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Peer review history for:

Nqowana T, Fogel R, Bezerra JC, Limson J. Citizen science tools for engaged research: Water quality monitoring in remote communities. *S Afr J Sci.* 2024;120(9/10), Art. #18145.

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HOW TO CITE:

Citizen science tools for engaged research: Water quality monitoring in remote communities [peer review history]. *S Afr J Sci.* 2024;120(9/10), Art. #18145. <https://doi.org/10.17159/sajs.2024/18145/peerreview>

Reviewer D: Round 1

Date completed: 16 May 2024

Recommendation: Accept / **Revisions required** / Resubmit for review / Decline

Conflicts of interest: None

Does the manuscript fall within the scope of SAJS?

Yes/No

Is the manuscript written in a style suitable for a non-specialist and is it of wider interest than to specialists alone?

Yes/No

Does the manuscript contain sufficient novel and significant information to justify publication?

Yes/No

Do the Title and Abstract clearly and accurately reflect the content of the manuscript?

Yes/No

Is the research problem significant and concisely stated?

Yes/No

Are the methods described comprehensively?

Yes/No

Is the statistical treatment appropriate?

Yes/No/Not applicable/Not qualified to judge

Are the interpretations and conclusions justified by the research results?

Yes/Partly/No

Please rate the manuscript on overall contribution to the field

Excellent/**Good**/Average/Below average/Poor

Please rate the manuscript on language, grammar and tone

Excellent/**Good**/Average/Below average/Poor

Is the manuscript succinct and free of repetition and redundancies?

Yes/No

Are the results and discussion confined to relevance to the objective(s)?

Yes/No

The number of tables in the manuscript is

Too few/Adequate/Too many/**Not applicable**

The number of figures in the manuscript is

Too few/**Adequate**/Too many/Not applicable

Is the supplementary material relevant and separated appropriately from the main document?

Yes/No/Not applicable

Please rate the manuscript on overall quality

Excellent/**Good**/Average/Below average/Poor

Is appropriate and adequate reference made to other work in the field?

Yes/No

Is it stated that ethical approval was granted by an institutional ethics committee for studies involving human subjects and non-human vertebrates?

Yes/No/Not applicable

If accepted, would you recommend that the article receives priority publication?

Yes/No

Are you willing to review a revision of this manuscript?

Yes/No

Select a recommendation:

Accept / **Revisions required** / Resubmit for review / Decline

With regard to our policy on 'Publishing peer review reports', do you give us permission to publish your anonymised peer review report alongside the authors' response, as a supplementary file to the published article? Publication is voluntary and only with permission from both yourself and the author.

Yes/No

Comments to the Author:

General review of the manuscript

Citizen science relating to water quality in South Africa is an important and growing field of study, with many benefits and challenges. The aim of citizen science is increasing living standards for people across the country where poor to no governance occurs. The manuscript aimed to target this research gap in the Amakhala villiages to determine whether a population of people living in an area with poor to no water management are at risk of poor water quality. I found the manuscript to be of sound design, being open and engaging with community members and taking extra care of people in this area. I have read the manuscript and I believe if the following points are addressed the manuscript can be considered for publication by the Editor.

General comments

1. I found the introduction being a bit short with some much-needed information about water in South Africa that could be included. Some information about water quality issues in the country and types of pollution could highlight the need for studies of this nature. I know this is a case study but I feel some hypotheses would strengthen the overall manuscript?
2. I see from the map that there is a river moving through the area. However, I see no questions regarding the use of the river for water? From my experiences, in areas with poor water accessibility, people make great use of the rivers for collecting water to use. Did you investigate this possibility?
3. The map is a bit of poor quality. The colours blend and I struggle to see some information, I recommend that map is improved. Maybe look at QGIS for map making?
4. I find the solution of placing water in plastic bottles to purify the water as problematic as the heating of the plastic may release additives of the plastic that could itself be harmful to people, this must be addressed in future community meetings. Recycling glass bottles would be better.
5. I understand the manuscript is written in the form of a case study, but I would appreciate a section in the method where some more information is given to the statistical analysis that was conducted, software used, and so on.
6. I think it would be interesting to readdress the community after the study to see if fewer health issues occur in the communities. Naturally I do not expect this to be included now, but possibly in a future study.

