the term should be either “Supplement #”, “Supplementary Materials”, or “Appendix #” (with # = number). Supplementary is an adverb and is confusing to a native English speaker.

All suggestions and edits were integrated.

Line 146: tiles or mosaics?

Tiles is indeed correct but we included another sentence on this to be more explicit [line 141].

Lines 152-153: Was there a specific rationale that the authors decided to resample? I’m concerned about the use of resampling to get down to 30 meter resolution. While resampling works in terms of getting the job done, but is not always suggested because it adds in artifacts and raster cells can potentially be misaligned. I usually would suggest using the lowest resolution data source as your first step, and go from there.

Thank you for your thorough feedback on this. We have carefully considered this point and decided to leave the resampling of the land cover as it is now, since all other raster layers were on 30-meter resolution. Moreover, it was the first time that AccessMod was applied at this scale (i.e. 30 meters), which ensures notably a more realistic consideration of the vector-based linear road segments and barriers. We reason that the nearest neighbor resampling of the land cover dataset does not introduce much uncertainty for the analysis.

Line 159: Capitalize PDF

Line 161: Put “(1)... ..closed”) into a parenthetical statement, since using i.e.,

Line 162: Comma after May 3

All suggestions and edits were integrated accordingly.

Line 164: Is there a table of the road type – damage combinations?

Yes, the travel scenario represents all unique road damage combinations in supplement 2.

Line 169: Is there an assumption of bridges or something like that when crossing rivers and/or if the river is passable by a population? (Do you know what the width of said river may be as well, or if a trail normally passed through it?) Furthermore, what was the definition of a "primary river"? Rivers and lakes were available in polygon format where width could be considered. Primary streams were available as lines, where width could not be considered. Lines were converted to 30 meters as part of the rasterization in the land cover merge module in AccessMod. These were separate datasets provided by the DNGRH and reflect clear barriers to movement whereas the smaller rivers and streams were highly variable when checking against background imagery.

Line 171: Need to cite Sentinel-1 and Copernicus Sources

Line 179: Capitalize "network"

All suggestions and edits were integrated accordingly.

Line 180: Ideally, should clearly define how calculation for grid * population is done to calculate the people that are not covered. It's somewhat clear, reading between the lines, but not completely clear. Lines 193-195 are rewritten to read: "In this step the total population per district is summed and the estimated absolute number of children under 5 that are able to reach a facility in a pre-defined travel time catchment are calculated."

Lines 184-185: If I'm reading this sentence correctly, the analyses for Cyclone Idai insinuates that similar analyses were NOT done for Cyclone Kenneth. Did I understand this correctly? If so, were there plans to do anything similar for Cyclone Kenneth? If not, why was this not performed? Unfortunately, geographic coordinates of villages in Kenneth-affected districts were not available at the time of study, and we are now specifying this [lines 202-203].

Line 190: "Health facilities" at the end of the line

Line 202: Should cite as "Figures 1a & 1b"

All suggestions and edits were integrated accordingly.

Geographic Accessibility Modelling

Line 212: May want to say which module(s) were specifically used in AccessMod

Line 222 (at the semicolon): Was this where flood waters were not ... inundating roads? Might want to rethink word choice here.

Line 229: Don't need "(2018)" after "Ouma et al." here.

Line 232: Simply can cite study instead of adding parenthetical statement for "Ebener et al., 2019"

All suggestions and edits were integrated accordingly.

Line 232: Why is a paired T-test being used to compare between the groups? Are you attempting to use sampled data (i.e., the correct usage of the T_test)? I would be cautious about this, because the raster that's assumed here would be using z-scores since you're comparing across the entire population (of raster cells). GHSP should have an article performed by Schmitz et al, which describes the calculation used between rasters.

Thank you for this very valuable feedback. We strongly agree on your comment on the t-test and decided to not do any statistical tests on the accessibility coverage estimates.

RESULTS

The results, in general, should be clear that this is estimated coverage in terms of the amount of children covered.

Added a sentence in lines 262-263: "All statistics mentioned in the results are estimates of children covered by functional health facilities based on our accessibility model."

