

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)	The Spatial Distribution and Determinant Factors of Anemia among Women of Reproductive Age in Ethiopia: A Multilevel and Spatial Analysis
AUTHORS	Kibret, Kelemu; Chojenta, Catherine; Gresham, Eliie; Loxton, Deborah

VERSION 1 - REVIEW

REVIEWER	Raphael Enrique Tiongco Angeles University Foundation, Angeles City, 2009, Philippines
REVIEW RETURNED	30-Oct-2018

GENERAL COMMENTS	<p>GENERAL COMMENT: The authors have performed a spatial analysis on the determinants of maternal anemia in Ethiopia. According to the authors, this is the first spatial analysis conducted to identify cold and hot spots of maternal anemia and its determinant factors in the country. However, certain parts of the manuscript is poorly structured and concerns from other parts were noted. As it currently stands, concerns must first be addressed before publication is possible. Attached are some of my comments which can be used by the authors to further improve their manuscript.</p> <p>SPECIFIC COMMENTS:</p> <p>1) Page 2 (Abstract): In the results part of the abstract, please consider organizing the determinant factors as to individual level or community level factors.</p> <p>2) Page 2 (Abstract): In the conclusion part of the abstract, What do you exactly mean by "Maternal anemia is not randomly distributed across the country."? Consider rephrasing this part and specify what you exactly mean.</p> <p>3) Page 4-5 (Introduction): The introduction is poorly written, and the structure is not logically arranged. Please consider revising/improving the introduction.</p> <p>4) Page 5 (Introduction): Consider revising/improving this part: "Mapping the geographical distribution of anemia can also be beneficial for prevention and control of parasitic infections like soil transmitted-helminthiasis, schistosomiasis and malaria; because the control programmes for soil transmitted-helminthiasis and malaria have been evaluated using the burden of anemia as a quantifiable indicator [23]." You focused more on the association of parasitic infections with anemia which was not elaborated in other parts of the manuscript.</p>
-------------------------	--

5) Page 5 (Methodology, Patient and Public Involvement): Please elaborate further who are your target participants. What are their sociodemographic characteristics?

6) Page 5 (Methodology, Study Design and Setting): You mentioned in the strengths and limitations of the study that the EDHS is a cross-sectional study, please indicate it in this part.

7) Page 6 (Methodology, Sampling and Data Measurements): Please create or express this part (Lines 5 - 35) in a diagram (if possible) for easier understanding and at the same time to lessen the text.

8) Page 6 (Methodology, Sampling and Data Measurements): Please indicate in this part that the HemoCue is the standard test used in the EDHS 2016.

9) Page 6 (Methodology, Explanatory Variables): What do you mean by explanatory variables? Is it same with determinant factors? If so, please consider renaming this part to avoid confusion.

10) Page 6 (Methodology, Explanatory Variables): What was your basis for including the different factors mentioned? Please indicate it here.

11) Page 6 (Methodology, Explanatory Variables, Table 1): As to my understanding, this table or the contents of the table were the ones used for statistical analysis. If so, consider removing this table in the main text and add it as a supplemental table as it is of little value in the manuscript.

12) Page 9 (Methodology, Spatial Analysis): Please include in this part what do you mean by cold and hot spots and how they are determined/interpreted.

13) Page 20, (Results, Multilevel Analysis): What do you mean by not random in the communities? Please specify what you exactly mean.

14) Page 25 (Discussion): The discussion is poorly structured and incomplete. Based on what I have read, only the results of table 5 was discussed. Other results such as table 3 and 4 were not included in the discussion. Please consider adding them as they contain relevant findings. For the existing discussion, please organize it as to community and individual level factor.

15) Page 26 (Discussion): In line 41, please elaborate what could be the effect of low fertility to anemia?

16) Page 27 (Discussion): Consider removing the paragraph in lines 27 – 34 as it is already proven that pregnancy causes anemia. Instead, consider discussion the possible effects of maternal characteristics with anemia.

17) Page 28 (Discussion): In lines 6 - 7, please include the possible reason why HIV positive women are two-fold at risk in developing anemia?

