Date: May 9 2017 11:59AM
To: "Tarek Loubani" tarek@tarek.org
From: "PLOS ONE" plosone@plos.org
Subject: PLOS ONE Decision: Revision required [PONE-D-17-10454]

PONE-D-17-10454
Validation of an effective, low-cost, high-quality, Free/open access 3D-printed stethoscope
PLOS ONE

Dear Dr. Loubani,

Thank you for submitting your manuscript to PLOS ONE. After careful consideration, we feel that it has merit but does not fully meet PLOS ONE's publication criteria as it currently stands. Therefore, we invite you to submit a revised version of the manuscript that addresses the points raised during the review process.

Overall this is an excellent project and concept, but the manuscript requires major revisions. There are several sweeping statements without justifications or references, the literature review is incomplete, the quality of the figures requires improvement, and the text requires modification as itemized by both reviewers.

We would appreciate receiving your revised manuscript by Jun 23 2017 11:59PM. When you are ready to submit your revision, log on to http://pone.edmgr.com/ and select the 'Submissions Needing Revision' folder to locate your manuscript file.

If you would like to make changes to your financial disclosure, please include your updated statement in your cover letter.

To enhance the reproducibility of your results, we recommend that if applicable you deposit your laboratory protocols in protocols.io, where a protocol can be assigned its own identifier (DOI) such that it can be cited independently in the future. For instructions see:
http://journals.plos.org/plosone/s/submission-guidelines#loc-laboratory-protocols

Please include the following items when submitting your revised manuscript:

- A rebuttal letter that responds to each point raised by the academic editor and reviewer(s). This letter should be uploaded as separate file and labeled 'Response to Reviewers'.
- A marked-up copy of your manuscript that highlights changes made to the original version. This file should be uploaded as separate file and labeled 'Revised Manuscript with Track Changes'.
- An unmarked version of your revised paper without tracked changes. This file should be uploaded as separate file and labeled 'Manuscript'.

We look forward to receiving your revised manuscript.

Kind regards,

David T. Eddington, PhD
Academic Editor
PLOS ONE

Journal Requirements:

When submitting your revision, we need you to address these additional requirements.

1. Please ensure that your manuscript meets PLOS ONE's style requirements, including those for file naming. The PLOS ONE style templates can be found at http://www.journals.plos.org/plosone/s/file?id=wjVg/PLOSOne_formatting_sample_main_body.pdf and http://www.journals.plos.org/plosone/s/file?id=ba62/PLOSOne_formatting_sample_title_authors_affiliations.pdf

2. Please amend either the title on the online submission form (via Edit Submission) or the title in the manuscript so that they are identical.

3. Please amend your list of authors on the manuscript to ensure that each author is linked to an affiliation. Authors' affiliations should reflect the institution where the work was done (if authors moved subsequently, you can also list the new affiliation stating "current affiliation:…." as necessary).

[Note: HTML markup is below. Please do not edit.]

Reviewers' comments:

Reviewer's Responses to Questions

Comments to the Author

1. Is the manuscript technically sound, and do the data support the conclusions?

The manuscript must describe a technically sound piece of scientific research with data that supports the conclusions. Experiments must have been conducted rigorously, with appropriate controls, replication, and sample sizes. The conclusions must be drawn appropriately based on the data presented.

Reviewer #1: Yes

Reviewer #2: Partly

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2. Has the statistical analysis been performed appropriately and rigorously?

Reviewer #1: N/A

Reviewer #2: No

3. Have the authors made all data underlying the findings in their manuscript fully available?

The PLOS Data policy requires authors to make all data underlying the findings described in their manuscript fully available without restriction, with rare exception (please refer to the Data Availability Statement in the manuscript PDF file). The data should be provided as part of the manuscript or its supporting information, or deposited to a public repository. For example, in addition to summary statistics, the data points behind means, medians and variance measures should be available. If there are restrictions on publicly sharing data—e.g. participant privacy or use of data from a third party—those must be specified.

Reviewer #1: Yes

Reviewer #2: Yes

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4. Is the manuscript presented in an intelligible fashion and written in standard English?