Pre-cyclone accessibility

Lines 245-246: "2 hour catchment limit" (not "hours")

Lines 260-261: can say "cyclone-affected districts"

Lines 263-268: The authors may want to better standardize how figures are being cited. They're either being cited as parenthetical statements, or within the text itself. It's a stylistic matter.

All suggestions and edits were integrated accordingly.

Table 2: See previous notes about using a paired T-test. Since two samples are not being compared against, but two estimated populations, this is not a correct use of analysis.

P-value is better assessed at the right-hand side of the table.

Thank you for this very valuable feedback. We strongly agree on your comment on the t-test and decided to not do any statistical tests on the accessibility coverage estimates.

Adding commas or periods for numbers under each "Children <4 covered (nr.)" category improves legibility.

Line 281: "most affected district", not "heaviest affected district"

All suggestions and edits were integrated accordingly.

Lines 283-284: Why did the authors pick 20% faster/slower speeds for uncertainty modeling? Was there a specific rationale for this?

This was adapted from Ouma et al (2018), explained in lines 248-249.

Line 287: How can uncertainty modeling guide resource allocation for decreasing this uncertainty? (That's how the sentence reads.) This seems to be a point better for discussion, not results.

We changed the sentence to read: "This information indicates where our travel time assumptions have the largest effect on accessibility and coverage losses and where this may be either under- or overestimated based which can help guide resource allocation for decreasing this uncertainty." [lines 308-310].

Line 292: "previously-covered"?

Line 293: "heaviest-affected"?

Line 298: Can put analysis about floods in another paragraph

Lines 304-305: "2 hour catchment areas".

All suggestions and edits were integrated accordingly.

Travel time in affected communities

Lines 309-310: "Buzi and Muanza district in Sofala province"

Line 310: "The Mucinenemo community in Buzi district..." (can also say, "Mucinenemo, in Buzi District,...")

Line 312: "Supplementary Appendices 5 & 6)

Line 313: Idai-affected

Lines 316-317: Can say, "...community of Chipota in Muanza district", or can say, "with the highest travel time found in Chipota, in Muanza District".

All suggestions and edits were integrated accordingly.

Health facility closures

Lots of wording that can be modified. See suggestions below:

Line 323: "The effects of non-functioning health facilities were isolated..."

Line 325: "a post-cyclone scenario where modified functionality status was considered"

Line 326: "comparing these pre-cyclone and post-cyclone scenarios,"

Line 327: "transportation-specific disruptions"

All suggestions and edits were integrated accordingly.

Lines 330-331: Were the flood waters passable or impassable? This seems to be discordant with other analyses previously described. Why was this decision made? Possibly needs to be better described in methods as well.

We have added a couple of words on this because this was only done to actually consider the status of each health facility since health facilities located on barriers were excluded even though they might have been operational in the disaster phase. We changed this part to read [lines 349-351]: “providing a way to assess the likely impact of future programs aimed at reinforcing health facilities for disasters. In order to make these comparisons in this specific example, both scenarios were run under the assumption that flood waters were fully passable. In all other instances throughout the paper, flood waters were considered impassable.”

Lines 336-337: Causally speaking, does this statement make sense though? I could see that patients wouldn't be able to access hospitals/facilities because of reduced accessibility, but facilities also would be shut down because of the weather, affecting patients...

We fully agree and have removed the second part of the statement. We think that this sentence justifies exactly what we found. Of course, hospital closures have an effect but no additional effect when compared to road closures [lines 357-361].

Line 341: Description of coverage loss is not clear. Authors need to describe how calculations are created in the method section.

Lines 192-195 are rewritten to read: “Population density was used to run zonal statistics on the cyclone-affected districts. In this step the total population per district is summed and the estimated absolute number of children under 5 that are able to reach a facility in a pre-defined travel time catchment are calculated.”

Lines 345-347: Was there any particular reason that Cyclone Idai was focused upon, and not Cyclone Kenneth? I notice that “health facility closures did not have an additional effect on post-cyclone accessibility...”, which I'd expect given timing – but isn't it true that different districts were affected between Cyclone Idai and Cyclone Kenneth? The authors should think about a causal mechanism for why this may be the case (and bring it up in discussion).

