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)	Coverage and factors associated with full immunization among children aged 12 to 59 months in Bangladesh: insights from the nationwide cross-sectional demographic and health survey
AUTHORS	Sarker, Abdur; Akram, Raisul; Ali, Nausad; Sultana, Marufa

VERSION 1 - REVIEW

REVIEWER	Peter Wasswa Kityaba African Centre for Control of Epidemic and Pandemic Threats (ACCEPT), Kampala, Uganda
REVIEW RETURNED	14-Dec-2018

GENERAL COMMENTS	The article requires suggested revisions as indicated in the attached PDF before it can be considered for publication. In addition, the article needs significant language editing to improve its grammar. The authors also need to follow the instructions to authors as provided for by the Journal. The reviewer provided a marked copy with additional comments. Please contact the publisher for full details.

REVIEWER	Chiara de Waure University of Perugia, Italy
REVIEW RETURNED	06-Feb-2019

GENERAL COMMENTS	The paper "Coverage and determinants of full immunization coverage among children aged 12 to 59 months in Bangladesh" deals with determinants of full vaccination coverage among children. The topic is not original, but the setting and the representativeness of the sample makes the contribution useful. Nevertheless, there are few major concerns that should be addressed. One general main concern is about the use of the term "antigen" that in my opinion is misleading throughout the text. Abstract 1. A definition of full immunization should be provided in the abstract and findings should be better presented in order to make clear the direction of each association. Methods 2. Authors should make clear how they dealt with the outcome variable in the whole age group considered in the analysis. Looking at the definition of "full immunization", I can guess that a certainty on "full immunized" status may be achieved only at 59

months of age. The vaccination schedule is not reported and, indeed, it is difficult to understand at which time vaccination status was assessed. In fact, as found by the Authors themselves, it is expected that the proportion of full immunized changes according to age group. It depends on when full immunization may be reached. Another aspect that should deserve clarification is about children belonging to the same family. How were these type of data (two or more children belonging to the same households) dealt with?

3. Two exploratory variables, namely family size and mass media exposure, were not described in terms of categories and operational definitions.

4. Authors excluded 307 missing data on vaccination information but in methods they told that where health cards were unavailable, and mothers indicated that they did not know about their children's vaccination status the child was considered as "not fully immunized".

5. The goodness of fit of the model should be assessed and described. I see that R^2 is very low. Similarly, the selection of variables entered in the multivariable model should be better addressed.

Results
6. P<0.000 does not make sense. Please replace it with $p < 0.001$.
7. Collinearity was investigated but not described in results.

Conclusion
8. Authors referred to suboptimal immunization coverage among antigens and across various regions of Bangladesh. This sentence is not fully supported by data as the description of coverage across different vaccinations (and not antigens) is not described in detail in results.

Minor concerns
9. Authors quoted "Universal immunization program of children against six vaccine-preventable diseases (VPD) is recognized as one of the most cost-effective programs to diminish childhood mortalities and morbidities across the world". I believe that this sentence could be rephrased in order to include all vaccinations instead of only the six considered in the study.
10. The English should be improved.

VERSION 1 – AUTHOR RESPONSE

Reviewer(s)' Comments to Author:

Reviewer: 1

Reviewer Name: Peter Wasswa Kityaba

Institution and Country: African Centre for Control of Epidemic and Pandemic Threats (ACCEPT), Kampala, Uganda

Please state any competing interests or state 'None declared': None declared

Please leave your comments for the authors below

Comments: The article requires suggested revisions as indicated in the attached PDF before it can be considered for publication. In addition, the article needs significant language editing to improve its grammar. The authors also need to follow the instructions to authors as provided for by the Journal.

Response: Authors humbly thanks the reviewer for his valuable comments, suggestions and corrections for the improvement of the quality of this paper. Authors have addressed all the concerns of the reviewer mentioned in the pdf file. Please see the track change version. Moreover, English language and the grammar has improved by the professional copyeditors. Please see the revised version of the manuscript.

Reviewer: 2

Reviewer Name: Chiara de Waure

Institution and Country: University of Perugia, Italy

 Please state any competing interests or state 'None declared': None declared

Please leave your comments for the authors below

Comments: The paper "Coverage and determinants of full immunization coverage among children aged 12 to 59 months in Bangladesh" deals with determinants of full vaccination coverage among children. The topic is not original, but the setting and the representativeness of the sample makes the contribution useful. Nevertheless, there are few major concerns that should be addressed. One general main concern is about the use of the term "antigen" that in my opinion is misleading throughout the text.

Response: Authors thank the reviewer for his valuable comments for the improvement of this research. Authors agree with the reviewer concern about use of the term "antigen". This term is now removed and rewritten to make easily presentable to the readers. Please see the introduction (page 4,5 and throughout the manuscript).