Specific comments

line 17: change to "rainwater harvesting, rivers, pans, reservoirs, and borehole-extracted water"

line 80-87: Possibly space for hypotheses here? Hypotheses investigated in the case study.

line 90: This is a big statement, lots of research takes place in many freshwater environments in South Africa with various toxicants and pollutants investigated. Either rephrase or add more references than one to support your statement.

Line 92: As well as rivers, streams, pans, dams, and reservoirs
Line 93: Maybe mention that South Africa is also poor in water management and has low rainfall too.
Line 97: and other adverse health effects
Figure 1: As mentioned previously please improve the quality of the map.
All figures: Please check the consistency of your figure legends. The format changes through the entire document.
Figure 2: I like the figure, could we possibly increase the size to make it easier to read?
Line 145: See my comment about the questionnaire in the general comments.
Line 149: How exactly were they assisted? General question.
Line 164: Any information about who gave the original protocols?
Line 199: How were they incubated? Is there a prescribed way? Would different temperatures depending on when sampled impact the results?
Line 229: Maybe a statistical analysis section here?
Line 240: Any reason why such a small number of the greater community chose not to partake in the study out of 200 adults? This is important to know if researchers want to know how to improve citizen science projects to have a larger dataset of people taking place in the study. What was their responses why they didn't partake? Maybe can be included in a future questionnaire.
Line 271: Did any select "other"?
Figure 4: legend style changed.
Line 310: I might have missed it but does the borehole water have any filters before entering the tank?
Figure 6: Should 25% false negatives be concerning?
Line 388: Missing a bracket here somewhere.

Conclusion

I appreciate including some shortcomings that need to be addressed in the field for future citizen science projects such as these.
Supplementary materials: Consider changing plastic bottles with glass.

Author response to Reviewer D: Round 1

I found the introduction being a bit short with some much-needed information about water in South Africa that could be included. Some information about water quality issues in the country and types of pollution could highlight the need for studies of this nature. I know this is a case study but I feel some hypotheses would strengthen the overall manuscript?

AUTHOR: Thank you for this comment. SAJS has a word limit of 6000 and this restricts detailed analysis of the water quality issues. Therefore, we have removed the section called "citizen science case study" and instead included it as an amended paragraph in the introduction as follows:

"Access to safe drinking water remains a global challenge, exposing communities to waterborne diseases and their attendant consequences on health. Reliance on alternative water sources such as rivers, streams, pans, dams, and reservoirs as well as rainwater harvesting and borehole water - in rural regions is a common practice already employed in different African countries, including South Africa^{1,2}. South Africa specifically has poor water management systems, while also experiencing low rainfall. These water sources often have poor quality when considering either microbial presence and/or adverse chemical compositions³. Many rural communities in South Africa are therefore reliant on unsafe, untreated, water sources for drinking purposes, risking exposure to waterborne diseases and other adverse health effects⁴. Community knowledge and understanding of water quality and treatment is crucial in the prevention of waterborne disease outbreaks. Lack of access to water quality information and to information of alternative methods of treating water to the community has created a situation of epistemic injustice⁵. The ability of the community to act upon the water quality problem is dependent on understanding specific aspects of water quality and their attendant health implications. Citizen science approaches may offer an opportunity for community-based water quality monitoring to address shortcomings in the routine monitoring of water quality"

I see from the map that there is a river moving through the area. However, I see no questions regarding the

use of the river for water? From my experiences, in areas with poor water accessibility, people make great use of the rivers for collecting water to use. Did you investigate this possibility?

AUTHOR: The communities did not make use of the river water as these were not accessible to the communities, given the particular challenges of being situated within a nature reserve. We have indicated this in the Results section under the heading: Water demand and Supply

“Given the location of the surveyed area being situated in a nature reserve, the communities did not indicate river water as an accessible source of water to them.”

The map is a bit of poor quality. The colours blend and I struggle to see some information, I recommend that map is improved. Maybe look at QGIS for map making?

AUTHOR: Thank you. A new map was generated and has replaced the earlier one.

I find the solution of placing water in plastic bottles to purify the water as problematic as the heating of the plastic may release additives of the plastic that could itself be harmful to people, this must be addressed in future community meetings. Recycling glass bottles would be better.

AUTHOR: Thank you for this valid comment. Glass bottles are not an accessible resource available to the communities. However, this is an important point to address in further engagements.

I understand the manuscript is written in the form of a case study, but I would appreciate a section in the method where some more information is given to the statistical analysis that was conducted, software used, and so on.