This is likely caused by the fact that flood extents and hospital closures were of much smaller magnitudes in the Kenneth-affected region than in the Idai-affected region [lines 373-376].

DISCUSSION

Line 350: Comma after “(p<0.05)”

Line 351: Comma after “increased”.

Line 358: Can revise to, “decreased population coverage directly after the cyclones,”

All suggestions and edits were integrated accordingly.

Line 361: In the first sentence, do the authors conclude that their methodology will help identify underserved districts early? How can this be methodologically implemented, given how long it takes to understand the full scope of a disaster after it has occurred?

We have extended the paragraph with a couple of sentences on the timeline of data availability in our specific case [lines 390-395].

Line 365: cyclone-affected
Integrated.

Lines 371-373: The transition between paragraphs here is a little confusing. I understand the observations found here, but I'm having a hard time understanding why the reader may care about this specifically.

This paragraph was rewritten in lines 383-398 to make the transition smoother. We decided to still present this information because prioritizing reconstruction efforts should be concerted between health- and road authorities, since they are strongly interrelated when it comes to accessibility to health care.

Line 387: Comma after “population distribution”, and then revise to “suggest this FIGURE is an understatement”

All suggestions and edits were integrated accordingly.

Lines 391-392: Was this statement, “Fourteen percent of all health facilities in cyclone-affected districts...”, based on the results for Cyclone Idai and Kenneth, or generally? Authors may want to revise statement to, “facilities in Cyclone Idai- and Kenneth-affected districts” to be clearer.

This has been changed to read: “Fourteen percent of all health facilities in Cyclone Idai- and Kenneth-affected cyclone-districts have been damaged or fully destroyed, although more health facilities were temporarily impacted in service provisioning due to flooding, electricity constraints or damage to equipment.” [lines 409-412].

Line 399: Write “four” as “4”

Lines 402-403: Revise to “subsequent health losses”

Lines 408-410: Move this sentence to be first in this paragraph.

Line 409: Revise to “where deployment of CHWs”

Line 410: Think about structure of citing supplementary material (previous comment)

Line 413: Commas between statements, to be, “The districts that were most affected by Cyclone Idai and Kenneth were historically, and are in the future, also prone to disasters”

All suggestions and edits were integrated accordingly.

Lines 413-414: Logical conclusion for statement needs to be better quantified

We changed the sentence to read: “The districts that were most affected by Cyclone Idai and Kenneth were historically, and are in the future, also prone to disasters due to their topography (i.e. coastal cities, cyclone belt Indian Ocean, and low elevation).” [lines 438-440].

Lines 423-424: May want to revise to, “While the occurrence of natural disasters generally accelerates data... there also are challenges of data quality...”

Lines 434-436: Authors need to make long sentence into two smaller sentences.

All suggestions and edits were integrated accordingly.

Line 435: Authors may want to consider that this conclusion also could happen because river paths may change with occurrence of cyclone (e.g., river -> flooding -> new paths developed).

This could indeed be the case, however the hydrography layer was a pre-cyclone layer and superimposed on pre-cyclone satellite imagery.

Lines 438-440: Wording is awkward, may need to revise.

Integrated.

Line 448: Authors say that the accessibility model was run for walking alone on closed roads. They may want to clearly define how they would expect results to change if using multiple forms of transport.

We have added a sentence on this in lines 473-475: “However, some of the restricted roads were in fact passable by 4x4 vehicles. Other means of transport (e.g. bicycle, motorcycle) may also have been used in some places, which would increase accessibility to health centres.”

Lines 458-461: Through what use case would people see this occurring? Throughout the country? Subnationally? May need to clearly define what outputs are expected from this.
Lines 487-491 were rewritten to describe this more clearly.

Lines 468-471: Authors should break up long sentence into smaller ones.
Integrated.

REFERENCES:

#5: Write out reference author: "United Nations Office of Coordinated Humanitarian Affairs".
#15: Check citation. Do the authors want to write out "UNICEF" as "UNICEF", or as its full name? Also, punctuation seems questionable.
#32: Write out reference author: "World Health Organization"
#43 See note about #15
All suggestions and edits were integrated accordingly.

