Author’s response to reviews

Title: Reliability of length measurements collected by community nurses and health volunteers in rural growth monitoring and promotion services

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Author’s response to reviews:

REVIEWER 1:

1. I thought it was interesting that the nurses improved quite a bit in Session B compared to A, but the Health Volunteers (HV) did not. This difference should be emphasized and possible explanation(s) provided. Why did only the nurses improve?. This also factors into your conclusion that more training is needed. Additional training helped the nurses, but not the HVs. Perhaps something else is needed for the HVs? Or maybe their baseline level of training was such that just two trainings were insufficient? That would support your conclusion, but does not seem to be supported by the data; the nurses and HVs were similarly unreliable in Session A, so their difference in baseline training did not result in different performance in Session A, but the nurses improved with more training. Edit the Abstract and Discussion accordingly.

Action taken by authors:

We thank the reviewer for these very useful queries. In response to this we have edited the Abstract sections –Methods (Line 69, pg 3) and Conclusions (Line 74, pg 4), and Discussion section from (Lines 413-420, pg 19).

2. As you mention in Line 358, "...equipment and protocols used in training differ among studies." In order to assess how applicable your results are to other settings, it is vital to know more about the previous training of the nurses and HVs, and the details of the training provided as part of your study. Give any information you have access to about the former and, since you designed the training for the study, definitely give sufficient details about the
latter such that other researchers can imitate your training. Additionally, give suggestions for improving the training.

Action taken by authors:

In response to this, information on previous training and training provided for the study is covered under Methods, Lines 145-151, pg 7. Suggestions for improving the training can be found in the Discussion from Lines 461-467, pg 21.

3. Since measuring length required two people, it seems your unit of observation for reliability should not have been individual nurses or HVs, but pairs of individuals. More detail needs to be given about how you paired people so it can be determined if this impacted your results.

Also, was training given specifically for being the assistant in a length measurement?

Action taken by authors:

Thank you. Information on pairings and training are provided under Methods, Lines 151-152, pg. 7 and Methods, Lines 172-174, pg 8.

4. You observed underestimation of length. So did WHO. How did your bias compare in magnitude to theirs?

Action taken by authors:

In response, the values for the average bias in the WHO studies and our study have been compared under Discussion, from Lines 383 to 387, pg 17.

5. WHO observed underestimation. Do their WLZ charts reflect this underestimation? If so, and your magnitude of bias was similar, then does the bias you observed matter for evaluating wasting? Similarly for LAZ and stunting.

Action taken by authors:

Thank you. From Discussion, Lines 387-391, pg 17-18 we have included statements about the WHO charts and how the biases observed in our study may influence the evaluation of wasting.

6. If the bias does matter, the fact that length is UNDERestimated results in OVERestimation of WLZ since L is in the denominator. That would result in decreased sensitivity for screening
for wasting (too many false negatives) but would lead to UNDERestimation of LAZ, resulting in decreased specificity for screening for stunting (too many false positives). Your statement in Line 126 that "Missed growth faltering results in no growth promotion action and thus thwarts the purpose of GMP" should be edited. In fact, missed growth faltering would lead to too little action for wasting, but too much action for stunting.

Action taken by authors:

Concerns on bias have been addressed under Comment 5. Thanks.

7. What was the expert's intra-TEM? That information would be helpful to know what the thresholds were that you were comparing inter- and intra-TEM to.

Action taken by authors:

Thanks for pointing this out. The intra-TEM of the expert has been provided under Results, Line 261, pg 12

8. Line 439: Should you change "before" to "along with"? If staff increases are needed anyway, and they are done first, then adding length will still result in understaffing. If staff increases are only needed when adding length and they are done first, then those paying the staff may question the need and, even though staffing is appropriate, when length is added less committed volunteers may still balk at the increased work load. Doing the two together (increasing staff and adding length) may work better. You know the setting... what do you think would work best?

Action taken by authors:

As suggested, before has been replaced with alongside for clarity. Thanks! Refer to Discussion, Line 460, pg 21.

Specific edits:

9. In some places you capitalize "Intra" or "Inter". These should always be lower case, right?

Action taken by authors:
Thank you. Formatting check completed. The first letter was capitalized only at the beginning of sentences.

10. Line 57: Add the age range of the children to the Abstract Methods
Action taken by authors:
Added to Abstract, Line 58, pg 3.

11. Line 74: "more susceptible"... More than what?
Action taken by authors:
Sentence edited for better clarity. Refer to Abstract, Line 75, pg 2.

