

## PEER REVIEW HISTORY

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### ARTICLE DETAILS

<b>TITLE (PROVISIONAL)</b>	Determinants of contraceptive use among sexually active unmarried adolescent girls and young women aged 15-24 years in Ghana: a nationally representative cross-sectional study.
<b>AUTHORS</b>	Oppong, Felix; Logo, Divine; Agbedra, Senyo; Adomah, Anthony; Amenyaglo, Seidu; Arhin-Wiredu, Kingsley; Afari-Asiedu, Samuel; Ae-Ngibise, Kenneth

### VERSION 1 – REVIEW

<b>REVIEWER</b>	Catarina Krug Department of Infectious Disease Epidemiology, Faculty of Epidemiology and Population Health, London School of Hygiene and Tropical Medicine, UK
<b>REVIEW RETURNED</b>	21-Sep-2020

<b>GENERAL COMMENTS</b>	<p>The primary aim of this study was to assess the prevalence of (modern and traditional) contraceptive use among sexually active unmarried adolescents (15-19 yrs old) and young women (20-24 yrs old) in Ghana. The secondary aims were to investigate the determinants of contraceptive use in this population, to assess trends in use and knowledge of contraceptive methods. The authors used 2017 Ghana Maternal Health cross-sectional surveys (<b>GMHS</b>) to extract data on sexually active adolescents and young women (n=809). To explore trends in use, the authors further extracted data from 2008 and 2014 GMHS. Contraceptive use was computed by age group, by type of contraceptive, as well as socio-demographic characteristics. Logistic regression was used to assess the determinants of contraceptive use. The authors concluded that there is a significant gap between knowledge and use of contraceptives among sexually active unmarried adolescents and young women in Ghana.</p> <p>This study is of interest, as it focuses in unmarried adolescents and young women, a population often underrepresented in sexual and reproductive health literature. However, the objectives are unclear, and the study lacks detail to be reproduced. The text does not follow a clear line of thought, containing results (e.g. trends in use, 'knowledge of a place where to buy contraceptives',...) that were not included in the aims of the study and/or in the methodology. I suggest that the authors either focus in the aims stated at the beginning of the text – assessing prevalence of contraceptive use and its determinants – or adding further objectives (e.g. knowledge</p>
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	<p>and trends in use) and their respective methodology. The latter may cause the article to become lengthy.</p> <p>The prevalence of contraceptive use stated by the authors is greater than the one mentioned in other studies. For instance, Appiah et al 2020 used Ghana Demographic and Health surveys (<b>GDHS</b>) and found a prevalence of contraceptive use among Ghanaian adolescents (15-19) of 21.1% in 2009 and of 20.4% in 2014. The prevalence was slightly but significantly greater among unmarried compared to married adolescents. However, the current study of Felix et al, found a prevalence of contraceptive use among unmarried Ghanaian adolescents (15-19) of 74% in 2009 and of 53% in 2014. I would therefore recommend that the authors present their definition of contraceptive use in the methods and review their computations once again.</p> <p><b>Major comments:</b></p> <p>Abstract: Objectives stated on P2/L16 and on P7/L10 (use and its determinants) differ from those stated on L45 (knowledge and use). Please ensure uniformity throughout the text.</p> <p>P6/L22-L29: The authors could provide a justification for why the prevalence is so different between GMHS estimates in 2017 and GDHS estimates in 2009 and 2014. Were the same definitions used? For instance in terms of sexual activity, modern/traditional methods considered, regions considered, sampling methodology, etc?</p> <p>P8/L6-L13: Please describe how (and why) you have categorized each variable.</p> <p>P8/L13: Please provide the definition of contraceptive knowledge used.</p> <p>P8/L22: "Contraceptive use was assessed through" rather than "Contraception use was defined as an affirmative response to the"</p> <p>P8/L22: Please provide the definition of contraceptive prevalence used in the manuscript (numerator and denominator used for calculation).</p> <p>P8/L55: The trends in use come by surprise as not mentioned in the aims of the study. I suggest either removing from the manuscript or adding it to the study objectives.</p> <p>P9/L5: It is unclear why the authors decided to use chi-squared to explore the associations between knowledge vs age and use vs age, but not with the other socio-demographic variables. Also, the authors did not state in their aims assessing the relationship between knowledge and age group.</p>
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	<p>P9/L13: Were there any missing values for any of the variables of interest? Please present this in the results section.</p> <p>P9/L16: The authors should be aware of the limitations of this model-building strategy (i.e. screening variables based on unconditional associations). One problem is the collinearity between variables – this should be investigated. Another problem is that important predictors may be excluded if its effect is masked by another variable (e.g. presence of confounding).</p> <p>P12/L18: The term CPR is mentioned here for the first time, but it should have been defined earlier, in the methods section. Also, there is no need to define the abbreviation if it is not used later in text.</p> <p>P12/L25-L29: “knowledge of a place” is mentioned here for the first time, but it was not mentioned before in the aims or in the methods section. Suggest removing from here and from the discussion.</p> <p>Table 2:</p> <ul style="list-style-type: none"> <li>- The authors show that most unmarried women aged 20-24 that are using a method, use emergency contraception (9.3%). This finding should be discussed (in the discussion section), as it is an important and unexpected finding.</li> <li>- Although the sample in this study is slightly different from the one presented at the GMHS report, the use by method is very similar to the GMHS report, with the exception of female and male sterilization in girls aged 15-19 years. Could the authors please review these findings?</li> <li>- The overall method mix is not in agreement with the one described in FP2020 website (<a href="http://www.familyplanning2020.org/ghana">http://www.familyplanning2020.org/ghana</a>), could the authors provide an explanation for the differences found in this age group? Are these differences in method-mix between younger vs older women supported by other studies in Ghana or in other regions of the world? Is this greater use of emergency pill supported by other studies in Ghana?</li> <li>- Please add one line on “Any contraceptive method”, showing the overall CPR for both traditional and modern methods.</li> </ul> <p>Table 3: Please add 95%CI to the prevalence or p-values for the associations between background characteristic and contraceptive use, to understand if numeric differences are significant or not. If greater use among women (15-24) living in rural areas compared to urban areas is significant, then the reasons for this should be discussed, as it is an</p>
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	<p>unexpected finding. The same for greater use among young women (20-24) in the lowest vs the highest wealth quintile.</p> <p>P13/L51: Please provide prevalence as well as 95%CI and/or p-value of the association to back up your statements.</p> <p>P15/L10: The absence of association should also be described in text.</p> <p>P15/L13: Please provide OR and 95%CI to back up your statements.</p> <p>Table 4: Please add in Table footnote which models are adjusted for which variables in the multivariate analysis.</p> <p>Discussion:</p> <ul style="list-style-type: none"> <li>- The discussion should start with the results on contraceptive use, as it was the main objective of this study. This should be followed by a summary of its determinants (P19/L47-L54). A discussion on the agreement/disagreement between the findings of this study (e.g. prevalence and associations) and the findings from other studies in Ghana (or elsewhere) should follow, with justifications on why there may be any gaps.</li> <li>- Any ideas why trends are going down, rather than up? From 70% in 2007 to 30% in 2019 seems like a big gap. Also, the opposite is found in the overall population of women, with trends going up rather than down (<a href="http://www.familyplanning2020.org/ghana">http://www.familyplanning2020.org/ghana</a>). This should be discussed.</li> </ul> <p>Minor comments:</p> <p>Abstract/P3/L8: The authors should also present the results on the absence of association between socio-demographic characteristics and contraceptive use.</p> <p>P5/L16-L18: Please rephrase.</p> <p>P5/L26-L28: Higher unintended pregnancies among adolescence compared to ...?</p> <p>P5/L33: If the abbreviation UP is to be used, it should be used throughout the doc (e.g. P6/L13; P18/L25; ...)</p> <p>P6/L4-8: Please add a reference on the legislation to back-up this statement.</p> <p>P6/L13: "Use of contraception" rather than "Adolescent contraceptive"</p>
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	<p>P7/L38: One individual missing in '10,010' to complete 25,063 respondents.</p> <p>Figure 1: 25,062 is different from 25,063 in text.</p> <p>P7/L38: The definition of 'unmarried' used by the authors should be described earlier in the document (it only appears later, on P10/L11).</p> <p>P8/L48: Please remove the sentence "The age distribution (15-19 years vs. 20-24 years) of the history of pregnancy, abortion and births were explored"</p> <p>P9/L8: This sentence is unclear. Suggest rephrasing.</p> <p>P11/L17-L31: I suggest presenting this information in the form of a Table (added to Table 1 for instance), and then only summarizing the results in text.</p> <p>P12/L3: This section "Knowledge and use of contraceptive" should be separated in two, starting by contraceptive use, the main outcome.</p> <p>P17/L37-L40: Please rephrase.</p> <p>P18/L6: Please rephrase.</p> <p>P18/L36: Please describe if any interventions on FP were implemented in Ghana and if any were specifically targeted to adolescents and/or young-women.</p> <p>P20/L37: Please rephrase.</p>
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<b>REVIEWER</b>	Meghan Gallagher Save the Children, USA
<b>REVIEW RETURNED</b>	28-Oct-2020