Figure 1:

Should probably have flood extent and/or cyclone tracts shown here. Also, should probably have information in footnote about how districts affected, as it is hard to tell based on map alone since areal units (districts) are shown alone.

This figure was updated to include the cyclone trajectories for both districts in figure 1c and d and to represent road closures in figure 1e and f.

Figure 2:

Data presentation is not that easy to follow. Graphic is relatively small, which is possibly not fault of authors. However, it's hard to tell the reasoning behind the ordering of the districts. Have the authors considered other types of data presentation/visualization here?

Yes, we have considered other types of data visualization, but we concluded that pre and post cyclone comparisons are difficult when you want to illustrate absolute coverage losses combined with relative losses in the labels. The size of the image has been updated accordingly.

Figure 3:

Flood extent not easy to spot here. Should probably darken it, or make easier to see. Looks like uncertainty intervals are partially driven by the fact that road network speeds are much higher than other types of land cover. Is this assumption correct? If so, quantify in text. Flood extents were darkened, however flood extents for Kenneth are relatively small.

Figure 4:

River/flood extent very hard to spot. (See comments for Figure 3)
Flood extents were darkened, however flood extents for Kenneth are relatively small.

S1:

Authors should clearly be citing all sources used (with URLs).

Elevation – authors should explain why they mosaiced first before analyzing, for purposes of reader comprehension.

Road network - When was this data collected, specifically? This seems a little bit of an odd statement to say.

Say, "up-to-date"

Authors could make these paragraph a little more succinct; it's currently hard to follow.

Capitalize "PDF"

Table, with road speeds, can be easier to follow than prose if included in appendix

All suggestions and edits were integrated accordingly.

Barriers to movement

Source DNGRH

Authors need to mention which satellite imagery was used (Copernicus/Sentinel assumed, but should mention nonetheless), as well as collection date and scaling.

All suggestions and edits were integrated accordingly.

Population Data

Authors need to be more explicit about the raster calculator calculation used to re-interpolate the lost population into the raster cells equally.

All suggestions and edits were integrated accordingly.

Health facilities

Authors should be citing all sources used, and the dates used. (Or, just reference to Table 1)!

Is the "Neonatal Inventory Survey" the NIS from UNICEF? Also, if UNICEF is being described up here, write the full name of UNICEF up here, and not in the next paragraph.

All suggestions and edits were integrated accordingly.

S2

Is it fair to assume that if an area was flooded and not on a road, there was a reduction in speed taken?

Yes, because even though some region might not have been flooded, heavy rain persisted in the direct aftermath of a disaster impacting travel speeds.

S3

No major comments

S4

No major comments

S5

Authors should think about revising title - should probably give heading on this page (i.e., "Difference between...")

All suggestions and edits were integrated accordingly.

S6

Why was this (very well done) map only created for Idai and not for Kenneth, given that the same areas hit twice with two cyclones in a very constricted time period?

Unfortunately, geographic coordinates of villages in Kenneth-affected districts were not available at the time of study [lines 202-203].

VERSION 2 – REVIEW

REVIEWER	Peter M Macharia KEMRI Wellcome Trust Research Programme, Nairobi, Kenya
REVIEW RETURNED	30-Jul-2020

GENERAL COMMENTS	all my comments have been addressed
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REVIEWER	Michelle M. Schmitz
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	Booz Allen Hamilton (former Centers for Disease Control and Prevention), United States of America
REVIEW RETURNED	16-Aug-2020

