

## 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

<b>TITLE (PROVISIONAL)</b>	Mid-Upper Arm Circumference, Calf Circumference, and Mortality in Chinese Long-Term Care Facility Residents: A Prospective Cohort Study
<b>AUTHORS</b>	Weng, Chien-Hsiang; Tien, Chia-Ping; Li, Chia-Ing; L'Heureux, Abby; Liu, Chiu-Shong; Lin, Chih-Hsueh; Lin, Cheng-Chieh; Lai, Shih-Wei; Lai, Ming-May; Lin, Wen-Yuan

## VERSION 1 – REVIEW

<b>REVIEWER</b>	Hanneke A. H. Wijnhoven Department of Health Sciences, Faculty of Science, Vrije Universiteit Amsterdam, Amsterdam Public Health research institute, Amsterdam, the Netherlands
<b>REVIEW RETURNED</b>	13-Nov-2017

<b>GENERAL COMMENTS</b>	<p>Abstract:</p> <ul style="list-style-type: none"> <li>- Conclusions: the association with BMI was not examined, so this can not be included in the conclusion.</li> </ul> <p>Introduction:</p> <ul style="list-style-type: none"> <li>- I would suggest to use a term like “older adults” instead on elderly/elder.</li> <li>- References included in the second paragraph (ref 4, 5) do not include original data or a systematic review, and should therefore not be used when referring to associations between malnutrition (by which definition?) and health outcomes. I would suggest to use the term “associations” and “impacts” when referring to results from observational studies.</li> <li>- When referring to prevalence rates of malnutrition (third paragraph), the criteria used should shortly be referred to, as this has a major impact on these rates.</li> <li>- What is the relevance of the sentence on nutritional screening tools? The introduction is quite general, and the part on malnutrition is quite extended, given the actual research question. More attention should be paid to the MUAC and calf circumference (CC) measurement and their clinical value, and to what this research adds on top of the existing literature.</li> <li>- The statement on the association between BMI and mortality is not correct, as this association is U-shaped in an older population and not inversely linearly shaped.</li> <li>- When referring to associations between anthropometric measures and mortality (like WC, BMI) please always state the category and reference group or indicate lower/higher, whatever appropriate.</li> </ul> <p>Methods</p> <ul style="list-style-type: none"> <li>- Was there no non-response?</li> <li>- Why follow-up until 2007 (and no longer? It is now 2017)</li> </ul>
-------------------------	--

	<ul style="list-style-type: none"> <li>- Line 126: quartiles or tertiles? (both mentioned). What is the rationale for using tertiles? For MUAC the association may be U shaped, so you should carefully check the appropriateness of the cut-offs (data driven) or use data on the shape of the association from a previous study with a comparable population.</li> <li>- The statistical analyses are not clearly described and are not completely in line with the research aim. For example line 156, line 158 (which groups?), 160-161 (how were independent variables operationalized, continuous, tertiles?). In line 163, BMI, BW, and waist circumference are suddenly mentioned while these are not included in the research aim. It is not clear if the model is causal or predictive, as you adjust for confounders, but also perform a ROC analyses. For the ROC analyses, it is not clear what this adds to the Cox models (this should be explained) and again, it is not clear how the independent variables were operationalized. How did you “adjust” for sex (line 164) and how did you incorporate this in the ROC model and resulting AUC (as sex itself may also predict mortality risk).</li> </ul> <p>Results:</p> <ul style="list-style-type: none"> <li>- Why are baseline characteristics presented by tertiles of MUAC and CC? Why are baseline differences between those who died and did not die tested. Baseline characteristics should be used to describe your study sample.</li> <li>- Type line 175: weigh</li> <li>- The rationale for the adjustment steps (lines 227-230) should be described in the methods (and it should be explained why you examine a causal model)</li> <li>- The additive value of the ROC analyses is not clear (line 237-239) and should be explained in the methods. Why would you choose a causal model first (Cox) and a predictive model (presumably based on a logistic regression model, without time to event?) as a second approach? If you adjust for sex, this is also included as a predictor and adds to the predictive capability (and the AUC).</li> <li>- Points estimates are almost the same for MUAC and CC (Table 4); so I do not see that the association between low MUAC and mortality differs from low CC and mortality. The AUC for CC is not provided in the text, nor are confidence intervals. There seems to be (and must be given Table 4) a large overlap in AUC.</li> <li>- You did not include results on BMI and waist circumference in the results section, like stated in the statistical paragraph</li> </ul> <p>Discussion</p> <ul style="list-style-type: none"> <li>- A Discussion section usually starts (first paragraph) with a summary of main findings.</li> <li>- There should be more focus in the discussion on the clinical application of MUAC and CC (perhaps compared to BMI, if you would add this to the research question and result), and much less on “malnutrition” as this is a broad concept with multiple definitions.</li> <li>- It is not clear to me why it is a limitation that you did not measure body composition. It could be a limitation, but this depends on your research aim and interpretation of your findings.</li> <li>- Why was the follow-up period limited to 2007? Included as a limitation (line 310).</li> <li>- What other confounders are important and why? Again, is this a causal model? (line 315)</li> <li>- See previous point on difference in association between low MUAC and low CC.</li> </ul> <p>General:</p> <p>English writing should be checked.</p>
--	---