REVIEWER	THOMAS SENGHORE School of Medicine and Allied Health Sciences University of The Gambia Banjul CampusThe Gambia
REVIEW RETURNED	19-Nov-2018

GENERAL COMMENTS	<p>General Remarks The authors have conducted a study on a very important public health issue. The findings of the study could be of relevance in addressing the anemia problem in Ethiopia. However, several issues in the paper need to be addressed or clarified.</p> <p>Major revision Title</p> <ul style="list-style-type: none"> • The study is titled “The Spatial Distribution and Determinant Factors of Maternal Anemia in Ethiopia: A Multilevel and Spatial Analysis” the use of the word ‘Maternal’ would imply that the study included only pregnant women and/or those with children, which is not the case. Your sample included a large number of women who probably have never had a pregnancy or had a child. I suggest you change the title to suit the sample population. Probably use “among women of reproductive age”. <p>Introduction</p> <ul style="list-style-type: none"> • The author has mentioned in the introduction some of the causes of anemia, however they have not made mention of the consequences of anemia. This would have added more justification for a study on anemia. <p>Methodology Sampling and data measurements:</p> <ul style="list-style-type: none"> • Some unnecessary details have been included about the sampling section. Specifically the second paragraph (page 6, lines 23 – 33). The sampling procedure is available in DHS methodology. A brief description of this part with citation would suffice. <p>Variables</p> <ul style="list-style-type: none"> • Not all the variables mentioned in Table 1 are presented in tables 2 and 4. Did the authors use these variables in the study? Please, show the results. • How/Why did the authors select the variables used in this study (not mentioned in the methodology) • How did the authors determine which variables are analyzed at individual and community level? Of the 28 variables mentioned in table 1, only two were aggregated into a community level variable (water source and latrine facility). These two variables were not also used at the individual level analysis. Why this? <p>Statistical analysis</p> <ul style="list-style-type: none"> • In the DHS data, the Hemoglobin values have been adjusted for altitude and smoking (why include ‘Smoking’ as a covariate?) • Did the authors test for any multicollinearity among the variables used? There might be a significant correlation between some variables. E.g. “Total children ever born” and “children ever born in the preceding 5 years” (this variable not found in Table 1). If multicollinearity was tested, please, provide results. <p>Results</p>
-------------------------	---

- There is a lot of inconsistency in the way the results are displayed in the text. For instance, page 16 line 18. 28% (95% CI (22.0, 25.3), in line 20, 17.8% (16.6 - 19) line 28, [17.0 (14.4, 20.0)] (p=0.0001) and other areas in the text. Use one uniform style throughout the paper e.g. (28%; 95% CI: 22.0, 25.3)
- Page 19 lines 3. "Nearly one-third (n= 4,657; 31.2%) of women were breastfeeding at the time of the survey." This result should be described under "sociodemographic characteristics". Table 1 should also be appropriately tilted as it contains other health information.
- Page 19 line 7 – 9, "Lactating women had higher odds of anemia than non-lactating women with AOR 1.09 (95% CI: 1.025 -1.28)." this should be moved to the appropriate results section "individual factors".
- Page 19, line 25. "The average hemoglobin value was significantly different across age groups (p=0.0001)." this result not found in the tables.
- The formulas provided in "Multilevel analysis (random effect analysis)" section are irrelevant; they have been mentioned in the methodology.
- Table of results Table 2 (the total for "iron folate intake during pregnancy" is not accurate) is this for those pregnant at the time of data collection? If so, indicate the total.
- Page 25 lines 5 – 13. This has been described in the methodology already, just mention the results.

Discussion

- Page 26 lines line 8, "A higher number of cases" The results on the maps are presented in proportions. It would be more appropriate to use proportion instead of number of cases.
- Page 26, lines 17 – 21. If the hemoglobin level was adjusted for altitude, can this still be a possible cause of regional difference? Please explain.
- Page 26 lines 40 – 41. Please, specify the age group been referred to in this sentence.
- Page 26 lines 44 -46. " this might be a result of Iran having a targeted intervention for
- younger women or women of reproductive age." Please, provide a citation for this assumption.
- Page 27, lines 19 -20 "low income leads to poor dietary intake" Better to have "low income would mean less money to cater for nutritious foods or a balanced diet "

Minor revision

- Introduction
- Line 23 – 34. Grammatical issue
- Methodology
 - o Sampling and data measurements:
 - Page 6, lines 5-8, this sentence needs revision, the idea it intends to convey is not clear.
 - Page 6, lines 36 – 37, please provide specification and/or citation.
 - o Spatial analysis:
 - Page 9 lines 44 – 45, please mention the platform that SAS was used. (Same for the SPSS)
 - Page 9, lines 55 – 56 delete "using ArcGIS version 10.1", already mentioned earlier. Just "Getis-Ord Gi* statistics was used for this spatial analysis" should be ok.
- Results:

	<ul style="list-style-type: none"> o Page 20, line 9, the confidence Interval mentioned here are different form that in table 5. o Page 25 lines 12 – 20 has some grammatical issues. • Discussion: <ul style="list-style-type: none"> o Page 25 lines 14 – 15 grammar issue o Page 26 lines 22 – 24 grammar issue o Page 28 lines 18, typo (dada)
--	---

VERSION 1 – AUTHOR RESPONSE

Reviewer:1			
The authors have performed a spatial analysis on the determinants of maternal anemia in Ethiopia. According to the authors, this is the first spatial analysis conducted to identify cold and hot spots of maternal anemia and its determinant factors in the country. However, certain parts of the manuscript is poorly structured and concerns from other parts were noted. As it currently stands, concerns must first be addressed before publication is possible. Attached are some of my comments which can be used by the authors to further improve their manuscript.	No response required.		
1) Page 2 (Abstract): In the results part of the abstract, please consider organizing the determinant factors as to individual level or community level factors.	It has been corrected accordingly as follows: “older age (adjusted odd ratio (AOR) = 0.75; 0.64, 0.96)), no education (AOR = 1.37; 95 % CI: 1.102–1.72), lowest wealth quantile (AOR = 1.29; 95 % CI: 1.014-1.60), currently pregnant (AOR=1.28; 95% CI: 1.10, 1.51, currently breastfeeding (AOR =1.09; 95% CI: 1.025, 1.28), high gravidity (AOR=1.39; 95% CI: 1.13, 1.69), and HIV positive (AOR= 2.11; 95% CI: 1.59, 2.79) are individual factors associated with occurrence of anemia. Likewise, living in a rural area (AOR=1.29; 95%CI: 1.02, 1.63), and availability of unimproved latrine facilities (AOR = 1.18; 95 % CI: 1.01, 1.39) are community-level factors associated with higher odds of anemia.”	2	16-23
2) Page 2 (Abstract): In the conclusion part of the abstract, What do you exactly mean by “Maternal anemia is not randomly distributed across the country.”? Consider rephrasing this part and specify what you exactly mean.	It has been corrected as: “the prevalence rate of anemia among women of reproductive age is varied across the country”.	2	26-27
3) Page 4-5 (Introduction): The introduction is poorly written, and the structure is not logically arranged. Please consider revising/improving the introduction.	The introduction has been revised	3	48-50;58-70
4) Page 5 (Introduction): Consider revising/improving this part: “Mapping the geographical distribution of anemia can also be beneficial for prevention and control of parasitic infections like soil transmitted-helminthiasis, schistosomiasis and malaria; because the control programmes for soil transmitted-	It has been revised as: “The burden of anemia has been used as a measurable indicator of soil transmitted-helminthiasis, so understanding the geographical distribution of anemia can help to	4	90-92