GENERAL COMMENTS	<p>Thank you for providing the opportunity to review another draft of this manuscript - a lot has changed on it, but in a good way. I appreciated reviewing this manuscript - and suggest that with minor revisions, that this article is accepted for publication. I'm happy to review with the authors to give clarity on my suggestions, or some examples.</p> <p>Before I start: Generally, if you're using an abbreviation multiple times across the paper, go ahead and introduce the term and abbreviation, and then use the abbreviation throughout the paper.</p> <p>However, if you're not using an abbreviation in multiple places, just write out the word and don't introduce the abbreviation. It can be a little confusing, otherwise.</p> <p>Abstract</p> <p>Line 10: Mention the exact version of AccessMod v5 (revision), since that's already in text and shouldn't add to the word count.</p> <p>Line 51: "higher quality" should be hyphenated.</p> <p>Introduction</p> <p>Line 67: comma after "2019"</p> <p>Lines 67-68: break into two separate sentences or add an "and" before "the storm ended".</p> <p>Lines 83-101: I understand the need to outline the cluster approach before going into the sectors for humanitarian approach. HOWEVER, I feel like a lot of the post-disaster data gathering, and movement towards assessing loss in geographic accessibility, are getting lost in the long paragraph here.</p> <p>My suggestions are two-fold: 1) Possibly put a paragraph break on Line 93 (to make it easier to read) 2) Reduce a little bit of the first paragraph (if not clear) and then emphasize work on geographic accessibility.</p> <p>Additionally, this paragraph is very, very bulky.</p> <p>I appreciate that you took a lot of my comments into consideration - but it would be useful to break this up into more discrete paragraphs - kind of like what you had before. It was harder to understand the flow of logic in the first draft, but it could have been potentially done with some paragraph rearrangement as well.</p> <p>Lines 86-87: hyphenate "post" and "disaster", per the recommendations online.</p> <p>Methods</p>
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	<p>In general, it seems that there was a significant amount of overlap between the methods and the Supplementary Appendix containing the methods. You may want to remove details from the Methods section, and make the link to the supplementary appendix more explicit.</p> <p>Line 118: Add an "s" to "Cyclone" (i.e., "Cyclones").</p> <p>Line 137: Modify to "...and is fully detailed..."</p> <p>Lines 141-142: "...and was accounted for in modeling walking movements."</p> <p>Lines 144-147: Was a sensitivity analysis done to account for relative effects of resampling vs not resampling? I read the initial comments of the authors to my first set of analyses, but I wanted to check as the authors said that there was minimal change.</p> <p>Lines 146: Add comma after, "30-meter resolution".</p> <p>Lines 164-166: Would have put the references at the end of the sentence, but this is a stylistic choice.</p> <p>Lines 174-183: May want to figure out how to make this paragraph more concise. It's understandable, but a little bit repetitive throughout the sentences.</p> <p>Line 177: remove space between "limited" and citation.</p> <p>Line 189: hyphenate "high" and "resolution"</p> <p>Line 206: May want to reference SIS-MA, even if already cited in the table.</p> <p>Line 219: Write "Figure" as "Figures".</p> <p>Results</p> <p>Lines 262-263: I see the note about statistics mentioned in the results - but I also recall that statistics were stripped out of the analyses (particularly the tables) because of the emphasis on not doing paired t-tests vs. z-scores.</p> <p>This begs two questions: 1) Was there any statistical analysis done in this revision of the analysis? 2) Do the authors need any additional thoughts on statistical analyses to be done between pre- and post-disaster analyses?</p> <p>Line 301: Hyphenate "previously" and "covered". (i.e., "previously-covered").</p> <p>Line 310: Can remove "based" - adds nothing to the sentence.</p> <p>Lines 322-323: Were there plans on these results being displayed (i.e., are these in Table 2)? It doesn't appear as such, from where I'm reading.</p> <p>Lines 344-368: Were there plans of showing this analysis in a figure or table? (It's okay if it's not, just wanted to check.)</p>
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	<p>Discussion</p> <p>Pretty good, in general. I went back and forth on whether to suggest opening with an overall recommendation, followed by what your results showed, for most paragraphs, though.</p> <p>Lines 371-372: You can remove the comma between "increased" and "in the direct aftermath".</p> <p>Line 377: Probably may want to include a paragraph break between this paragraph and the next one.</p> <p>Line 386: Add "the" between "with" and "largest".</p> <p>Line 416: remove the space between "equipment" and the references.</p> <p>Line 435: Can eliminate the written-out form of CHWs (i.e., "deploy CHWs and mobile outreach services"), as it's already been mentioned before. Just use the abbreviation (CHWs).</p> <p>Line 439: I think you can say "Supplementary Materials 3-6" instead of what's currently there. Also, what is the point of bringing up this sentence if you're not going to directly mention what's addressed in each supplement (i.e., put individual clauses in the sentence which describe each of the appendices)?</p> <p>Line 440: Can remove ", directly".</p> <p>Lines 443: Would re-write parenthetical statement as "due to their location as low-lying coastal cities in the cyclone belt near the Indian Ocean."</p> <p>Line 457: Can split sentence between "possible" and "but since data gathering".</p> <p>Lines 458-459: Can remove "for instance".</p> <p>Lines 468-469: Change to "was potentially overestimated" and "land pockets were created". (This was a change of tense.)</p> <p>Line 475: Can remove comma between "closed" and "were considered".</p> <p>Lines 502-509: Would you make any suggestions for a standardized approach for this, or outline what you'd want to see in any standards? This seems to be tacked on at the end of the paper, but could be better strengthened.</p> <p>Tables</p> <p>Table 1: I agree that including the links in-tables are helpful for the source - BUT you might just want to put these in the bibliography or in some type of technical appendix. I'm not sure how BMJ Open likes to link this type of citation; please check with your editor.</p> <p>Also, under "Health facilities damage", "post cyclone" should probably be written as "post-cyclone".</p>
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	<p>Table 2: What is the difference between this Table 2 and the one in the previous version? I saw no major changes when reviewing the edited draft.</p> <p>Figure Legends</p> <p>Line 720: This can be consolidated into a single caption (no line break needed).</p> <p>Line 734: Add "in" between "results" and "Kenneth districts".</p> <p>Figures</p> <p>Figure 1B: This graphic (with the cyclone path included) was easier to follow, but you may need to make the cyclone path a little more transparent for easier viewing. Additionally, is there also a way to overlay the roads on here, or not at all?</p> <p>Figure 1C: Affected roads can be seen, but with a dark grey background, is actually hard to view.</p> <p>Figure 2: In the legend, instead of breaking the legend classes out into headings/legend classes (i.e., "Pre-cyclone" // "population within 2 hours", where "//" is a line break), you can consolidate into individual legend classes. Good presentation, though!</p> <p>Figures 3 and 4: Like the presentation of the figures - good improvement! May want to hyphenate 'pre-cyclone' and 'post-cyclone', though.</p> <p>Supplement 6: Hyphenate "Idai-affected". Also, beautiful color scheme used.</p>
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VERSION 2 – AUTHOR RESPONSE