REVIEWER	Moses Ngari Kenya Medical Research Institute/Wellcome Trust, Kenya
REVIEW RETURNED	01-Dec-2017

GENERAL COMMENTS	<p><b>Larger Mid-Upper Arm Circumference and Calf Circumference 1 Are Associated with Lower Mortality in Chinese Long-Term Care Facility Residents: A Prospective Cohort Study</b></p> <p><b>General comments</b> This is a well written manuscript that addresses an important scientific question.</p> <p><b>Reviewer comments</b> Lines 49 to 51, makes conclusion based on comparison of MUAC, CC with BMI which has not been mention in the who abstract? This seems like a conclusion not supported by the provided results. Add some BMI results in the results section or remove the conclusion of BMI. The study main objective was to examined association of MUAC and CC with all-cause mortality but not to compare MUAC and CC with BMI.</p> <p>Line65: This should be “the rural population should be made with caution.”</p> <p>Lines160 to 161, is misleading. Cox proportional hazard regressions analysis yields Hazard Ratios and not relative risks. Is what is reported in Table 4, relative risks or Hazard Risks? Explain how the relative risks were computed.</p> <p>Lines 172 to 173, please give the total person years at risk.</p> <p>Line 175: should this read “tended to have heavier weight and”</p> <p>Line 42: the height of the survivors and deaths, does not seem different, the means of 152.8 and 152.5 looks so similar. Please confirm the p-value. Alternatively report geometric means or medians.</p> <p>Line213: Table 4, from the MUAC and CC (grouped into I, II and III) what does group I, II and III represent? This is important to determine the reference group.</p> <p>Table 4: Please explain in the methods (statistical methods) why you decided to run the three (models II, III and IV) multivariable regression models? Could it be better to combined all the variables in one model and probably eliminate variables using step-wise method?</p> <p>MUAC and CC analysis, would you try fixing cox proportional regression analysis with both continuous MUAC and CC as a sensitivity analysis. This model would have more statistical power because you will be including everyone (all the 149 deaths). This model would allow you to examined utmost 15 independent variables (Eric Vittinghoff (2007) (Relaxing the Rule of Ten Events per Variable in Logistic and Cox Regression)).</p> <p>Lines 234 to 235: the statement that the increasing adjusted RRs of MUAC and CC showed response effect is not supported by the</p>
------------------	--

	<p>results. Did you perform a linear trend of the adjusted RR? Then provide a p-value for this.</p> <p>Line 237 to 239, Looking at figure 1, I think the difference between AUC for MUAC (62%) and BMI (59%) might not be statistical significant. Can you include the 95% CI on the AUC plot? Can you also compare the AUCs using BMI (as the reference) statistically (you can use the 'rocomp' command in stata)?</p> <p>Line 248 to 250: you can also reference Mramba et.al 2017 (<a href="https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5541507/">https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5541507/</a>) which showed MUAC performs better than BMI among school going children.</p> <p>Line 271: should this be " However, it is often difficult to accurately ...".</p> <p>Study settings: Please describe in detail the study settings. Can you explain what are long-term care facilities? Are these homes for the elderly? This might not be clear to use in different settings.</p>
--	--

## VERSION 1 – AUTHOR RESPONSE

### Editorial Requirements:

- Please revise the title to state the research question. We do not accept declarative titles.

Response: The authors thank the Editor's comment. We have revised our title as "Mid-Upper Arm Circumference, Calf Circumference, and Mortality in Chinese Long-Term Care Facility Residents: A Prospective Cohort Study".

- Please work to improve the quality of English throughout the manuscript, either with the help of a native speaking colleague or with the assistance of a professional copyediting agency.