AUTHOR: Thank you. We have now included this under the methodology section as follows:

Data analysis

Quantitative information extracted from the questionnaires' answers, from the H2S kits validation and the responses of the citizen scientists' water monitoring using the H2S kits were evaluated statistically, using R (v 4.3.1), using the ggplot2 package to generate graphical summaries of this information. Specific inferential statistical tests used to evaluate significant differences between samples can be found within the captions for these summaries.

I think it would be interesting to readdress the community after the study to see if fewer health issues occur in the communities. Naturally I do not expect this to be included now, but possibly in a future study.

AUTHOR: Thank you for this valuable suggestion.

line 17: change to “rainwater harvesting, rivers, pans, reservoirs, and borehole-extracted water”

AUTHOR: This line in the abstract was changed as per the above.

line 80-87: Possibly space for hypotheses here? Hypotheses investigated in the case study.

AUTHOR: Thank you. The following was added in at the end of the introduction:

“In the research, it was hypothesized that the use of H2S testing kits by citizen scientists would provide an accessible tool for communities to monitor microbial quality of water and that this would correlate with water quality results from Colilert tests conducted in a water quality testing laboratory”.

line 90: This is a big statement, lots of research takes place in many freshwater environments in South Africa with various toxicants and pollutants investigated. Either rephrase or add more references than one to support your statement.

AUTHOR: This sentence was meant to refer only to community knowledge of water quality but has now been removed.

Line 92: As well as rivers, streams, pans, dams, and reservoirs

AUTHOR: This has been included in a section moved to the first paragraph of the introduction.

Line 93: Maybe mention that South Africa is also poor in water management and has low rainfall too.

AUTHOR: Thank you. This has been included in the first paragraph of the introduction.

Line 97: and other adverse health effects

AUTHOR: This has been included in the first paragraph of the introduction.

Figure 1: As mentioned previously please improve the quality of the map.

AUTHOR: Thank you. This has been amended.

All figures: Please check the consistency of your figure legends. The format changes through the entire document.

AUTHOR: We have checked this and corrected where needed.

Figure 2: I like the figure, could we possibly increase the size to make it easier to read?

AUTHOR: We will submit high resolution images for SAJS editors to use.

Line 145: See my comment about the questionnaire in the general comments.

AUTHOR: Thank you. We have included text expanding on how the questionnaire was conducted:

The Kobo Toolbox¹⁷ is software used to collect, analyze, and manage data for surveys, monitoring, evaluation, and research. Researchers worked with individual community members in completing the questionnaire, inputting the responses provided into the Kobo Toolbox application. As the participants responded to each question, the researcher typed out the answer and read it back to the participant to confirm correct capture of the response.

Line 149: How exactly were they assisted? General question.

AUTHOR: Thank you. This was addressed as per the above:

The Kobo Toolbox¹⁷ is software used to collect, analyze, and manage data for surveys, monitoring, evaluation, and research. Researchers worked with individual community members in completing the questionnaire, inputting the responses provided into the Kobo Toolbox application. As the participants responded to each question, the researcher typed out the answer and read it back to the participant to confirm correct capture of the response.

Line 164: Any information about who gave the original protocols?

AUTHOR: References have been provided.

Line 199: How were they incubated? Is there a prescribed way? Would different temperatures depending on when sampled impact the results?

AUTHOR: Thank you. This has been included as follows:

Following 72 hours' incubation, participants recorded the number of issued H₂S water testing kits (out of 5) that were positive. Placing the sealed test bottles in a dark area at room temperature, typically between 25°C to 37°C allowed for incubation of the samples. Temperatures lower than this interval could affect the incubation of the hydrogen sulphide-producing bacteria.

Line 229: Maybe a statistical analysis section here?

AUTHOR: Thank you. A data analysis section has been included here as follows:

"Data analysis

Quantitative information extracted from the questionnaires' answers, from the H₂S kits validation and the responses of the citizen scientists' water monitoring using the H₂S kits were evaluated statistically, using R (v 4.3.1), using the ggplot2 package to generate graphical summaries of this information. Specific inferential statistical tests used to evaluate significant differences between samples can be found within the captions for these summaries".

Further statistical analysis has been indicated below relevant figures.

Line 240: Any reason why such a small number of the greater community chose not to partake in the study out of 200 adults? This is important to know if researchers want to know how to improve citizen science projects to have a larger dataset of people taking place in the study. What was their responses why they didn't partake? Maybe can be included in a future questionnaire.