GENERAL COMMENTS	Li	Comment
	Page (# on bottom of page)	
	5 16	"... there still remains a disproportionately low AYSRH outcome in sub-Saharan Africa..."
	5 28	Higher percentage among adolescents (not adolescence)

	5	28	Include the percentage of unintended pregnancy for adolescents immediately  after you reference that it is higher
	5	33	Need a citation at the end of the phrase that ends in “social rejection.”
	5	35	Please note the high school dropout rate
	5	52	Please define specific ages for teenagers (i.e. age 15-19)
	6	37	What are the Ghana-specific FP2020 goals? Not necessary to elaborate on all of  them, but given the topic of the paper, framing with Ghana-specific  commitments are important here.
	6	44	Remove “often”
	6	44	Replace “the bigger reproductive age group” with “all women of reproductive  age”
	6	46	Replace “a couple” with “several”
	7	3	Replace “older” with “old”
	7	3	Please cite the DHS to which you refer
	7	10	Replace “determinant” with “determinants”
	7	19	Replace “were” with “was” in the line Data from the 2017 Ghana Maternal  Health Survey...”
	7	21	The survey design and methodology should be detailed more fully here. Please  provide the summary of the GMHS and conclude the paragraph with the line,  “Additional details of the survey design and methodology can be found in the  survey report.”
	7	47	Since you note the 809 sexually active adolescents in the phrase above, need to  indicate that the 809 in the final phrase is referring back to that group. You  could say, for example, “data from the subset of 809 respondents were included

		<b>in the data analysis”</b>
<b>8</b>	<b>19</b>	<b>How are you classifying cycle beads? In DHS, these are modern contraception, but they are not noted here as modern or traditional.</b>
<b>8</b>	<b>32</b>	<b>Patient and Public Involvement does not need to be its own section; please incorporate relevant text from this into another part of the paper- likely where you describe the survey methodology.</b>
<b>8</b>	<b>46</b>	<b>Though you refer to the report, please briefly describe the weighting of data directly.</b>
<b>9</b>	<b>6</b>	<b>Change to: “Chi-Square tests were used”</b>
<b>10</b>	<b>14</b>	<b>Change “is” to “are” – “respondents are presented in Table 1”</b>