PLOS ONE does not copyedit accepted manuscripts, so the language in submitted articles must be clear, correct, and unambiguous. Any typographical or grammatical errors should be corrected at revision, so please note any specific errors here.

Reviewer #1: Yes

Reviewer #2: Yes

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5. Review Comments to the Author

Please use the space provided to explain your answers to the questions above. You may also include additional comments for the author, including concerns about dual publication, research ethics, or publication ethics. (Please upload your review as an attachment if it exceeds 20,000 characters)

Reviewer #1: This is a good and useful paper but I think both the paper and the presentation can be improved to further enhance the impact of this work.
1. ® symbol is distracting and not necessary or wanted in an academic work - please remove.
2. On the same front - mentioning the name brand of a stethoscope you are comparing it to in the abstract seems excessive.
3. page 9 line 2 it would be good to explain why this is (e.g. the RepRap project and associated publications) and provide a range of costs for the 3d printers that could produce the Glia
4. It is not clear to me what the benefit of CrystalSCAD is for this application - why not just use OpenSCAD for all design files? Please explain.
5. Please include what kind of 3d printer was used, what the settings were (e.g. fill density, etc.)
6. The costs in Table 1 - do not appear to be conservative to me - most 3d printer users do not make

their own filament -- I recommend expanding table 1 -- with a column for using commercial filament, the column you have using commercial abs pellets, and then a 3rd column for using recyclebot based recycled abs (e.g. just elec costs to run it). This will demonstrate the full range of potential costs for the Glia in the field.
7. Include some other commercial stethoscope costs.
8. Include a slightly wider range of literature review (e.g. there is a lot of work talking about using 3D printing for sustainable development and medicine in the developing world). Something like this would fit well into the mission of Field Ready -- and would also be considered "open source appropriate technology".
9. Briefly discuss other 3d printable stethoscopes available on the web. See http://www.yeggi.com/q/stethoscope/ Differentiate this work from those designs.
10. On the same note - I highly recommend that you upload the Glia to a design repository like Youmagine that enables a) a wider audience to find it and b) download tracking so you can start to track the downloaded substitution value, which is begining to be covered in the literature as a way to quantify the impact of libre hardware (e.g. in this case ~$150 saved per download depending on the cost of the commercial stethoscope (see point 7))
11. Fig 2a, 2b are not readable to me - please expand the size of the font, add in a high rez figure. Ensure that the figure can be read by colorblind readers.
12. Discuss the potential for using flexible filament instead of the silicone molds (or simply printing in silicone)

Reviewer #2: This paper describes the method used to produce 3D printed (3DP) parts required to assemble a stethoscope. Assembled 3DP stethoscopes (Glia) were compared with the Littmann Cardiology III in terms of signal amplitude in the range of 20 to 5k Hz. Figures display renders of the parts, a photograph of the Gila, and the traces of Gila vs. Littmann.

Firstly, the figures are not sufficient to support the claims made by the authors. Figure 1 has no scale bars, are of poor quality, lack of detail in the caption, and are unclear as to which parts are 3DP and which are bought/cast. Figure 1B in particular is misleading, and should most likely be put into ESI. I would like to see two figures: one demonstrating the measurements, of each part, with a photo of said printed part, and additionally where they are clearly labelled in a high-quality photograph of the Gila.

Figure 2 is unreadable and completely unacceptable; this data had to be sourced from the github.com to be legible. Further to this, it is puzzling to the reader as to why the scale bar for the frequency is not in logarithmic scale, as human hearing follows a log trend. In addition, the magnitude (which should be labelled Power) starts at -55, and goes to -25 dB. Why does it not start at 0 and have +ve and –ve axis? As typically seen in the literature? Is the 3DP Gila better for cardiology (40-100 Hz)? Respiratory (40-2000 Hz)? Both?
In terms of references, of which a number are missing, which are even referenced on the Gila website, including Wodicka et al. 1997, Pesonen et al. 2005. I suggest a much more thorough literature review to support this work.