Reviewer: 1

Reviewer Name: Peter M Macharia

Institution and Country: KEMRI Wellcome Trust Research Programme, Nairobi, Kenya

Please leave your comments for the authors below

all my comments have been addressed

Thank you for the time and efforts put in the second round of revisions.

Reviewer: 2

Reviewer Name: Michelle M. Schmitz

Institution and Country: Booz Allen Hamilton (former Centers for Disease Control and Prevention), United States of America

Thank you for providing the opportunity to review another draft of this manuscript - a lot has changed on it, but in a good way. I appreciated reviewing this manuscript - and suggest that with minor revisions, that this article is accepted for publication. I'm happy to review with the authors to give clarity on my suggestions, or some examples.

Thank you again for the helpful comments on our paper. We have made changes throughout the entire paper to improve it accordingly. Below we indicate the changes per comment. In case of any questions do not hesitate to reach out.

Before I start:

Generally, if you're using an abbreviation multiple times across the paper, go ahead and introduce the term and abbreviation, and then use the abbreviation throughout the paper.

However, if you're not using an abbreviation in multiple places, just write out the word and don't introduce the abbreviation. It can be a little confusing, otherwise.

Thank you for pointing this out. We have checked the introduced abbreviations throughout the paper and removed abbreviations used only once.

Abstract

Line 10: Mention the exact version of AccessMod v5 (revision), since that's already in text and shouldn't add to the word count.

Line 51: "higher quality" should be hyphenated.

All suggestions and edits were integrated accordingly.

Introduction

Line 67: comma after "2019"

Lines 67-68: break into two separate sentences or add an "and" before "the storm ended".

All suggestions and edits were integrated accordingly.