### VERSION 1 – AUTHOR RESPONSE

<b>A. First reviewers’ comments</b>	
<p>1. This study is of interest, as it focuses in unmarried adolescents and young women, a population often underrepresented in sexual and reproductive health literature. However, the objectives are unclear, and the study lacks detail to be reproduced. The text does not follow a clear line of thought, containing results (e.g. trends in use, ‘knowledge of a place where to buy contraceptives’,...) that were not included in the aims of the study and/or in the methodology. I suggest that the authors either focus in the aims stated at the beginning of the text – assessing prevalence of contraceptive use and its determinants – or adding further objectives (e.g. knowledge and trends in use) and their respective methodology. The latter may cause the article to become lengthy.</p>	<p>As contraceptive knowledge is a major contributor to its use, we have revised the study’s objective to include the assessment of contraceptive knowledge among the study respondents. The revised objective reads: “With a focus on sexually active unmarried adolescents and young women 15-24 years, we assessed the knowledge and prevalence of contraceptive use, and determinant of contraceptive use in Ghana.” Page 7.</p> <p>Given that trends in use of contraceptive is not captured as a specific objective, the results on trends in contraceptive use have been excluded from the manuscript.</p>
<p>2. The prevalence of contraceptive use stated by the authors is greater than the one mentioned in other studies. For instance, Appiah et al 2020 used Ghana Demographic and Health surveys (GDHS) and found a prevalence of contraceptive use among Ghanaian adolescents (15-19) of 21.1% in 2009 and of 20.4% in 2014. The prevalence was slightly but significantly greater among unmarried</p>	<p>The prevalence of contraceptive use reported in our study is based on <b>sexually active unmarried adolescents and young women 15-24 years</b>. All the reported estimates have been crosschecked and are correct (page 83 in both 2008 and 2014 Ghana demographic and health survey (GDHS), page 51 in 2017 Ghana maternal health survey (GMHS)). Also,</p>



<p>compared to married adolescents. However, the current study of Felix et al, found a prevalence of contraceptive use among unmarried Ghanaian adolescents (15-19) of 74% in 2009 and of 53% in 2014. I would therefore recommend that the authors present their definition of contraceptive use in the methods and review their computations once again.</p>	<p>the definition of contraceptive use in all three surveys (2008 GDHS, 2014 GDHS and 2017 GMHS) encompasses the percentage of respondents who used any of the following contraceptive methods (Female sterilization, male sterilization, pill, IUD, injectables, implants, male condom, female condom, diaphragm, foam, or jelly, Lactational Amenorrhoea Method (LAM), emergency contraception, rhythm and withdrawal method – thus, any method, both modern and traditional).</p> <p>Like in Appiah et al 2020, most studies on adolescent contraception in Ghana report the prevalence among all adolescents aged 15-19 years (Not sexually active and unmarried adolescents). <b>Our study reports on sexually active unmarried adolescents and young women, a vulnerable population often underrepresented in sexual and reproductive health studies.</b> In addition, our study population include respondents aged 15-24 years which is wider, and especially young women who are between 19-24 years might have had the opportunity to use contraceptives the more, considering they might be staying on their own without parental/guardian control.</p> <p>We have also defined what contraceptive use entails in our study. Page 9 and 10.</p>
<p><b>Abstract:</b></p> <p>3. Objectives stated on P2/L16 and on P7/L10 (use and its determinants) differ from those stated on L45 (knowledge and use). Please ensure uniformity throughout the text.</p>	<p>This has been resolved. We have refined the study's objective to specifically include the assessment of contraceptive knowledge, and this has been made uniform throughout the manuscript. See page 7.</p>
<p>4. P6/L22-L29: The authors could provide a justification for why the prevalence is so different between GMHS estimates in 2017 and GDHS estimates in 2009 and 2014. Were the same definitions used? For instance in terms of sexual activity, modern/traditional methods considered, regions considered, sampling methodology, etc?</p>	<p>All three surveys used the same definition for contraceptive use as described in the previous response, and used the same definition for sexually active respondents (thus, sexual intercourse within 30 days of the survey).</p> <p>In terms of sampling methodology, the 2008 survey used a two-stage sampling approach to</p>



	<p>produce separate estimates for key indicators for each of the ten regions in Ghana. Also the 2014 survey followed a two-stage sampling design and was intended to allow estimates of key indicators at the national level as well as for urban and rural areas and each of Ghana's 10 administrative regions. With regards to the 2017 survey, the sampling was designed to provide estimates of key reproductive health indicators for the country as a whole, for urban and rural areas separately, for three zonal levels (Coastal, Middle, and Northern), and for each of the 10 administrative regions in Ghana (Western, Central, Greater Accra, Volta, Eastern, Ashanti, Brong Ahafo, Northern, Upper East, and Upper West). As such, as far as national representation is concerned, all three studies are comparable in terms of methodology.</p>
<p>5. P8/L6-L13: Please describe how (and why) you have categorized each variable.</p>	<p>We have included a table (Table 1, page 9 and 10) to describe all the variables used in our study and how they were classified.</p>
<p>6. P8/L13: Please provide the definition of contraceptive knowledge used.</p>	<p>The definition of contraceptive knowledge has been included, and it reads "Contraceptive knowledge was defined as having heard of any contraceptive method (either modern or traditional methods)." See page 9.</p>
<p>7. P8/L22: "Contraceptive use was assessed through" rather than "Contraception use was defined as an affirmative response to the"</p>	<p>This sentence has been revised appropriately. See page 9.</p>
<p>8. P8/L22: Please provide the definition of contraceptive prevalence used in the manuscript (numerator and denominator used for calculation).</p>	<p>Contraceptive prevalence has been defined and it reads "Contraceptive prevalence rate was defined as the percentage of sexually active unmarried adolescent girls and young women who used any contraceptive method (modern or traditional)." See page 10.</p>
<p>9. P8/L55: The trends in use come by surprise as not mentioned in the aims of the study. I suggest either removing from the manuscript or adding it to the study objectives.</p>	<p>This has been excluded from the manuscript.</p>
<p>10. P9/L5: It is unclear why the authors decided to use chi-squared to explore the associations between knowledge vs age and use vs age, but not with the other socio-demographic variables. Also, the authors did not state in their aims assessing the relationship between knowledge and age group.</p>	<p>It was of interest in this study to explore the age (adolescents vs young women) differentials in contraceptive knowledge and use, of which the Chi-squared test was used. As such, we have revised our objective to include "In addition, we explored the age differentials in knowledge and use of the different contraceptive methods." Please see page 7.</p>