My final thoughts on the paper are this. I was genuinely looking forward to this paper, and have been disappointed. While a great deal of work has gone into developing a low-cost 3DP stethoscope for the Gaza strip, I do not see that reflected in this paper. There is an over focusing on the low-cost aspect, boarding on sensationalism, and not enough on why it stands as practical medical device in its own right. Further detail and discussion of the technical merits of the device are needed, and careful interpretation of the results.

As the paper stands, there are also a number of inconsistencies, lack of engineering detail, and sweeping statements which I shall detail below:

Page 2 - Abstract
L2 – Powerful (sweeping statement, revise)
L4 – widely regarded (sweeping statement, revise, and reference)
L6 – high cost (disposable stethoscopes, and nurse single head stethoscopes are available for $5 USD or lower)

Page 3
L2 – introduced in 1819, by who? (Reference?)
L3 – Powerful (sweeping statement, revise)
L4 – Radical innovations (sweeping statement, revise)
L9 – There is more than one major brand than the Littmann Cardiology? (more on this later)
L10 - Widely regarded? By a website? (http://www.forusdocs.com/reviews/Acoustic_Stethoscope_Review.htm)
L22- Aim of the project? (not research?)

Page 4
L3-4 We also attempt to make our validation methods accessible and low cost (why? Why not make this paper the definitive proof that low-cost 3DP stethoscopes are equal if not better than commercial ones?)
L10 – CrystalSCAD (address, country)
L11 – OpenSCAD (address, country)
L3 - commodity 3D printer (which one? Resolution, nozzle width, temperatures, support? More detail needed)
L4 – Why 15% or 100%? Please explain.
Silicone tubing was sourced from where?
L12 – printed ring? Made of what?
L14 – Spring properties? Which material? Is it a design aspect or materials?
L15 – Silicone? What kind? What is the process?

Page 6
L1 – Phantom-based frequency response setup, needs more detail, I believe the reference from 1966 is not sufficient. What about Wodicka et al. 1997 and their work?
L10 – Many iterations? (What were the significant changes that were needed to arrive at the working version?)
L14 – Why three designs? Why only compare to the Littmann? How does it compare to disposable or single head stethoscopes?
L16 – Performed similarly? Can you explain the differences in the plots? It looks like the Littmann performs better at high-frequencies 4 to 5 kHz and at 3 kHz; which is better suited to respiratory sounds. The 15% infill seems to be better suited to 2.5 kHz range as well. Why does the Littmann underperform so significantly in the 20-100 Hz range? How does this compare to the study by Kindig et al. and Abella et al.

Page 7
L9 – Gold standard (repetition)

L13 to L18 – Repetition

Page 8
L1 to L7 – Fine, but more discussion as to how the Gila made use of this information in the design is needed.
L1 – Is it possible that the orientation of the model would affect the acoustic properties due to the alignment of the fibres affecting the surface roughness? Has this been tested?
L13 to L15 – Repetition
L18 – Class I medical device? Certified or is this speculative? (Is there a reference for this?)
L22 and L23 – Are contradictory, please clarify; are the Gila being gradually introduced or self-sufficient in the Gaza strip? Do they make their own filament, silicone, and tubing as well?

Page 9
L2 – I do not understand why we are discussing pulse oximeters and ECG machines. Conclusion in general needs significant reworking.

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6. If you would like your identity to be revealed to the authors, please include your name here (optional).

Your name and review will not be published with the manuscript.

Reviewer #1: (No Response)

Reviewer #2: (No Response)

[NOTE: If reviewer comments were submitted as an attachment file, they will be attached to this email and accessible via the submission site. Please log into your account, locate the manuscript record, and check for the action link "View Attachments". If this link does not appear, there are no attachment files to be viewed.]

Need assistance with your figure files?

While revising your submission, we encourage you to use PACE (the Preflight* Analysis and Conversion Engine, http://pace.apexcovantage.com/), a digital diagnostic and conversion tool for figure files. PACE helps users ensure that their figures meet PLOS requirements and that the quality of published figures will be as high as possible. To use PACE, you must first register as a user. Then, login and navigate to the UPLOAD tab, where you will find detailed instructions on how to use the tool. If you encounter any issues or have any questions when using PACE, please email us at figures@plos.org.