AUTHOR: Thank you. We have clarified that the 29 adults were each representative of households that varied between 1 and 10 members. A total of 47 households are present in the survey area. The main cited reason for not participating was unavailability due to work or not being available for the whole duration of the study. The total number: 200 included all 7 villages and not just the 5 villages participating in the survey.

This has been expanded on further:

"The game reserve includes seven villages that are home to approximately 200 adults and 80 children¹⁶.

At the time of the survey, the 5 identified villages comprised 47 households. All of the households in these villages were invited to participate; 29 of the households, each represented by one person, agreed to

participate and were interviewed as part of the study. The main cited reason for non-participation was non-availability due to work or not being available for the whole duration of the study.

Line 271: Did any select "other"?

AUTHOR: Only borehole and rainwater were indicated.

Figure 4: legend style changed.

AUTHOR: We have edited this.

Line 310: I might have missed it but does the borehole water have any filters before entering the tank?

AUTHOR: No filters were noted. This has been indicated in the paper:

No filtration systems were noted on the borehole water accessed by surveyed participants.

Figure 6: Should 25% false negatives be concerning?

AUTHOR: Thank you. Of the 8 negative tests indicated by the H₂S test kits, 6 of these were considered true negative tests as judged by the laboratory-based Colilert testing. 2 out of these 8 tested samples had Colilert measurements slightly above the threshold, and were therefore classed as false negatives, hence the 25% value. We have edited the text below Figure 6 to include this information more clearly.

To note: The 25% on the figure 6 is caused by the small sample size that comprised the "0 positive H₂S kits" sample used to calculate true negatives and false negatives, as well as the threshold value used to distinguish between intermediate- and high-risk water samples by the paired Colilert test (<10 MPN/100 ml).

(only 8 samples, of which 6 were true negatives and two false negative samples having Colilert measurements close to the 10 MPN/100 ml threshold value),

Line 388: Missing a bracket here somewhere.

AUTHOR: This has been corrected.

Conclusion: I appreciate including some shortcomings that need to be addressed in the field for future citizen science projects such as these.

AUTHOR: Thank you. We have noted the following:

"A limitation of this approach, identified by both communities and researchers, is the validity of the test results given the three-day incubation period required to obtain results. Communities are also reliant on access to the water testing kits provided by researchers. Reflecting on this research, and with knowledge of the specific contextual requirements and available resources, a novel testing technology was identified that is currently under development by the researchers, that aims to provide more rapid results in a sustainable way".

Supplementary materials: Consider changing plastic bottles with glass.

AUTHOR: Thank you.

Reviewer D: Round 2

Date completed: 25 July 2024

Recommendation: **Accept** / Revisions required / Resubmit for review / Decline

Conflicts of interest: None

Does the manuscript fall within the scope of SAJS?

Yes/No

Is the manuscript written in a style suitable for a non-specialist and is it of wider interest than to specialists alone?

Yes/No

Does the manuscript contain sufficient novel and significant information to justify publication?

Yes/No

Do the Title and Abstract clearly and accurately reflect the content of the manuscript?

Yes/No

Is the research problem significant and concisely stated?
Yes/No

Are the methods described comprehensively?
Yes/No

Is the statistical treatment appropriate?
Yes/No/Not applicable/Not qualified to judge

Are the interpretations and conclusions justified by the research results?
Yes/Partly/No

Please rate the manuscript on overall contribution to the field
 Excellent/**Good**/Average/Below average/Poor

Please rate the manuscript on language, grammar and tone
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Is the manuscript succinct and free of repetition and redundancies?
Yes/No

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Please rate the manuscript on overall quality
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Is appropriate and adequate reference made to other work in the field?
Yes/No

Is it stated that ethical approval was granted by an institutional ethics committee for studies involving human subjects and non-human vertebrates?
Yes/No/Not applicable

If accepted, would you recommend that the article receives priority publication?
Yes/No

Are you willing to review a revision of this manuscript?
Yes/No

Select a recommendation:
Accept / Revisions required / Resubmit for review / Decline

With regard to our policy on '[Publishing peer review reports](#)', do you give us permission to publish your anonymised peer review report alongside the authors' response, as a supplementary file to the published article? Publication is voluntary and only with permission from both yourself and the author.
Yes/No

Comments to the Author:
 No comments provided.

Reviewer A: Round 1 and 2

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