helminthiasis and malaria have been evaluated using the burden of anemia as a quantifiable indicator [23].” You focused more on the association of parasitic infections with anemia which was not elaborated in other parts of the manuscript.	target prevention and control mechanisms for parasitic infections such as these.”		
5) Page 5 (Methodology, Patient and Public Involvement): Please elaborate further who are your target participants. What are their sociodemographic characteristics?	The following sentences has been added: The participants of this study were women of reproductive age (15-49). The mean (\pm standard deviation (sd)) age of the respondents was 28.2 years (\pm 9.2 years). The majority (78%) of the participants resided in a rural area and nearly two thirds (66%) of them were married or living with a partner. Almost half (48%) of the participants had no formal education.	4	98-101
6) Page 5 (Methodology, Study Design and Setting): You mentioned in the strengths and limitations of the study that the EDHS is a cross-sectional study, please indicate it in this part.	The following texts have been added, “EDHS 2016 was a population-based cross-sectional study conducted across the country”.	4	103-104
7) Page 6 (Methodology, Sampling and Data Measurements): Please create or express this part (Lines 5 - 35) in a diagram (if possible) for easier understanding and at the same time to lessen the text.	It has been revised and diagrammatically presented in Figure 1.	5	113-117
8) Page 6 (Methodology, Sampling and Data Measurements): Please indicate in this part that the HemoCue is the standard test used in the EDHS 2016.	We have added the following sentence: “Haemoglobin levels of the women were measured using HemoCue, which is the standard test used in the EDHS 2016.”	5	124-125
9) Page 6 (Methodology, Explanatory Variables): What do you mean by explanatory variables? Is it same with determinant factors? If so, please consider renaming this part to avoid confusion.	Yes, explanatory variables are the same as determinant factors and the text is corrected accordingly	5	130
10) Page 6 (Methodology, Explanatory Variables): What was your basis for including the different factors mentioned? Please indicate it here.	It has been updated as: “The variables were selected based on the literature review for factors affecting anemia. Variables were then categorised as either sociodemographic, maternal or community level factors and included in the analysis.”	5	133-136
11) Page 6 (Methodology, Explanatory Variables, Table 1): As to my understanding, this table or the contents of the table were the ones used for statistical analysis. If so, consider removing this table in the main text and add it as a supplemental table as it is of little value in the manuscript.	Noted and removed from the main text and added it as Supplemental Table 1	5	132
12) Page 9 (Methodology, Spatial Analysis): Please include in this part what do you mean by cold and hot spots and how they are determined/interpreted.	This has been corrected as follows: “Hotspots of anemia rates were determined as high prevalence rates of anemia clustered together on the map. Cold spots are defined as the occurrence of low prevalence rates of anemia clustered together on the map. Hot and cold spots are determined by the Gets Ord statistics using positive autocorrelation and the statistical significance of autocorrelation was determined by z-	7	179-181

	scores and p-value with a 95 % level of confidence.”		
13) Page 20, (Results, Multilevel Analysis): What do you mean by not random in the communities? Please specify what you exactly mean.	It has been modified as follows: “It is to mean that the prevalence rate of anemia was varied across the country. That means the anemia prevalence rate was not similarly distributed across the communities”.	17	367-369
14) Page 25 (Discussion): The discussion is poorly structured and incomplete. Based on what I have read, only the results of table 5 was discussed. Other results such as table 3 and 4 were not included in the discussion. Please consider adding them as they contain relevant findings. For the existing discussion, please organize it as to community and individual level factor.	The discussion has been revised and organized in three themes: the distribution of maternal anemia, individual factors as well as and community factors; and presented sequentially in the beginning, in the middle and in the last part of the discussion. And we have now discussed the findings of Tables 3 and 4 too	21-23	415-485
15) Page 26 (Discussion): In line 41, please elaborate what could be the effect of low fertility to anemia?	It has been updated as: “This might be explained as the more the women gave birth the more the women exposed for blood loss which intern resulted in low haemoglobin level in the blood (58). Similarly, prior births may deplete maternal iron stores due to the increased nutritional demands of pregnancy and puerperal blood loss (59)”.	23	469-471
16) Page 27 (Discussion): Consider removing the paragraph in lines 27 – 34 as it is already proven that pregnancy causes anemia. Instead, consider discussion the possible effects of maternal characteristics with anemia.	It has been corrected accordingly	22	459-462
17) Page 28 (Discussion): In lines 6 - 7, please include the possible reason why HIV positive women are two-fold at risk in developing anemia?	We have added the following statement regarding the possible reason why HIV positive women are at a two-fold risk of developing anemia: “This could be due the direct effects of the HIV infection on the bone marrow and depletion of hemoglobin levels in the blood (60). Many of the opportunistic infections to which HIV patients are susceptible might also lead to anemia (60).”	23	475-577
Reviewer: 2			
General Remarks	No needs of response		
The authors have conducted a study on a very important public health issue. The findings of the study could be of relevance in addressing the anemia problem in Ethiopia. However, several issues in the paper need to be addressed or clarified.			
Major revision			
Title	It has been corrected as follows “The Spatial Distribution and Determinant Factors of Anemia	1	1-2