Response: We appreciate your comment. We had one of our coauthors Dr. Abby L'heureux who is a native English speaker edited the entire manuscript in our revised version.

### Reviewer(s)' Comments to Author:

Reviewer: 1

Reviewer Name: Hanneke A. H. Wijnhoven

### Abstract:

- Conclusions: the association with BMI was not examined, so this can not be included in the conclusion.

Response: Authors thank Dr. Wijnhoven's review and comments. We have revised our abstract conclusion. (Line 71-73)

### Introduction:

- I would suggest to use a term like "older adults" instead on elderly/elder.

Response: We thank the reviewer's comment. We have replaced 'elderly' or 'elder' with 'older adult' as suggested by the reviewer which is more precise than elderly. (Introduction section)

- References included in the second paragraph (ref 4, 5) do not include original data or a systematic review, and should therefore not be used when referring to associations between malnutrition (by

which definition?) and health outcomes. I would suggest to use the term “associations” and “impacts” when referring to results from observational studies.

- When referring to prevalence rates of malnutrition (third paragraph), the criteria used should shortly be referred to, as this has a major impact on these rates.

Responses: We appreciate the reviewer's comments and have removed the malnutrition part from both the introduction and discussion sections per suggestion from reviewer in later comments.

- What is the relevance of the sentence on nutritional screening tools? The introduction is quite general, and the part on malnutrition is quite extended, given the actual research question. More attention should be paid to the MUAC and calf circumference (CC) measurement and their clinical value, and to what this research adds on top of the existing literature.

Response: We thank the reviewer's comment. We have removed the part related to nutrition and expanded the brief literature summary and what our research adds on in the introduction section.

- The statement on the association between BMI and mortality is not correct, as this association is U-shaped in an older population and not inversely linearly shaped.

- When referring to associations between anthropometric measures and mortality (like WC, BMI) please always state the category and reference group or indicate lower/higher, whatever appropriate.

Responses: We have revised the statement to U-shaped association between BMI and mortality and added lower/higher to clarify the associations. (Line 103-105)

## Methods

- Was there no non-response?

Response: We have expanded our description for the study population to make it clearer. A total of 447 residents were lived in the 8 long-term care facilities. 393 of them were aged  $\geq 60$  years old, and were invited to participate in the study. 39 of them did not agree. Of the 354 agreed (156 men and 198 women), 25 participants did not have appropriate data of MUAC or CC recorded. 329 subjects were kept in our study analysis. (Line 129-134)

- Why follow-up until 2007 (and no longer? It is now 2017)

Response: Due to the government policy change in 2008, we were not able to assess the National Death Registry for the cause of death. Also, after a 5-year follow up, the total mortality rate was close to 50%, thus we believe it was clinically significant enough to analyze the trend.

- Line 126: quartiles or tertiles? (both mentioned). What is the rationale for using tertiles? For MUAC the association may be U shaped, so you should carefully check the appropriateness of the cut-offs (data driven) or use data on the shape of the association from a previous study with a comparable population.

Response: The authors thank the reviewer's comment. We discussed this in the beginning of the study analysis with our statistician. Due to the relatively small sample size in our study, the relationship we found between MUAC/CC and mortality were more of a linear relationship than U- or J-shaped in our cohort. The authors thought that using tertiles in this relatively small cohort would make it easier for the readers to understand.

- The statistical analyses are not clearly described and are not completely in line with the research aim. For example line 156, line 158 (which groups?). In line 163, BMI, BW, and waist circumference are suddenly mentioned while these are not included in the research aim. It is not clear if the model is causal or predictive, as you adjust for confounders, but also perform a ROC analyses. For the ROC analyses, it is not clear what this adds to the Cox models (this should be explained) and again, it is not clear how the independent variables were operationalized. How did you “adjust” for sex (line 164)

and how did you incorporate this in the ROC model and resulting AUC (as sex itself may also predict mortality risk).

Response: We thank the reviewer's comment. We have revised the statistical analysis section to clarify the confusions. We removed the ROC analysis from our manuscript since it did not represent a significant difference and was not consistent with our study design- which was a causal model. We added Kaplan-Meier survival curves based on different MUAC and CC tertiles and used log-rank test to examine the differences between tertiles. (Line 180, 183-186)

#### Results:

- Why are baseline characteristics presented by tertiles of MUAC and CC? Why are baseline differences between those who died and did not die tested. Baseline characteristics should be used to describe your study sample.