12. Lines 88-89: 50% and 9% of what? Countries? Children?
Action taken by authors:
Thank you. Sentence has been edited for clarity. Please refer to Background, Line 91, pg 4.

13. Line 96: Change "weight-for-height/length Z score (WLZ/WHZ) <-2 Z" to "weight-for-length/height Z score (WLZ or WHZ) <-2"
[I changed the order of "length" and "height" to match the order of the abbreviations, I changed the / because it looked like you were dividing two things, and the Z at the end was incorrect]
Action taken by authors:
Thank you. All suggested edits completed. Refer to Background, line 98, pg 5.

14. Line 97: Change "length/height-for-age Z score (LAZ/HAZ) <-2 Z" to "length/height-for-age Z score (LAZ or HAZ) <-2"
[I changed the / because it looked like you were dividing two things, and the Z at the end was incorrect]
Action taken by authors:
Thank you. All suggested edits completed. Refer to Background, line 99, pg 5.

15. Line 97: The 17% is not a rate, but a proportion or prevalence

Action taken by authors:

Thank you. All suggested edits completed. Refer to Background, line 99, pg 5.

16. Line 98: "<-2 Z" should just be "<-2"

Action taken by authors:

Thank you. All suggested edits completed. Refer to Background, Line 100, pg 5.

17. Line 102: Change "wasting which once identified can" to "wasting which, once identified, can"

Action taken by authors:

Thank you. All suggested edits completed. Refer to Background, Lines 104-105, pg 5.

18. Line 104: Change "influences rate of linear growth [7-10]. Linear" to "influences the rate of linear growth [7-10], and linear"

Action taken by authors:

Thank you. All suggested edits completed. Refer to Background, Line 106, pg 5.

19. Lines 145-146: Change "standardization sessions were conducted at the training sessions held after three (session A) and nine months (session B) of the initial training session." to "standardization sessions were conducted at the training sessions held three (session A) and nine months (session B) after the initial training session." (unless I misunderstood your Table 1)

Action taken by authors:

Thank you. All suggested edits completed. Refer to Methods, Lines 156-157, pg 7.
20. Lines 148-149: "conducted by an observer experienced in anthropometric data collection sixth months after six months of using length measurements"

"six months after six months of..." is confusing. First, from Table 1, it looks like it should be 7 months after, right? Either way, reword it.

Action taken by authors:

Thank you. All suggested edits completed. Refer to Methods, Lines 159, pg 7.

21. Line 222: Add the SPSS version number.

Action taken by authors:

Thank you. All suggested edits completed. Refer to Methods, Line 231, pg 11.

22. Line 242: "Table 2 and 3" should be "Tables 2 and 3"

Action taken by authors:

Thank you. All suggested edits completed. Refer Methods, Lines 244 and 251, pg 11.

23. Line 258: "All length measurements were within" should be "All biases in length measurements were within", right?

Action taken by authors:

Thank you. All suggested edits completed. Refer to Methods, Lines 268-270, pg 12.

24. Line 293: Change "confidence and skill of length measurements" to "confidence and skill in measuring length"

Action taken by authors:

Thank you. All suggested edits completed. Refer to Results, Lines 303, pg 14.

25. Line 354: Add a comma after "Session A"
Action taken by authors:
Thank you. All suggested edits completed. Refer to Discussion, Lines 475, pg 21.

26. Line 355: "the 6 to 24 month age group"
This is the first time this age range is mentioned. Where did it come from? Is this referring to one of the citations?
Action taken by authors:
The 6 – 24 months agegroup is specified in published literature with an expected TEM for precision of length.. We quoted the proportion of our subjects, used for the standardization sessions, who fell within this age bracket to emphasize that the published TEM could be compared with the TEM from our study because of the similarities in age.
Kindly refer to Discussion, Line 361-364, page 16

27. Line 364: Add "a" before "criterion anthropometrist"
Action taken by authors:
Thank you. Suggested edits have been made. Refer to Discussion, line 371, pg 17.

28. Line 383: The last two sentences of the paragraph should be one.
Action taken by authors:
Thank you. Suggested edits have been made. Refer to Discussion, line 397-400, pg 18.

29. Line 387: Change "both groups did not reach" to "although neither group reached"
Action taken by authors:
Thank you. Suggested edits have been made. Refer to Discussion, line 402, pg 18.

30. Line 392: "(Angawadi)" Is this a citation? No date, and not in the references.
Action taken by authors:
Thank you. “Angawadi” is not a citation, it is the local name for community workers in the Integrated Child Development Service in India. Clarification has been made in Discussion, line 407, page 18.