<p><input type="checkbox"/> The study is titled “The Spatial Distribution and Determinant Factors of Maternal Anemia in Ethiopia: A Multilevel and Spatial Analysis” the use of the word ‘Maternal’ would imply that the study included only pregnant women and/or those with children, which is not the case. Your sample included a large number of women who probably have never had a pregnancy or had a child. I suggest you change the title to suit the sample population. Probably use “among women of reproductive age”.</p>	<p>among Women of Reproductive Age in Ethiopia: A Multilevel and Spatial Analysis”</p>		
<p>Introduction</p> <p><input type="checkbox"/> The author has mentioned in the introduction some of the causes of anemia, however they have not made mention of the consequences of anemia. This would have added more justification for a study on anemia.</p>	<p>It has been updated as follows “Consequently, a low hemoglobin level would adversely affect the health of the women such as maternal mortality and severe morbidity (2), depression (3,4)raised blood pressure (5,6), as well as low birth weight and preterm birth (7).”</p>	3	47-50
<p>Methodology</p> <p>Sampling and data measurements:</p> <p><input type="checkbox"/> Some unnecessary details have been included about the sampling section. Specifically the second paragraph (page 6, lines 23 – 33). The sampling procedure is available in DHS methodology. A brief description of this part with citation would suffice.</p>	<p>Revised accordingly and the following text has been removed “The value of the design effect, averaged over all variables, is 1.99. This means that because of multi-stage clustering of the sample, the average standard error is increased by a factor of 1.99 beyond that in an equivalent simple random sample.”</p>	5	123
<p>Variables</p> <p>Not all the variables mentioned in Table 1 are presented in tables 2 and 4. Did the authors use these variables in the study? Please, show the results.</p>	<p>No, some variables were not used in the study and these variables have been removed from Supplemental Table 1</p>	9	243
<p><input type="checkbox"/> How/Why did the authors select the variables used in this study (not mentioned in the methodology)</p>	<p>The variables were selected based on the literature review for factors affecting anemia. Variables were then categorised as either sociodemographic, maternal or community level factors and included in the analysis.</p>	5	133-136
<p><input type="checkbox"/> How did the authors determine which variables are analyzed at individual and community level? Of the 28 variables mentioned in table 1, only two were aggregated into a community level variable (water source and latrine facility). These two variables were</p>	<p>It has been updated as follows “The assumption of independence of observation have been taken as a basis to determine which variables are analysed at individual and community level. If the observations</p>	6	144-150

<p>not also used at the individual level analysis. Why this?</p>	<p>at the individual level are independent, variables are treated as individual level factors. Whereas, if the observations are clustered into higher levels of units and if several women would have shared features like, place of residence, types of water source, latrine facility and region that could have the same effect on maternal anemia in the locality, then variables are analysed at community level factor.”</p>		
<p>Statistical analysis <input type="checkbox"/> In the DHS data, the Hemoglobin values have been adjusted for altitude and smoking (why include ‘Smoking’ as a covariate?)</p>	<p>Even though the hemoglobin values have been adjusted for smoking, it is better if it is incorporated in the multivariable model in the covariate analysis as a means of controlling possible confounding effect.</p>		
<p><input type="checkbox"/> Did the authors test for any multicollinearity among the variables used? There might be a significant correlation between some variables. E.g. “Total children ever born” and “children ever born in the preceding 5 years” (this variable not found in Table 1). If multicollinearity was tested, please, provide results.</p>	<p>It has been updated as follows “A multicollinearity test was done in order to rule out a significant correlation between variables. If the values of variance inflation factor (VIF) is lower than 10, then the collinearity problem less likely. “</p> <p>The result of multicollinearity test indicated that no collinearity problem detected, since the VIF value of all variables are lower than 10.</p>	<p>8 16</p>	<p>212-214 335-336</p>
<p>Results <input type="checkbox"/> There is a lot of inconsistency in the way the results are displayed in the text. For instance, page 16 line 18. 28% (95% CI (22.0, 25.3), in line 20, 17.8% (16.6 - 19) line 28, [17.0 (14.4, 20.0)] (p=0.0001) and other areas in the text. Use one uniform style throughout the paper e.g. (28%; 95% CI: 22.0, 25.3)</p>	<p>Noted and corrected accordingly</p>	<p>13</p>	<p>286-293</p>
<p><input type="checkbox"/> Page 19 lines 3. “Nearly one-third (n= 4,657; 31.2%) of women were breastfeeding at the time of the survey.” This result should be described under “sociodemographic characteristics”. Table 1 should also be appropriately tilted as it contains other health information.</p>	<p>Noted and corrected accordingly</p>	<p>9</p>	<p>28-249,253</p>
<p><input type="checkbox"/> Page 19 line 7 – 9, “Lactating women had higher odds of anemia than non-lactating women with AOR 1.09 (95% CI: 1.025 -1.28).” this should be moved to the</p>	<p>Noted and corrected accordingly</p>	<p>16</p>	<p>349-350</p>