<p>11. P9/L13: Were there any missing values for any of the variables of interest? Please present this in the results section.</p>	<p>There were no missing data</p>
<p>12. P9/L16: The authors should be aware of the limitations of this model-building strategy (i.e. screening variables based on unconditional associations). One problem is the collinearity between variables – this should be investigated. Another problem is that important predictors may be excluded if its effect is masked by another variable (e.g. presence of confounding).</p>	<p>The approach to model building has been revised. The revised approach is as follows. “With interest in all the selected sociodemographic and obstetric variables, we included all the variables in a multivariate logistic regression model regardless of their statistical significance in the univariate analysis. However, abortion in the past 5 years and history of child birth were excluded from the multivariate model due to collinearity with history of past pregnancy. Please see page 10 and 11.</p>
<p>13. P12/L18: The term CPR is mentioned here for the first time, but it should have been defined earlier, in the methods section. Also, there is no need to define the abbreviation if it is not used later in text.</p>	<p>Contraceptive prevalence rate has been defined in the method section, under statistical analysis. It reads “Contraceptive prevalence rate (CPR) was defined as the percentage of sexually active unmarried adolescent girls and young women who used any contraceptive method.” Likewise, CPR has been used later in text following.</p>
<p>14. P12/L25-L29: “knowledge of a place” is mentioned here for the first time, but it was not mentioned before in the aims or in the methods section. Suggest removing from here and from the discussion.</p>	<p>This has been excluded.</p>
<p><b>Table 2:</b> 15. The authors show that most unmarried women aged 20-24 that are using a method, use emergency contraception (9.3%). This finding should be discussed (in the discussion section), as it is an important and unexpected finding.</p>	<p>The findings on emergency contraceptive use have been discussed, by making reference to other studies in Ghana. Please see page 18 and 19.</p>
<p>16. Although the sample in this study is slightly different from the one presented at the GMHS report, the use by method is very similar to the GMHS report, with the exception of female and male sterilization in girls aged 15-19 years. Could the authors please review these findings?</p>	<p>This was an oversight and has been corrected. The output for male sterilization and female sterilization was interchanged.</p>
<p>17. The overall method mix is not in agreement with the one described in FP2020 website (<a href="http://www.familyplanning2020.org/ghana">http://www.familyplanning2020.org/ghana</a>), could the authors provide an explanation for the differences found in this age group? Are these differences in method-mix between younger vs older women supported by other studies in Ghana or in other regions of the world? Is this greater use of emergency pill supported by other studies in Ghana?</p>	<p>The overall methods mix for sexually active unmarried adolescents and young women have been discussed in comparison with the overall method mix for all women of reproductive age. Studies in Ghana supporting the high use of emergency contraception among adolescents and young women have</p>

	also been referenced. Please see page 18 and 19.
18. Please add one line on “Any contraceptive method”, showing the overall CPR for both traditional and modern methods.	We have also included the results on overall contraceptive knowledge and use in Table 3.
19. Table 3: Please add 95%CI to the prevalence or p-values for the associations between background characteristic and contraceptive use, to understand if numeric differences are significant or not. If greater use among women (15-24) living in rural areas compared to urban areas is significant, then the reasons for this should be discussed, as it is an unexpected finding. The same for greater use among young women (20-24) in the lowest vs the highest wealth quintile.	Both the 95% confidence intervals and p-values have been included in the output on contraceptive use by background characteristics of respondents. Significant results have also been highlighted in text. Please see page 14, 15 and 16.
20. P13/L51: Please provide prevalence as well as 95%CI and/or p-value of the association to back up your statements.	The prevalence and 95% CIs have been included in the text.
21. P15/L10: The absence of association should also be described in text.	We have also included in the text the variables that were not significantly associated with contraceptive use. Please see page 16.
22. P15/L13: Please provide OR and 95%CI to back up your statements.	The OR and 95% CIs have also been reported in text. Please see page 16.
23. Table 4: Please add in Table footnote which models are adjusted for which variables in the multivariate analysis.	We have revised the model building approach to include all the variables selected in the study in the adjusted analysis. However, due to collinearity with history of pregnancy, abortion in the past 5 years and history of child birth were excluded from the multivariate model. This has been detailed under the section on statistical analysis.
<b>Discussion:</b>	
24. The discussion should start with the results on contraceptive use, as it was the main objective of this study. This should be followed by a summary of its determinants (P19/L47-L54). A discussion on the agreement/disagreement between the findings of this study (e.g. prevalence and associations) and the findings from other studies in Ghana (or elsewhere) should follow, with justifications on why there may be any gaps.	We have discussed the findings of our study by beginning with the results of the main objective – prevalence of knowledge and use of contraceptives, followed by the determinants of contraceptive use. We have also compared our findings with other studies conducted in Ghana and elsewhere. Please see page 18 and 19.
25. Any ideas why trends are going down, rather than up? From 70% in 2007 to 30% in 2019 seems like a big gap. Also, the opposite is found in the overall population of women, with trends going up rather than down ( <a href="http://www.familyplanning2020.org/ghana">http://www.familyplanning2020.org/ghana</a> ). This should be discussed.	We have excluded the results on the trends in contraceptive use and also excluded the part of the discussion on the trend in contraceptive use among sexually active unmarried adolescents and young women in Ghana.