Lines 83-101:

I understand the need to outline the cluster approach before going into the sectors for humanitarian approach. HOWEVER, I feel like a lot of the post-disaster data gathering, and movement towards assessing loss in geographic accessibility, are getting lost in the long paragraph here.

My suggestions are two-fold:

- 1) Possibly put a paragraph break on Line 93 (to make it easier to read)
- 2) Reduce a little bit of the first paragraph (if not clear) and then emphasize work on geographic accessibility.

Additionally, this paragraph is very, very bulky.

I appreciate that you took a lot of my comments into consideration - but it would be useful to break this up into more discrete paragraphs - kind of like what you had before. It was harder to understand the flow of logic in the first draft, but it could have been potentially done with some paragraph rearrangement as well.

We have removed the explanation on the cluster approach and brought back some lines from the first manuscript to make the transition of topics smoother (lines 83-96 in track changes version). To reduce the introduction of new information we only kept the sentences on key indicators from the WHO (lines 93-97 in track changes version).

Lines 86-87: hyphenate "post" and "disaster", per the recommendations online.

Suggestions and edits were integrated accordingly.

Methods

In general, it seems that there was a significant amount of overlap between the methods and the Supplementary Appendix containing the methods. You may want to remove details from the Methods section, and make the link to the supplementary appendix more explicit.

Thank you for the feedback. The supplementary material contains more details on the methods that we have applied to the data preparation and we have therefore decided to leave the methods and supplementary material as they are. In addition, this improves readability because both the methods and supplementary material can be read as standalone information.

Line 118: Add an "s" to "Cyclone" (i.e., "Cyclones").

Line 137: Modify to "...and is fully detailed..."

Lines 141-142: "...and was accounted for in modeling walking movements."

All suggestions and edits were integrated accordingly.

Lines 144-147: Was a sensitivity analysis done to account for relative effects of resampling vs not resampling? I read the initial comments of the authors to my first set of analyses, but I wanted to check as the authors said that there was minimal change.

No, we did not do a sensitivity analysis because this would require the resampling of other continuous raster layers that would introduce more uncertainty (i.e. the population density layer). Moreover, working at a resolution of 30 meters will also minimize errors/uncertainty around rasterizing vector data (roads, rivers, flood extents).

Lines 146: Add comma after, "30-meter resolution".

Lines 164-166: Would have put the references at the end of the sentence, but this is a stylistic choice.

All suggestions and edits were integrated accordingly.

Lines 174-183: May want to figure out how to make this paragraph more concise. It's understandable, but a little bit repetitive throughout the sentences.

Line 177: remove space between "limited" and citation.

Line 189: hyphenate "high" and "resolution"

Line 206: May want to reference SIS-MA, even if already cited in the table.

Line 219: Write "Figure" as "Figures".

All suggestions and edits were integrated accordingly.

Results

Lines 262-263: I see the note about statistics mentioned in the results - but I also recall that statistics were stripped out of the analyses (particularly the tables) because of the emphasis on not doing paired t-tests vs. z-scores.

This begs two questions:

1) Was there any statistical analysis done in this revision of the analysis?

2) Do the authors need any additional thoughts on statistical analyses to be done between pre- and post-disaster analyses?

1) No additional statistical test was carried out. 2) Thank you for pointing this out. The question of the paper is whether there is a difference between pre- and post-cyclone coverage and travel time, and this has become apparent from the results shown in the tables and figures. In addition, one of the other main points of the paper is to address and introduce a potential workflow for doing this type of work in the aftermath of a disaster. Therefore, we feel that the current representation of the results is

sufficient for the objectives and goal of the study and at the moment no additional analyses are needed.

Line 301: Hyphenate "previously" and "covered". (i.e., "previously-covered").

Line 310: Can remove "based" - adds nothing to the sentence.

All suggestions and edits were integrated accordingly.

Lines 322-323: Were there plans on these results being displayed (i.e., are these in Table 2)? It doesn't appear as such, from where I'm reading.

All statistics mentioned in these lines are presented in Table 2. The results in lines 344-368 (in track changes version) are not in any tables and are just be presented in-text.

Lines 344-368: Were there plans of showing this analysis in a figure or table? (It's okay if it's not, just wanted to check.)