appropriate results section “individual factors”.			
<input type="checkbox"/> Page 19, line 25. “The average hemoglobin value was significantly different across age groups (p=0.0001).” this result not found in the tables.	This finding is not shown in the tables, and this value is presented to clarify and strengthen the result of Figure 1.		
<input type="checkbox"/> The formulas provided in “Multilevel analysis (random effect analysis)” section are irrelevant; they have been mentioned in the methodology.	Noted and removed	17	379-380
<input type="checkbox"/> Table of results Table 2 (the total for “iron folate intake during pregnancy” is not accurate) is this for those pregnant at the time of data collection? If so, indicate the total.	It is not only for those pregnant at the time of data collection, but it also includes iron folate intake during the pregnancy of the most recent birth in the past 5 years, the total is (n = 7328).	11	Table 1
<input type="checkbox"/> Page 25 lines 5 – 13. This has been described in the methodology already, just mention the results.	Noted and corrected accordingly	21	390-391
Discussion <input type="checkbox"/> Page 26 lines line 8, “A higher number of cases” The results on the maps are presented in proportions. It would be more appropriate to use proportion instead of number of cases.	Noted and corrected accordingly	21	417
<input type="checkbox"/> Page 26, lines 17 – 21. If the hemoglobin level was adjusted for altitude, can this still be a possible cause of regional difference? Please explain.	Yes, the regional variations could possibly be explained by altitude because, in addition to the direct effect of altitude, there might be several differences across different altitudes.		
<input type="checkbox"/> Page 26 lines 40 – 41. Please, specify the age group been referred to in this sentence.	It has been specified as 40-49 years of age	22	436
<input type="checkbox"/> Page 26 lines 44 -46. “this might be a result of Iran having a targeted intervention for younger women or women of reproductive age.” Please, provide a citation for this assumption	Noted and citation inserted	22	438
<input type="checkbox"/> Page 27, lines 19 -20 “low income leads to poor dietary intake” Better to have “low income would mean less money to cater for nutritious foods or a balanced diet ”	Noted and corrected accordingly	22,23	453-455
Minor revisions			
Introduction <input type="checkbox"/> Line 23 – 34. Grammatical issue	Noted and corrected accordingly	3	58-65
Methodology o Sampling and data measurements: <input type="checkbox"/> Page 6, lines 5-8, this sentence needs revision,	In the 2016 EDHS, stratified and cluster multistage sampling was used and intended to have appropriate demographic and health	5	111-112

the idea it intends to convey is not clear.	indicators at nationwide and regional states		
□ Page 6, lines 36 – 37, please provide specification and/or citation.	The citation has been added	3	126
o Spatial analysis: ♣ Page 9 lines 44 – 45, please mention the platform that SAS was used. (Same for the SPSS)	It has been updated as follows The platform used in SAS was PROC GLIMMIX with Laplace method The Complex sample analysis was used for the descriptive statistics	8 7	204 193
♣ Page 9, lines 55 – 56 delete “using ArcGIS version 10.1”, already mentioned earlier. Just “Getis-Ord Gi* statistics was used for this spatial analysis” should be ok.	Noted and corrected accordingly	7	175
Results: o Page 20, line 9, the confidence Interval mentioned here are different form that in table 5.	noted and corrected as (AOR = 2.16; 95 % CI: 1.58, 2.90)	16	361-362
o Page 25 lines 12 – 20 has some grammatical issues.	We have corrected the paragraph to now read: “The severe anemia prevalence rate ($\geq 40\%$) among women of reproductive age was observed in Afar and Somali Regional States. Likewise, a moderate anemia prevalence rate (20-40%) was observed in Oromia, Gambella, SNNPR, Harari and Dire Dawa Regional States. Whereas, a mild anemia prevalence rate ($< 20\%$) was observed in Tigray and Amhara Regional Sates and Addis Ababa.	21	392-396
Discussion: o Page 25 lines 14 – 15 grammar issue	corrected	21	420-421
o Page 26 lines 22 – 24 grammar issue	corrected	22	424-425
o Page 28 lines 18, typo (dada)	corrected	24	492