<p>26. Abstract/P3/L8: The authors should also present the results on the absence of association between socio-demographic characteristics and contraceptive use.</p>	<p>In the abstract, we have also presented the variables that were not significantly associated with contraceptive use. The revised test reads “In an unadjusted analysis, age (<math>p=0.002</math>), past pregnancy (<math>p &lt; 0.001</math>), abortion in the past 5 years (<math>p=0.007</math>), and ever given birth (<math>p=0.025</math>) were independently associated with contraceptive use, whereas education (<math>p=0.072</math>), place of residence (<math>p=0.702</math>), household wealth (<math>p=0.836</math>), and age at first sex (<math>p=0.924</math>) were not independently associated with contraceptive use.” Please see page 2 and 3.</p>
<p>27. P5/L16-L18: Please rephrase.</p>	<p>This sentence has been rephrased to “Despite this improvement, there still remains a disproportionately low AYSRH outcomes in SSA compared to other parts of the world, with the region having the highest adolescent pregnancy rate and the lowest rate of contraception (4).” Please see page 5.</p>
<p>28. P5/L26-L28: Higher unintended pregnancies among adolescence compared to ...?</p>	<p>This sentence has been revised to “In Ghana, about 30% of all pregnancies are unintended, with significantly higher prevalence among adolescents (70%) compared to adults”. Please see page 5</p>
<p>29. P5/L33: If the abbreviation UP is to be used, it should be used throughout the doc (e.g. P6/L13; P18/L25; ...)</p>	<p>Unintended pregnancy has been defined as UP and used throughout the paper.</p>
<p>30. P6/L4-8: Please add a reference on the legislation to back-up this statement.</p>	<p>Reference has been provided. Please see page 6.</p>
<p>31. P6/L13: “Use of contraception” rather than “Adolescent contraceptive”</p>	<p>“Adolescent contraception” has been replaced with “Use of contraception”. Please see page 6.</p>
<p>32. P7/L38: One individual missing in '10,010' to complete 25,063 respondents.</p>	<p>This has been rectified. The correct number is 25,062 and not 25,063. Please see page 8.</p>
<p>33. Figure 1: 25,062 is different from 25,063 in text.</p>	<p>This has been corrected in the text. The correct number is 25,062. Please see page 8.</p>
<p>34. P7/L38: The definition of ‘unmarried’ used by the authors should be described earlier in the document (it only appears later, on P10/L11).</p>	<p>The definition of unmarried respondents has been stated in the method section as “Unmarried respondents are those who were single, divorced, widowed or separated”. Page 8 This has also been defined in Figure 1.</p>
<p>35. P8/L48: Please remove the sentence “The age distribution (15-19 years vs. 20-24 years) of the history of pregnancy, abortion and births were explored”</p>	<p>This sentence has been removed.</p>

36. P9/L8: This sentence is unclear. Suggest rephrasing.	This sentence has been removed. We meant that CPR was presented by background and obstetric characteristics of the study respondents
37. P11/L17-L31: I suggest presenting this information in the form of a Table (added to Table 1 for instance), and then only summarizing the results in text.	The section on “pregnancy, abortion and childbirth” has been included in Table 2 and the results summarized in text.
38. P12/L3: This section “Knowledge and use of contraceptive” should be separated in two, starting by contraceptive use, the main outcome.	This section has been split in two to differentiate the results on use and knowledge on contraceptive use. Please see page 13 and 14.
39. P17/L37-L40: Please rephrase.	This sentence has been rephrased. “Another factor contributing to the gap between knowledge and use of contraceptives is the myth surrounding the use of various methods and female sex.” See page 20.
40. P18/L6: Please rephrase.	This sentence has been rephrased. “This includes lack of education about how to use contraceptive and its potential side effects”. Please see page 20.
41. P18/L36: Please describe if any interventions on FP were implemented in Ghana and if any were specifically targeted to adolescents and/or young-women.	We have described FP interventions that have been implemented in Ghana. See page 21.
42. P20/L37: Please rephrase.	This has been rephrased to “To address the gap in contraceptive use among young women in Ghana, the health authorities must ensure that contraceptive services are available and easily accessible.” See page 22.
<b>B. Second reviewers’ comments</b>	
1. P5/L16: “... there still remains a disproportionately low AYSRH outcome in sub-Saharan Africa...”	This sentence has been rephrased to “Despite this improvement, there still remains a disproportionately low AYSRH outcomes in Sub-Saharan Africa compared to other parts of the world, with the region having the highest adolescent pregnancy rate and the lowest rate of contraception (4).” See page 5.
2. P5/L28: Higher percentage among adolescents (not adolescence)	This has been modified. Please see page 5.
3. P5/L28: Include the percentage of unintended pregnancy for adolescents immediately after you reference that it is higher	This sentence has been rephrased to “In Ghana, about 30% of all pregnancies are unintended, with significantly higher prevalence among adolescents (70%) compared to adults”. Please see page 5.

4. P5/L33: Need a citation at the end of the phrase that ends in “social rejection.”	A reference has been provided for this sentence (page 5).
5. P5/L35: Please note the high school dropout rate	An example has been provided to give emphasis to the high dropout rate. “Unintended pregnancies (UP) among young females also result in high school dropout rates and truncate future development. In a study conducted in Chorkor, a fishing community in Ghana’s Capital, 86% of the 50 teenage pregnant girls who were involved in the study had dropped out of school (13).” Page 5 and 6.
6. P5/L52 Please define specific ages for teenagers (i.e. age 15-19)	This no longer applies as we have excluded this paragraph.
7. P6/L37: What are the Ghana-specific FP2020 goals? Not necessary to elaborate on all of them, but given the topic of the paper, framing with Ghana-specific commitments are important here.	The Ghana-specific FP2020 goals have been highlighted. “Meeting adolescents’ contraceptive need is pertinent in achieving the Ghana Family Planning 2020 (FP2020) goal of expanding the use of modern contraception from 1.46 million in 2015 to 1.93 million in 2020, and increasing contraceptive use among sexually active unmarried adolescents by 2020 (21).” Please see page 6.
8. P6/L44: Remove “often”	Often has been removed from the sentence. The revised sentence reads “Most research on contraception use are conducted among all women of reproductive age (15-49 years), without detailed stratified analysis by age (23, 24).” Please see page 6.
9. P6/L44: Replace “the bigger reproductive age group” with “all women of reproductive age”	.... “the bigger reproductive age group” has been replaced with “all women of reproductive age”. Please see page 6.
10. P6/L46: Replace “a couple” with “several”	This change has been effected. See page 6
11. P7/L3: Replace “older” with “old”	Older has been replaced with old. See page 6.
12. P7/L3: Please cite the DHS to which you refer	The DHS that is been referred to has been cited. See page 6
13. P7/L10: Replace “determinant” with “determinants”	This correction has been made. Please see 7.
14. P7/L19: Replace “were” with “was” in the line Data from the 2017 Ghana Maternal Health Survey...”	This correction has been made. Please see 7.
15. P7/L21: The survey design and methodology should be detailed more fully here. Please provide the summary of the GMHS and conclude the paragraph with the line, “Additional details of the survey design and	A more detailed summary of the survey design and methodology has been provided (page 7 and 8).