31. Line 394: Should there be an "among" before "community health personnel"?

Action taken by authors:

Thank you. Suggested edits have been made. Refer to Discussion, line 409, pg 18.

32. Line 395: Add "the" before "midpoint"

Action taken by authors:

Thank you. Suggested edits have been made. Refer to Discussion, line 411, pg 19.

33. Line 422: The last two sentences of the paragraph should be one.

Action taken by authors:

Thank you. Suggested edits have been made. Refer to Discussion, line 443-444, pg 20.

34. Line 425: Change "perceived" to "perception of the"

Action taken by authors:

Thank you. Suggested edits have been made. Refer to Discussion, lines 446-447, pg 20.

35. Line 453: Change "several in-service training" to "several in-service trainings"

Action taken by authors:

Thank you. Suggested edits have been made. Refer to Discussion, line 475, pg 21.

36. Line 480: Should you add "a need" before "for" in "There is for both pre- and in-service training"?
Action taken by authors:

Thank you. Suggested edits have been made. Refer to Conclusion, line 503, pg 23.

37. Line 489: Remove the space in "Height-for- age"

Action taken by authors:

Thank you. Suggested edits have been made. Refer to Abbreviations, line 512 pg 23.

38. Line 491: Remove the space in "Length for- age"

Action taken by authors:

Thank you. Suggested edits have been made. Refer to Abbreviations, line 514, pg 23.

39. Line 509: Were parents consented or was this not considered necessary by the ethics boards? If consented, state so. If not, state why not necessary.

Action taken by authors:

Thank you. Suggested edits have been made. Refer to Declaration, line 534, pg 24.

40. Line 553: Should "one observer" be "multiple observers"?

Action taken by authors:

Thank you. Suggested edits have been made. Refer to Discussion, line 580, pg 26.

41. Line 586: Replace "differences between paired measurements" with "it"

Action taken by authors:

Thank you. Suggested edits have been made. Refer to Discussion, line 612, pg 27.

42. Table 1: Add "Month" in the upper left cell.
Action taken by authors:

Thank you. Suggested edits have been made. Refer to Table 1, 702, pg 30.

43. Table 1: Consider combining the two Standardization rows into one.

Action taken by authors:

Thank you. The standardization sessions were kept separate to make timeline clearer. The sessions were conducted 6 months apart. Refer to Table 1.

44. Tables 2 and 3: Not completely consistent. For Table 3, you can add "(N=15)" after Session A and Session B as you did in Table 1, and eliminate the current footnote b. Make all the footnotes consistent between Tables 2 and 3. Add the actual values of 2.8*TEM and 2*TEM so it is clear what numerical values you compared to.

Action taken by authors:

Thank you. Issues on consistency have been addressed. Refer to Table 2, Line 706, pg 31 and Table 3, Line 725, pg 32. However, we believe that adding actual values of the error margins takes from the clarity of the tables. The intra-TEM of the expert for both sessions is clearly stated under the results section (Results, Line 261, pg 12).

REVIEWER 2:

This paper describes a fairly standard quality improvement / standardisation exercise in one service, with just 15 measurers that was introducing length measurement. It finds unsurprisingly that accuracy improves with training. While I applaud the authors for doing this and writing it up so clearly, this does not constitute original research. This is the sort of exercise that any large study should do before collecting original survey data and as such only merits publication as a small part of a larger paper which actually addresses a novel scientific question.

Incidentally the results touch on the difficulties and challenges of using length but discussion section makes no mention of this or the literature considering the usefulness/ limitations of length as a screening measure compared for example to MUAC or to weight alone.

Action taken by authors:

We thank the reviewer for her comments included in this report. This study was conducted as part a larger study (a cluster-randomized intervention) which aimed to examine whether
increasing the capacity of community nurses and health volunteers in rural outreach Growth Monitoring and Promotion (GMP) clinics, by providing them with appropriate tools and nutrition knowledge to identify low weight-for-length Z score ((WLZ) < -1) and offer effective individual nutrition counselling, would affect the prevalence of wasting in children less than two years at the community-level.