VERSION 2 – REVIEW

REVIEWER	Raphael Enrique Tiongco Angeles University Foundation, Angeles City, Philippines
REVIEW RETURNED	01-Jan-2019

GENERAL COMMENTS	<p>GENERAL COMMENTS: Thank you to the authors for revising the manuscript. They were able to address majority of the concerns noted during the initial review. I recommend this manuscript for publication after some changes.</p> <p>SPECIFIC COMMENTS: 1.) In the introduction, consider merging the contents of paragraph 1 with paragraph 2. As paragraph 1 seems to be out of place when you read it.</p> <p>2.) For the explanatory variables/determinant factor selection, please cite the studies used as your basis.</p> <p>3.) Certain parts of the manuscript still contain the phrase "non-random across the country", please revise accordingly.</p> <p>4.) Few more checks in the entire manuscript for minor grammatical errors will be useful.</p>
-------------------------	--

REVIEWER	THOMAS SENGHORE School of Medicine and Allied Health Sciences, University of The Gambia, Banjul Campus, The Gambia
REVIEW RETURNED	22-Dec-2018

GENERAL COMMENTS	<p>General comments The authors have responded adequately to comments raised in the first version. However, a few issues need to be revised or clarified before the manuscript could be accepted for possible publication.</p> <p>Minor revision</p> <p>1. The authors have changed the title as suggested however, certain aspects in the text have not been adequately changed to match the title. E.g. the methods section of the abstract, lines 11 – 14; same in the main body, introduction, methods, and discussion sections. Likewise the titles of figures 3 and 5. This need to be corrected accordingly.</p> <p>2. In the methodology, the authors responded to the issue of how variables were selected for analysis and what determined their inclusion as individual or community variable. Please include the citations accordingly.</p> <p>3. On the issue of the multicollinearity among variables used. Please, attach multicollinearity results to your response.</p> <p>4. The authors have not provided a convincing response to the issue on altitude explaining the regional difference in anemia. The hemoglobin levels in the DHS are already adjusted for altitude, therefore altitude cannot account for the regional difference in hemoglobin levels. I suggest the authors remove this justification from the discussion.</p> <p>5. Methodology (Sampling and data collection).</p>
-------------------------	--

	<p>“In the 2016 EDHS, stratified and cluster multistage sampling was used and it was intended to have appropriate demographic and health indicators at nationwide and regional states.” This statement is still not clear.</p> <p>Do the authors intend this “In the 2016 EDHS, stratified and cluster multistage sampling was used and it was intended to be representative at the regional and national level in terms of appropriate demographic and health indicators.” If so, please change or revise.</p>
--	---

VERSION 2 – AUTHOR RESPONSE

Reviewer:2				
<p>Minor revision</p> <p>1. The authors have changed the title as suggested however, certain aspects in the text have not been adequately changed to match the title. E.g. the methods section of the abstract, lines 11 – 14; same in the main body, introduction, methods, and discussion sections. Likewise the titles of figures 3 and 5. This need to be corrected accordingly.</p>	<p>It has been corrected accordingly.</p>	<p>2,4,6,7,8,1 2,13,15,16 , 21,24</p>	<p>14,15,80,89,9 2,153,165,17 5,180,181,18 7,194,207,21 1,217, 289,298,299, 338,344,371, 377,380,398, 399,414,508, 512,513,517, 518</p>	
	<p>2. In the methodology, the authors responded to the issue of how variables were selected for analysis and what determined their inclusion as individual or community variable. Please include the citations accordingly.</p>	<p>The citations have now been added.</p>	<p>6</p>	<p>138</p>
<p>3. On the issue of the multicollinearity among variables used. Please, attach multicollinearity results to your response</p>	<p>Multicollinearity results have now been added.</p>			
	<p>Variable</p>	<p>VIF (variance inflation factor)</p>		<p>Tolerance =1/VIF</p>
	<p>Total children ever born</p>	<p>3.87</p>		<p>0.258487</p>
	<p>Residence</p>	<p>3.30</p>		<p>0.303157</p>
	<p>Water source</p>	<p>2.92</p>		<p>0.342678</p>
	<p>Children born in the preceding 5 years</p>	<p>2.77</p>		<p>0.360676</p>
	<p>wealth index</p>	<p>2.61</p>		<p>0.383088</p>
	<p>Age</p>	<p>2.58</p>		<p>0.387219</p>
<p>Current breast feed</p>	<p>2.34</p>	<p>0.427727</p>		
<p>Toilet facility</p>	<p>1.84</p>	<p>0.544502</p>		