<p>methodology can be found in the survey report.”</p>	
<p>16. P7/L47: Since you note the 809 sexually active adolescents in the phrase above, need to indicate that the 809 in the final phrase is referring back to that group. You could say, for example, “data from the subset of 809 respondents were included in the data analysis”</p>	<p>This has been rectified. The revised sentence reads “Given our interest in contraceptive use among sexually active unmarried adolescents and young women aged 15-24 years, data from the subset of 809 respondents were included in the data analysis.” Please see page 8.</p>
<p>17. P8/L19: How are you classifying cycle beads? In DHS, these are modern contraception, but they are not noted here as modern or traditional.</p>	<p>Data on the use of cycle beads were not specifically collected in the 2017 GMHS survey.</p>
<p>18. P8/L32: Patient and Public Involvement does not need to be its own section; please incorporate relevant text from this into another part of the paper- likely where you describe the survey methodology.</p>	<p>This is a specific requirement by BMJ Open. We excluded this in an earlier submission and the paper was returned to us to include a specific section on Patient and Public Involvement. Please find some more details on what we received from the journal.</p> <p>“We have implemented an additional requirement to all articles to include 'Patient and Public Involvement' statement within the main text and your main document. Please refer below for more information regarding this new instruction:</p> <p>Patient and Public Involvement:</p> <p>Authors must include a statement in the methods section of the manuscript under the sub-heading 'Patient and Public Involvement'.</p> <p>This should provide a brief response to the following questions:</p> <p>How was the development of the research question and outcome measures informed by patients' priorities, experience, and preferences?</p> <p>How did you involve patients in the design of this study?</p> <p>Were patients involved in the recruitment to and conduct of the study?</p> <p>How will the results be disseminated to study participants?</p> <p>For randomised controlled trials, was the burden of the intervention assessed by patients themselves?</p> <p>Patient advisers should also be thanked in the contributorship statement/acknowledgements.</p>



	If there is no patient involved in the study, please state "No patient involved" under the sub-heading 'Patient and public involvement'."
19. P8/L46: Though you refer to the report, please briefly describe the weighting of data directly.	A brief description of the weighting has been provided in the manuscript.
20. P9/L6: Change to: "Chi-Square tests were used"	This change has been effected (page 10).
21. P10/L14: Change "is" to "are" – "respondents are presented in Table 1"	This change has been made (page 12).
22. P10 /L16: Please define junior high/high school as this is not a typical category. Usually education categories are no education, primary, secondary, and post-secondary	This has been defined in the method section as Middle/Junior Secondary/High School (JSS/JHS). Also, the education category Middle/JHS/JSS is very typical in Ghana and is recorded as a separate category in almost all surveys conducted in Ghana. Page 9.
23. P10/L41: How were household wealth quintiles determined? This is likely part of original survey methodology, but mention this when you describe study variables	This has been described in the method section. "Scores based on the number and kinds of consumer goods owned by a respondents household, ranging from a television to a bicycle or car, and housing characteristics such as source of drinking water, toilet facilities, and flooring materials". Page 9
24. P10/L20: In Table 1, if you want to include the unweighted number and the weighted percent, I recommend also including a column for the weighted number. Alternatively, you could include the weighted number and the weighted percent only and use parentheses and asterisks to warn you if there are too few unweighted cases in any category (like in the DHS)	The weighted frequencies have been included in Table 2.
25. P10/L20: Since you disaggregate 15-19 and 20-24 in later analyses, you should include them in Table 1. When you include them in Table 1, you should conduct tests of association to determine if the two groups differ in the way of demographic characteristics.	In Table 2, the background characteristics of respondents have been disaggregated by age (15-19 and 20-24). However, we did not test for association between respondent's characteristics and age, as that is not the main focus of the study. That said, in Table 3, we conducted test for association between background characteristics of respondents and contraceptive use, stratified by age (15-19 and 20-24).
26. P11/L15: For pregnancy, abortion, and childbirth section, you should begin with noting that the data appear in Figure 2.	This no longer applies as this section has been excluded and reported as part of Table 2.
27. P11/L15: Figure 2 should include information beneath regarding weights	This no longer applies as this figure has been excluded from the results.