Response: As for Table 1 and Table 2, we presented them by tertiles of MUAC and CC to show the baseline characteristics between tertiles – which were what we examined and tried to assess the associations with mortality. We thought that baseline characteristics by sex might not be able to present the purpose of the study well since the differences between male and female, such as survival, existed already. We also removed the table by survival (Table 3 in previous manuscript version). We made a table of characteristics according to sex as below:

	MALE		FEMALE		
CHARACTERISTIC	Mean	Std Dev	Mean	Std Dev	p value
AGE (YEAR)	76.51	7.62	80.01	7.64	<.0001
HEIGHT (CM)	159.90	4.77	147.30	4.68	<.0001
WEIGHT (KG)	54.38	10.85	48.28	10.44	<.0001
BMI (KG/M2)	21.24	4.09	22.19	4.40	0.053
MUAC	24.18	3.22	24.20	3.53	0.985
CC	28.38	4.53	26.81	4.05	0.002
WAIST CIRCUMGERENCE (CM)			81.77	10.43	83.09 11.00 0.279
SYSTOLIC BP (MMHG)	125.10	14.79	124.60	14.35	0.766
DIASTOLIC BP (MMHG)		76.69	11.40	73.35	10.13 0.006
ALBUMIN (G/DL)	3.15	0.50	3.25	0.40	0.031
CHOL	168.40	41.44	181.20	42.07	0.006
HDL	51.11	12.92	52.98	14.09	0.243
TRIGLYCERIDE (NG/DL)		87.79	55.20	132.00	239.10 <.0001

- Type line 175: weigh

Response: Thank you for the comment. We have corrected this mis-spelling.

- The rationale for the adjustment steps (lines 227-230) should be described in the methods.

Response: We thank the reviewer's comment. We have moved the above part to methods and revised the paragraph regarding the Cox proportional hazard analysis to make it more clearer. (Line 159-161)

- The additive value of the ROC analyses is not clear (line 237-239) and should be explained in the methods. Why would you choose a causal model first (Cox) and a predictive model (presumably based on a logistic regression model, without time to event?) as a second approach? If you adjust for sex, this is also included as a predictor and adds to the predictive capability (and the AUC).

Response: Thank you for the comment. We agreed with your comment that the ROC analysis was not an appropriate one to add as a second approach. We have removed the ROC analysis and added the Kaplan-Meier survival curves based on different MUAC and CC tertiles and used log-rank test to examine the differences between tertiles. (Line 243-245)



- Points estimates are almost the same for MUAC and CC (Table 4); so I do not see that the association between low MUAC and mortality differs from low CC and mortality. The AUC for CC is not provided in the text, nor are confidence intervals. There seems to be (and must be given Table 4) a large overlap in AUC.

Response: Authors thank the reviewer's comment. After discussion, we have revised the method, result and discussion sections- removing the ROC analysis and the statement regarding MUAC is superior than CC in correlating to mortality.

- You did not include results on BMI and waist circumference in the results section, like stated in the statistical paragraph

Response: We also removed the statements regarding BMI and WC in the result section since those were not our main goal in this study.

## Discussion

- A Discussion section usually starts (first paragraph) with a summary of main findings.

Response: Thank you for the comment. We have revised the first paragraph of the discussion section with a summary of the main findings. (Line 249-255)

- There should be more focus in the discussion on the clinical application of MUAC and CC (perhaps compared to BMI, if you would add this to the research question and result), and much less on "malnutrition" as this is a broad concept with multiple definitions.

Response: We appreciate the reviewer's comment. We revised the discussion section to emphasize more in the clinical applications of MUAC and CC and remove malnutrition discussion (paragraph 2-6, Discussion section).

- It is not clear to me why it is a limitation that you did not measure body composition. It could be a limitation, but this depends on your research aim and interpretation of your findings.

Response: We really appreciate your comment. In previous studies, body composition was thought to contribute to the inverse relation between BMI and mortality. However, we agreed with your comment that since BMI is not part of our research aim, body composition may not be listed as a limitation. (Line 303-309)

- Why was the follow-up period limited to 2007? Included as a limitation (line 310).

Response: Due to the government policy change in 2008, we were not able to assess the National Death Registry for the cause of death. After discussion with the team, we also removed it from the limitation section since after a 5-year follow up, the total mortality rate was close to 50%, thus we believe it as clinically significant enough to analyze the trend.

- See previous point on difference in association between low MUAC and low CC.