We have decided to not present these results in an additional table or figure. These results are presented in-text.

Discussion

Pretty good, in general. I went back and forth on whether to suggest opening with an overall recommendation, followed by what your results showed, for most paragraphs, though.

Lines 371-372: You can remove the comma between "increased" and "in the direct aftermath".

Line 377: Probably may want to include a paragraph break between this paragraph and the next one.

Line 386: Add "the" between "with" and "largest".

Line 416: remove the space between "equipment" and the references.

Line 435: Can eliminate the written-out form of CHWs (i.e., "deploy CHWs and mobile outreach services"), as it's already been mentioned before. Just use the abbreviation (CHWs).

All suggestions and edits were integrated accordingly.

Line 439: I think you can say "Supplementary Materials 3-6" instead of what's currently there. Also, what is the point of bringing up this sentence if you're not going to directly mention what's addressed in each supplement (i.e., put individual clauses in the sentence which describe each of the appendices)?

We changed the sentence based on your first suggestion but would like to keep the reference to the supplementary material there because they are strongly linked to the results we refer to. All supplementary files have captions and titles to address what is shown there.

Line 440: Can remove ", directly".

Lines 443: Would re-write parenthetical statement as "due to their location as low-lying coastal cities in the cyclone belt near the Indian Ocean."

Line 457: Can split sentence between "possible" and "but since data gathering".

Lines 458-459: Can remove "for instance".

Lines 468-469: Change to "was potentially overestimated" and "land pockets were created". (This was a change of tense.)

Line 475: Can remove comma between "closed" and "were considered".

All suggestions and edits were integrated accordingly.

Lines 502-509: Would you make any suggestions for a standardized approach for this, or outline what you'd want to see in any standards? This seems to be tacked on at the end of the paper, but could be better strengthened.

We have added the following sentence in lined 522-524 (in track changes version): "In general, we would advise upon a more rigorous and sustainable data management during and after humanitarian emergency operations to ensure the applicability of spatiotemporal data analyses to quantify disaster impacts."

Tables

Table 1: I agree that including the links in-tables are helpful for the source - BUT you might just want to put these in the bibliography or in some type of technical appendix. I'm not sure how BMJ Open likes to link this type of citation; please check with your editor.

Thank you for pointing this out. All url's also have respective references in the bibliography, but we feel that it might be helpful for readers to have a direct link to the data source. In case the hyperlinks do not function well in the pre-final version we will make changes accordingly.

Also, under "Health facilities damage", "post cyclone" should probably be written as "post-cyclone".

Suggestions and edits were integrated accordingly.

Table 2: What is the difference between this Table 2 and the one in the previous version? I saw no major changes when reviewing the edited draft.

The content has not changed, only the alignment has been changed.

Figure Legends

Line 720: This can be consolidated into a single caption (no line break needed).

Line 734: Add "in" between "results" and "Kenneth districts".

Suggestions and edits were integrated accordingly.

Figures

Figure 1B: This graphic (with the cyclone path included) was easier to follow, but you may need to make the cyclone path a little more transparent for easier viewing. Additionally, is there also a way to overlay the roads on here, or not at all?

Thank you for your suggestions. We tried to overlay the road damages and cyclone paths, but unfortunately this reduces the readability. In addition, increasing the transparency of the cyclone paths does not substantially improve the figure so we have decided to leave the figure as it is.

Figure 1C: Affected roads can be seen, but with a dark grey background, is actually hard to view.

The background has been changed to light grey.

Figure 2: In the legend, instead of breaking the legend classes out into headings/legend classes (i.e., "Pre-cyclone" // "population within 2 hours", where "//" is a line break), you can consolidate into individual legend classes. Good presentation, though!

Thank you for the suggestion. Unfortunately this is technically complicated because of the way the figure has been scripted in R. Therefore we kept the legend as it is.

Figures 3 and 4: Like the presentation of the figures - good improvement! May want to hyphenate 'pre-cyclone' and 'post-cyclone', though.

Supplement 6: Hyphenate "Idai-affected". Also, beautiful color scheme used.

Suggestions and edits were integrated accordingly.