	<table border="1"> <tbody> <tr> <td>Education status</td> <td>1.75</td> <td>0.571787</td> </tr> <tr> <td>Children born in last 1 year</td> <td>1.68</td> <td>0.593812</td> </tr> <tr> <td>Marital status</td> <td>1.61</td> <td>0.621168</td> </tr> <tr> <td>Region</td> <td>1.38</td> <td>0.723035</td> </tr> <tr> <td>Religion</td> <td>1.23</td> <td>0.814677</td> </tr> <tr> <td>Current pregnant</td> <td>1.12</td> <td>0.889108</td> </tr> <tr> <td>HIV test</td> <td>1.05</td> <td>0.956804</td> </tr> <tr> <td>Current contraceptive use</td> <td>1.00</td> <td>0.998772</td> </tr> </tbody> </table>	Education status	1.75	0.571787	Children born in last 1 year	1.68	0.593812	Marital status	1.61	0.621168	Region	1.38	0.723035	Religion	1.23	0.814677	Current pregnant	1.12	0.889108	HIV test	1.05	0.956804	Current contraceptive use	1.00	0.998772		
Education status	1.75	0.571787																									
Children born in last 1 year	1.68	0.593812																									
Marital status	1.61	0.621168																									
Region	1.38	0.723035																									
Religion	1.23	0.814677																									
Current pregnant	1.12	0.889108																									
HIV test	1.05	0.956804																									
Current contraceptive use	1.00	0.998772																									
4. The authors have not provided a convincing response to the issue on altitude explaining the regional difference in anemia. The hemoglobin levels in the DHS are already adjusted for altitude, therefore altitude cannot account for the regional difference in hemoglobin levels. I suggest the authors remove this justification from the discussion.	We agree with the reviewers and have now removed following sentences : The altitude also has an effect on the hemoglobin level [1] which results in a disparity of anemia occurrence across the country.	21	429,430																								
5. Methodology (Sampling and data collection). "In the 2016 EDHS, stratified and cluster multistage sampling was used and it was intended to have appropriate demographic and health indicators at nationwide and regional states." This statement is still not clear. Do the authors intend this "In the 2016 EDHS, stratified and cluster multistage sampling was used and it was intended to be representative at the regional and national level in terms of appropriate demographic and health indicators." If so, please change or revise.	The reviewer is correct. We have now corrected this statement to read "In the 2016 EDHS, stratified and cluster multistage sampling was used and it was intended to be representative at the regional and national level in terms of appropriate demographic and health indicators"	5	114-116																								
Reviewer :1																											
GENERAL COMMENTS: Thank you to the authors for revising the manuscript. They were able to address majority of the concerns noted during the initial review. I recommend this manuscript for publication after some changes	No response required.	NA	NA																								
SPECIFIC COMMENTS: 1.) In the introduction, consider merging the contents of paragraph 1 with paragraph 2. As paragraph 1 seems to be out of placed when you read it.	This has now been corrected.	3	45-60																								

2.) For the explanatory variables/determinant factor selection, please cite the studies used as your basis.	The citations for the explanatory variables/determinant factor selection have now been added to the manuscript.	6	138
3.) Certain parts of the manuscript still contain the phrase "non-random across the country", please revise accordingly.	This has now been corrected to read "...anemia among women varied across the country"	24	507
4.) Few more checks in the entire manuscript for minor grammatical errors will be useful.	The manuscript has been checked and minor grammatical errors corrected.	2,3,4,5,6,9,21,22,24	26,27,40,41,54-56,59,63,70,73,74,76,78,79,82,84,88,99,101,118,130,132,138,141,250,425,432,451,501,524

VERSION 3 – REVIEW

REVIEWER	THOMAS SENGHORE School of Medicine and Allied Health Sciences University of The Gambia Banjul Campus The Gambia
REVIEW RETURNED	29-Jan-2019

GENERAL COMMENTS	The authors have adequately responded and revised the manuscript accordingly. I recommend the manuscript for publication. Comment If accepted for publication, I suggest the multicollinearity results be presented as a supplementary file. In the methodology, page 4 lines 100 - 104, the results presented here are repeated in the results section page 9 lines 249 - 252. I suggest the authors retain them in the results section and delete from the methodology.
-------------------------	---