Response: We removed ROC analysis and also removed the statement regarding MUAC was superior to CC.

## General:

English writing should be checked.

Response: We appreciate the reviewer's comment. We had a native English speaker edited the entire manuscript in our revised version. (please see the tracking marks)

Reviewer: 2

Reviewer Name: Moses Ngari

Lines 49 to 51, makes conclusion based on comparison of MUAC, CC with BMI which has not been mention in the whole abstract? This seems like a conclusion not supported by the provided results. Add some BMI results in the results section or remove the conclusion of BMI. The study main objective was to examined association of MUAC and CC with all-cause mortality but not to compare MUAC and CC with BMI.

Response: Authors thank the reviewer's comment. Since BMI is not the main goal of this study, we revised the abstract conclusion to focus on MUAC and CC instead of comparing it with BMI. (Line 71-73)

Line65: This should be "the rural population should be made with caution."

Response: Authors appreciate your comment. We have revised it accordingly and edited English writing. (Line 85-87)

Lines160 to 161, is misleading. Cox proportional hazard regressions analysis yields Hazard Ratios and not relative risks. Is what is reported in Table 4, relative risks or Hazard Risks? Explain how the relative risks were computed.

Response: Authors thank the reviewer's comment. It should be hazard ratios not relative risks, we have corrected them in the revised manuscript. (Table 3)

Line 175: should this read "tended to have heavier weight and"

Response: We have corrected it accordingly, thank you.

Line 42: the height of the survivors and deaths, does not seem different, the means of 152.8 and 152.5 looks so similar. Please confirm the p-value. Alternatively report geometric means or medians.

Response: We thank the reviewer's comment. Considering comments regarding the original Table 3, we decided to remove this table since it did not contribute much information to our results.

Line 213: Table 4, from the MUAC and CC (grouped into I, II and III) what does group I, II and III represent? This is important to determine the reference group.

Response: We described the definition of Group I, II and III in the Methods section under Anthropometric Index part. The groups, 'tertiles', were defined as:

MUAC tertiles I-III: <22.9, 22.9-25.5, >25.5 cm in men; < 22.8, 22.8-25.5, >25.5 cm in women;

CC tertiles I-III: <26.0, 26.0-30.0, >30.0 cm in men; <25.0, 25.0-28.4, >28.4 cm in women. (Line 145-147)

Table 4: Please explain in the methods (statistical methods) why you decided to run the three (models II, III and IV) multivariable regression models? Could it be better to combined all the variables in one model and probably eliminate variables using step-wise method?

Response: Authors thank the reviewer's comment. We decided to run the multivariable regression models instead of step-wise method in order to better examine the effects from different risk factors based on their individual clinical importance. We ran the analysis by 4 models- 1) unadjusted; 2) only adjusted for age and gender (which are most important factors in mortality studies); 3) further adjusted for lifestyle; 4) adjusted for chronic disease status. (Table 3 in revised version)



Lines 234 to 235: the statement that the increasing adjusted HRs of MUAC and CC showed response effect is not supported by the results. Did you perform a linear trend of the adjusted HR? Then provide a p-value for this.

Response: Authors thank the reviewer's comment. We discussed with our statistician and decided to remove this statement from the Result section.

Line 237 to 239, Looking at figure 1, I think the difference between AUC for MUAC (62%) and BMI (59%) might not be statistical significant. Can you include the 95% CI on the AUC plot? Can you also compare the AUCs using BMI (as the reference) statistically (you can use the 'rocomp' command in stata)?

Response: Authors agreed with the reviewer's comment and also the ROC analysis did not fit the study design very well, we decided to remove the ROC analysis and added the Kaplan-Meier survival curves based on different MUAC and CC tertiles and used log-rank test to examine the differences between tertiles.

Line 248 to 250: you can also reference Mramba et.al 2017 (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5541507/>) which showed MUAC performs better than BMI among school going children.

Response: We appreciate your suggestion. We have revised and cited the above study in our manuscript. (Line 275-276)

Line 271: should this be "However, it is often difficult to accurately ...".

Response: We have revised it accordingly, thank you for the comment.

Study settings: Please describe in detail the study settings. Can you explain what are long-term care facilities? Are these homes for the elderly? This might not be clear to use in different settings.