We agree with the author that standardisation exercises are routine exercises that should be conducted for anthropometric data collection in all large studies. However, our standardisation sessions were conducted with the additional purpose of answering specific study objectives:

1. To determine the reliability of length measurements collected by trained community health personnel.

2. To determine the ability of nurses to collect reliable length measurements during GMP sessions.

A short background on the setting in which this study was conducted might help explain the need for our study. The Ghana Health Services’ GMP outreach program commenced about five decades ago and has since spread to very remote areas that will otherwise have no primary health services. However, to date, the program does not monitor length of children, only weight is monitored using the World Health Organization’s weight-for-age Z-score charts. The current efforts by the GMP program to address childhood wasting (through the Integrated Management of Childhood Illnesses and the Community Management of Acute Malnutrition) focuses on severe cases. The focus is on identifying the visible signs of severe acute malnutrition (muscle wasting in the gluteal region, prominence of bony structure particularly over the thorax, and loss of subcutaneous fat) and referral for in-patient care; nutritional counselling is prescribed for caregivers of children with low and very low weight-for-age Z score (WAZ). In districts where the Community Management of Acute Malnutrition is available, community nurses use a mid-upper arm circumference (MUAC) less than 115 mm in assessing severe wasting in children less than five years who consistently present with a faltering WAZ and/or clinical symptoms of severe acute malnutrition at monthly GMP clinics. Ready-to-use-therapeutic foods are provided to caregivers to be administered at home when the child has no medical complications and/or loss of appetite.

The wasting problem faced by the GHS is more of mild to moderate severe. The report from the recent Demographic Health Survey (2014) stated a reduction in the national prevalence of moderately and severely wasted children from 9% and 2% in 2008 to 5% and 1% in 2013, respectively. Furthermore, the age group (6 to 11 months) known to experience the highest rates of wasting in Ghanaian young children reported a reduced prevalence of 10.6% and 2.4% of moderate and severe wasting in 2013 compared to 29% and 5.8% in 2008, respectively. Given
the consistently low prevalence of severe compared to moderate wasting, current efforts by the GHS must be expanded to include the identification and management of mild (-2 ≤ WLZ < -1) to moderate (-3 ≤ WLZ < -2) wasting, which is more prevalent. Efforts in this direction could prevent progression to severe wasting and reduce retarded linear growth.

Length is not only important in assessing weight-for-length, but also in monitoring length-for-age (LAZ) to identify stunting. According to the Lancet Maternal and Child Nutrition Series, 2013, Ghana is one of the highest burden countries, that is, one of the 34 countries that contribute 90% of the global burden of malnutrition. Childhood stunting is directly associated with an increased risk of disease, poor mental development, and reduced productivity in later life. Children in rural (22%) Ghana are more vulnerable to stunting compared to their peers in urban (14%) settings (Ghana Demographic Health Survey, 2014). The current GMP efforts using MUAC AND WAZ do not address the issue of stunting in rural communities. Introducing length in rural GMP will provide the ability to identify and manage stunting in the first two years of life when stunting is more readily reversible. In addition, measuring length allows the assessment of both wasting and stunting, which gives a better picture of the factors that may be driving the undernutrition experienced by a child.

Since the development of the WHO Growth Standards in 2006, there has been talks by the GHS leadership to introduce length measurements in the GMP program. However some important questions by the leadership of the GHS have been:

1. Can community health personnel be trained to measure length?
2. Can the personnel measure length reliably in routine GMP sessions

Our paper answers both questions by first, looking at the precision and accuracy of length measurements of minimally trained community nurses and healthworkers using data from standardisation settings and the reliability of length measurements collected in the field (GMP sessions). To the best of our knowledge, our study is the first to examine the ability of community nurses and health volunteers to reliably measure length as part of rural outreach in Ghana. Our findings show that while intra-observer length measurement errors of health personnel after receiving two anthropometry trainings met acceptable error limits, inter-observer measurement errors did not at both time points. From our findings, length measurements taken by health personnel and those taken by the experienced anthropometrist at GMP sessions were of moderate agreement. In addition, the reliability of length measurements taken during GMP sessions may be more susceptible to errors due to overburdened personnel and understaffed, crowded GMP clinics. From the qualitative data, community nurses perceived that the inclusion of length measurement in GMP was feasible; however, they mentioned staff shortage, overwhelming workloads, and low confidence in positioning and plotting as real barriers to
success. In summary, our findings show that the training of health personnel to measure length in rural GMP is possible. Our paper also sheds light on what the issues are in terms of training community health personnel and what precautions can be taken by management to maintain the reliability of length measurement over time. The above background on current efforts by the GMP, and our findings have been reported in detail in the Background and Results section and carefully discussed keeping in mind the objectives for this study.

We believe our findings will be useful for the GHS and other Ministries of Health in resource-limited settings who may be contemplating introducing length measures as part of growth monitoring or health outreach efforts.