<p>28. P11/L16: It would be useful to see the data in Figure 2 added to Table 1. It would be more cohesive to have it in table form and to see the differences between the age groups. You go on to talk about contraceptive use being higher among 20-24 age group, which makes sense when you see that a much greater proportion of them have been pregnant as compared to 15-19.</p>	<p>As suggested, the information in Figure 2 has been included in Table 2.</p>
<p>29. P12/L34: Table 2: Conduct tests of association between the two groups and note where the age groups differ from each other in knowledge and use</p>	<p>The tests for significant association between contraceptive knowledge and use have been conducted and included in Table 3. We have also highlighted in text where significant differences were observed.</p>
<p>30. P14 : Table 3: Add symbols (or p-values) to show level of significance for the findings cited on page 13</p>	<p>The 95% confidence intervals and p-values have been included in the output on contraceptive use by background characteristics of respondents. See page 14, 15 and 16.</p>
<p>31. P15/L20: Table 4: There are not many significant findings; please highlight those that are significant.</p>	<p>We have highlighted the variables that were significantly associated with contraceptive use. Please see page 16.</p>
<p>32. P17/L14: Contraceptive knowledge is often high (cite other studies that find this); the knowledge and use discrepancy is consistent in other studies.</p>	<p>We have cited other studies that reported high contraceptive knowledge among young women, and also discussed the results on the discrepancy in knowledge and use with reference to other studies. See page 18 and 19.</p>
<p>33. P18/L32: It is important to have a citation to back up the statement that “unsafe abortion is widespread among adolescents in Ghana” Currently, the citation is from 2007, which is old. This is a very big statement and it needs to be backed with evidence. It would also be important to be able to back up the statement that unsafe abortions by adolescents specifically contributes significantly to maternal morbidity and mortality in the country.</p>	<p>A more current reference has been provided to support our assertion. “Unsafe abortion is widespread among adolescents in Ghana, and it contributes significantly to the burden of morbidity and mortality in the country (47, 48); about 35% of all women who die as a result of unsafe abortion in Ghana are adolescents (48).” Page 20.</p>
<p>34. P19/L52: If finding past pregnancies to be significant, this should be linked to age. Those in the sample who are older have had a longer time to get pregnant in their lifetimes.</p>	<p>Indeed, there is an association between age and pregnancy. The results of the adjusted analysis implies that adjusting for other factors does not affect the significant association found between contraceptive use and history of pregnancy. However, this cannot be said about the association found between age and contraceptive use. After adjusting for other factors including history of pregnancy, we do no longer observe a significant association between age and contraceptive use. In table 4, we find that in both age groups, contraceptive</p>

	use is higher among those with history of pregnancy.
35. General: Abortion in the past five years is a variable that has been found to be significant in the study. Since this is often VERY underreported, it would be useful to know what the sample size for this sub-population is. If the sample size is small, I would potentially exclude from the analysis (and, thus, results).	We have presented in Table 4 the sample involved for all the variables used in the final analysis. Of all the respondents, 163 (20.1%) reported a history of abortion in the past five years, which is not a small sample size.
36. General: Introduction: I would like to see more of a literature review on adolescent contraceptive use in the background. There are many citations, but I find the current introduction to be lacking in detail. I think that pulling out some of the findings on this topic within sub-Saharan Africa would be important in the first section of the Introduction	<p>We have beefed the introduction by including some literature on adolescent's contraceptive use in Sub-Saharan Africa.</p> <p>In so doing, we have removed some of the literature on unintended pregnancies and their consequences.</p>
37. General: Results: When you give a percentage, please note number or confidence interval (where relevant) in parentheses.	This has been rectified.
38. General: Would be useful to find similar articles from other countries and contexts in Sub-Saharan Africa. There are a lot of secondary analyses focused on adolescent contraceptive use.	We have included a number contextual references to both the introduction and discussion sections of our paper.

### VERSION 2 – REVIEW

<b>REVIEWER</b>	Catarina Krug London School of Hygiene and Tropical Medicine United Kingdom
<b>REVIEW RETURNED</b>	04-Dec-2020

<b>GENERAL COMMENTS</b>	<p>Most of my comments have been addressed, thank you.</p> <p>I only have a few minor comments:</p> <ul style="list-style-type: none"> <li>The information described in text on page 3 (lines 5-10) is slightly different from the one on Table 5. The 95%CI and p-values for secondary vs. primary education are 1.31 - 4.49 and p=0.017; and the OR and 95%CI of history of pregnancy 2.13 (1.48 - 3.06).</li> <li>Sometimes there is mix of present and past tense (e.g. page 14, line 30 "is the male condom", which is present tense, with line 32 "was 99.8% and 95.0% respectively", which is past tense), or non-accordance of singular and plural (e.g. page 5, line 18 "a ... low", which is singular, with "outcomes", which is plural) please correct throughout the text.</li> <li>Page 5, line 9: Suggest removing " , among others".</li> </ul>
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	<ul style="list-style-type: none"> <li>• Page 5, line 20: Suggest changing from “(...) lowest rate of contraception” to “(...) lowest rate of contraceptive use”.</li> <li>• Page 7, line 31: Suggest moving “The 2010 Population and Housing Census of Ghana (31), with enumeration area covering an average of 161 households was used as the sampling frame for the 2017 GMHS.” to the end of that paragraph.</li> <li>• Page 7, line 33: Suggest removing “The sampling frame has information on the location, type of residence (urban or rural), and estimated number of residential households for each enumeration area.”</li> <li>• Table 1: please remove one “)” from row region of residence.</li> <li>• Page 13, line 25: No need to redefine CPR.</li> <li>• Page 16, line 33: 95%CI different from the one on Table 5.</li> </ul>
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<b>REVIEWER</b>	Meghan Gallagher Save the Children USA
<b>REVIEW RETURNED</b>	14-Dec-2020

GENERAL COMMENTS	Page	Paragraph	Comment
	(# on bottom of page)		
	5	1	At some point in the Introduction, you need to state your age ranges for adolescents and youth; in effect, define each of these terms since they are the focus of the paper
	6	1	“It is worth to note that most UPs end in induced abortions”  Change to “worthy” or “it is noteworthy that”
	14	1	Change to “male sterilization is the least known method”
	16		Table 5 For Age, the 0.163 p-value in the multivariate analysis should be moved up one row
	17		Table 5 Why were “abortion in the past 5 years” and “ever given birth” not included in the multivariate analysis?