Response: Authors thank the reviewer's comment. We have added the definition of long-term care facilities in the first paragraph of the Methods section under Study Subjects: "Long-term care facilities provide a variety of services, both medical and personal care to people who are unable to manage independently in the community and offer residents 24-hour care from nurses with regular physician visits." - Which is the same as defined by the United States CDC (<https://www.cdc.gov/longtermcare/index.html>). (Line 126-129)

## VERSION 2 – REVIEW

<b>REVIEWER</b>	Moses Ngari KEMRI/Wellcome Trust Research Programme Kenya
<b>REVIEW RETURNED</b>	15-Jan-2018
<b>GENERAL COMMENTS</b>	<p>a) Good description for the long-term care facilities, however, the details provided about the numbers (lines 130 to 136) should be in the results section and not in the methods section. It would be ideal to also describe how these long-term care facilities are distributed in the country because later the authors claim that the sample is 'nationally representative' (line 255).</p> <p>b) Total person years at risk not provided in the results. For the survival analysis, the denominator is the person years at risk. We need it reported.</p>

	<p>c) The cox-regression models, the details provided on lines 220 -226 should be in the methods (statistical) section. The authors have not explained in the methods (statistical methods) why they decided to run the three (models II, III and IV) multivariable regression models.</p> <p>d) The authors have not explained the estimated sample size and the statistical power of the used sample. 393 might not be such a large sample size as claimed (line 255-256).</p> <p>e) From Table 1 and 2, the lowest MUAC and CC had the oldest participants while largest MUAC and CC groups had the youngest participants. These lowest MUAC and CC groups will on average have the highest mortality (regardless of the MUAC and CC) because they will die naturally compared to their younger peers. The authors did not examine these explanation in the discussion or test for MUAC and CC interaction with age. Was age an effect modifier of mortality?</p>
--	--

## VERSION 2 – AUTHOR RESPONSE

### Responses to Reviewer's Comments

Reviewer: 2

Reviewer Name: Moses Ngari

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

Please state any competing interests: None declared

Please leave your comments for the authors below

a) Good description for the long-term care facilities, however, the details provided about the numbers (lines 130 to 136) should be in the results section and not in the methods section. It would be ideal to also describe how these long-term care facilities are distributed in the country because later the authors claim that the sample is 'nationally representative' (line 255).

Response: Authors thank the reviewer's comment. We have moved the above to the result section (Line 202-206). We also added descriptions regarding how the facilities distributed and why the sample is nationally representative (Line 129-133).

b) Total person years at risk not provided in the results. For the survival analysis, the denominator is the person years at risk. We need it reported.

Response: The total person years at risk is 1159.13 (Line 206-207).

c) The cox-regression models, the details provided on lines 220 -226 should be in the methods (statistical) section. The authors have not explained in the methods (statistical methods) why they decided to run the three (models II, III and IV) multivariable regression models.

Response: We thank the reviewer's comment. We have moved it to Method section and explained the reason why using those models (Line 183-191).

d) The authors have not explained the estimated sample size and the statistical power of the used sample. 393 might not be such a large sample size as claimed (line 255-256).

Response: We thank the reviewer's comment. In our cohort of 329 residents, we estimated that we had more than an 80% power to detect an HR of 0.65 for the highest MUAC group compared with the

lowest MUAC group at 5% significance. We also removed the sentence mentioning that it was a relatively large sample size (Line 264).

e) From Table 1 and 2, the lowest MUAC and CC had the oldest participants while largest MUAC and CC groups had the youngest participants. These lowest MUAC and CC groups will on average have the highest mortality (regardless of the MUAC and CC) because they will die naturally compared to their younger peers. The authors did not examine these explanation in the discussion or test for MUAC and CC interaction with age. Was age an effect modifier of mortality?

Response: We thank the reviewer's comment. We performed a test for MUAC and CC interaction with age in model II (adjusted for age and sex) and the results were not statistically significant (age & MUAC,  $p=0.4489$ ; age & CC,  $p=0.4685$ ). Thus, age was not an effect modifier of mortality in our study (Line 232-235).

\*\*Authors filed application to the National Death Registry after Revision 1 since the reviewers asked about 5-year follow up rather than a longer period of time. It was due to the government policy change. However, our application was granted approval to access 2 extra years of death registry related to our cohort. Thus, we have updated all tables and results to 7-year follow up from the 5-year in the original version.

### VERSION 3 – REVIEW

<b>REVIEWER</b>	Moses Ngari KEMRI/Wellcome TRUST Research Programme. Kilifi, Kenya
<b>REVIEW RETURNED</b>	14-Mar-2018
<b>GENERAL COMMENTS</b>	The manuscript looks excellent now. Ready for publication.