		<b>Please briefly note in results.</b>
	<b>17</b>	<b>Table 5 For Place of Residence, the 0.339 p-value in the multivariate analysis should be moved up one row</b>
	<b>20</b>	<b>2</b>
		<p>You have focused a great deal on unsafe abortion, so worth noting that it is important to promote contraceptive use among adolescents and young girls, but also to ensure the availability of quality post-abortion contraception.</p>
	<b>General</b>	<p>You have placed p-values that are &lt;0.05 in bold font. I like this, but somewhere it should be indicated that bold font is indicative of a p-value &lt;0.05</p>

### VERSION 2 – AUTHOR RESPONSE

Comment	Action/response
<b>First reviewers' comments</b>	
<p>43. The information described in text on page 3 (lines 5-10) is slightly different from the one on Table 5. The 95%CI and p-values for secondary vs. primary education are 1.31 - 4.49 and p=0.017; and the OR and 95%CI of history of pregnancy 2.13 (1.48 - 3.06).</p>	<p>This has been corrected. Please see page 3. "In the adjusted analysis, contraceptive use was significantly higher among respondents with secondary education compared to those with primary education (OR: 2.43, 95% CI: 1.31 - 4.49, p=0.017), and was higher among respondents with a history of pregnancy (OR: 2.13, 95% CI: 1.48 - 3.06, p &lt;0.001)."</p>
<p>44. Sometimes there is mix of present and past tense (e.g. page 14, line 30 "is the male condom", which is present tense, with line 32 "was 99.8% and 95.0% respectively", which is past tense), or non-accordance of singular and plural (e.g. page 5, line 18 "a ... low", which is singular, with "outcomes", which is plural) please correct throughout the text.</p>	<p>We have proofread the entire manuscript and corrected all grammatical errors. For example, the referenced sentences, now read "The most commonly known contraceptive method was the male condom (99%), while male sterilization was the least known method (33%)."</p>

	"... there remains disproportionately low AYSRH outcomes in SSA compared ..."
45. Page 5, line 9: Suggest removing ", among others".	This has been considered. Please see the first paragraph of the introduction. "Improving adolescent and youth sexual and reproductive health (AYSRH) is important in preventing unintended pregnancies, sexually transmitted infections and unsafe abortion"
46. Page 5, line 20: Suggest changing from "(...) lowest rate of contraception" to "(...) lowest rate of contraceptive use".	This change has been effected. Please see the last sentence of the first paragraph of the introduction section. "Despite this improvement, there remains disproportionately low AYSRH outcomes in SSA compared to other parts of the world, with the region having the highest adolescent pregnancy rate and the lowest rate of contraceptive use (4)."
47. Page 7, line 31: Suggest moving "The 2010 Population and Housing Census of Ghana (31), with enumeration area covering an average of 161 households was used as the sampling frame for the 2017 GMHS." to the end of that paragraph.	This has been moved as suggested. Please see the last sentence in the second paragraph under the subsection "Data source and data description"
48. Page 7, line 33: Suggest removing "The sampling frame has information on the location, type of residence (urban or rural), and estimated number of residential households for each enumeration area."	This sentence has been removed.
49. Table 1: please remove one ")" from row region of residence.	This has been corrected. Please see Table 1.
50. Page 13, line 25: No need to redefine CPR.	The definition of CPR has been removed from the statistical analysis section.
51. Page 16, line 33: 95%CI different from the one on Table 5.	This has been corrected. Please see the sentence in reference. "Respondents with secondary level education were more likely to use contraceptives compared to those with primary education (OR: 2.43, 95% CI: (1.31 - 4.49), $p=0.017$ )."
<b>C. Second reviewers' comments</b>	
1. Page 5, paragraph 1: At some point in the Introduction, you need to state your age ranges for adolescents and youth; in effect, define each of these terms since they are the focus of the paper	The age range for adolescents and young women have been specified in the last paragraph of the introduction section. "With a focus on sexually active unmarried adolescents (15-19 years) and young women

	(20-24 years),.....". This has also been further defined in the description of study variables (Table 1)
2. Page 6, paragraph 1: "It is worth to note that most UPs end in induced abortions" Change to "worthy" or "it is noteworthy that"	This has been corrected. Please see the referenced sentence. "It is noteworthy that most UPs end in induced abortions ....."
3. Page 14, paragraph 1: Change to "male sterilization is the least known method"	This has been corrected as ".....while male sterilization was the least known method"
4. Page 16, Table 5: For Age, the 0.163 p-value in the multivariate analysis should be moved up one row	This has been moved up. Please see Table 5
5. Page 17, Table 5: Why were "abortion in the past 5 years" and "ever given birth" not included in the multivariate analysis? Please briefly note in results.	<p>We have explained in the method section how variables were included in the multivariate analysis. Please see the second to last paragraph of the statistical analysis section. "With an interest in all the selected sociodemographic and obstetric variables, we included all the variables in a multivariate logistic regression model regardless of their statistical significance in the univariate analysis. However, abortion in the past 5 years and history of childbirth were excluded from the multivariate model due to collinearity with history of past pregnancy.</p> <p>In the results section, we have also mentioned the reason for excluding these variables. "Due to collinearity with history of past pregnancy, abortion in the past 5 years and history of childbirth were excluded from the adjusted model."</p>
6. Page 17, Table 5: For Place of Residence, the 0.339 p-value in the multivariate analysis should be moved up one row	This has been moved up. Please see Table 5
7. Page 20, paragraph 2: You have focused a great deal on unsafe abortion, so worth noting that it is important to promote contraceptive use among adolescents and young girls, but also to ensure the availability of quality post-abortion contraception.	This has been considered. Please see the references paragraph. "To this end, promoting contraceptive use among adolescents and young girls, as well as ensuring the availability of quality post-abortion contraception is undoubtedly very important."
8. General: You have placed p-values that are <0.05 in bold font. I like this, but somewhere it should be indicated that bold font is indicative of a p-value <0.05	In Table 3, Table 4 and Table 5, we have indicated that " <i>p-values &lt; 0.05 are highlighted in bold and italicized text</i> "