Abstract

Comments: 1. A definition of full immunization should be provided in the abstract and findings should be better presented in order to make clear the direction of each association.

Response: The definition of full immunization is now inserted in the abstract section (page 2). The findings of the study are also rewritten to make clear direction and understanding.

Methods

Comments: 2.   Authors should make clear how they dealt with the outcome variable in the whole age group considered in the analysis. Looking at the definition of "full immunization", I can guess that a certainty on "full immunized" status may be achieved only at 59 months of age. The vaccination schedule is not reported and, indeed, it is difficult to understand at which time vaccination status was assessed. In fact, as found by the Authors themselves, it is expected that the proportion of full immunized changes according to age group. It depends on when full immunization may be reached. Another aspect that should deserve clarification is about children belonging to the same family. How were these type of data (two or more children belonging to the same households) dealt with?

Response: Authors thank the reviewer for the concern and apologies for not making it clearer while describing in the text. In this current analysis, the outcome variable (fully immunized or not) is defined considering the receipt of eight vaccines which have to be administrated within the first 12 months of age according to the EPI schedule in Bangladesh (please see page 5, outcome variable). This schedule is now inserted according to the reviewer suggestion (please see Table 1). On the contrary if the child failed to receive any of the eight vaccines, he/she is considered as "partially immunized/unimmunized".

In the DHS survey, vaccination status was assessed for all the living children of any age. However, as children less than that were not adult enough to receive all the recommended eight vaccines as per WHO recommended time schedule.

The 2014 BDHS collected data on childhood vaccinations for all surviving children who were born during the five-year period before the survey. As we have used the DHS data, therefore, all the children irrespective of the similar family are included in our analysis.

Comments: 3. Two exploratory variables, namely family size and mass media exposure, were not described in terms of categories and operational definitions.

Response: The above mentioned two explanatory variables (i.e., family size and mass media exposure) are now described accordingly. Please see Method section, page 6.

Comments: 4. Authors excluded 307 missing data on vaccination information but in methods they told that where health cards were unavailable, and mothers indicated that they did not know about their children's vaccination status the child was considered as "not fully immunized".

Response: Authors thanks the reviewer for raising this issue. For this current analysis we have excluded 307 data, as no vaccination related information was present for those IDs (filled as "." in the dataset). Besides, for few other cases, mothers responded "don't know" while asking, "do your children received BCG/pentavalent/OPV/measles vaccine?". Only in that cases when mother responded "don't know" about their children vaccination status, we considered their answer as negative and considered as not vaccinated. The related text has been added now under outcome subsection of method section. Please see page 5.

Comments: 5. The goodness of fit of the model should be assessed and described. I see that R2 is very low. Similarly, the selection of variables entered in the multivariable model should be better addressed.

Response: Goodness of fit statistics are now assessed and reported in the statistical analysis section (page 7). Moreover, according to the reviewer concern, selection of variables for multivariate analysis is also included in the text (page 6). Values related to the goodness-of-fit test is now presented in table 3 at page 19.

Results

Comments: 6. P<0.000 does not make sense. Please replace it with p < 0.001.

Response: Authors agrees with the reviews concern. P<0.000 is now replaced by p<0.001. Please see the result section.

Comments: 7. Collinearity was investigated but not described in results.

Response: Authors thank the reviewer for his concern. Collinearity is now described in the text. Please see the statistical analysis sub-section under method section at page 7.

Conclusion

Comments: 8. Authors referred to suboptimal immunization coverage among antigens and across various regions of Bangladesh. This sentence is not fully supported by data as the description of coverage across different vaccinations (and not antigens) is not described in detail in results.

Response: Authors thanks the reviewers concern. This sentence is now rephrased and revised as suggested. Please see page 12.

Minor concerns

Comments: 9. Authors quoted "Universal immunization program of children against six vaccine-preventable diseases (VPD) is recognized as one of the most cost-effective programs to diminish childhood mortalities and morbidities across the world". I believe that this sentence could be rephrased in order to include all vaccinations instead of only the six considered in the study.

Response: This sentence has been revised now as suggested. Please see page 3.

Comments: 10.   The English should be improved.

Response: The manuscript has been revised now as suggested. English language and the grammar has checked by the professional copyeditors as advised. Please see the revised version.

VERSION 2 – REVIEW

REVIEWER	Chiara de Waure University of Perugia, Italy
REVIEW RETURNED	02-Apr-2019

GENERAL COMMENTS	The paper has been improved according to previous comments but there are still some (mostly minor) pending issues. They are as followed: - the term "full immunization coverage" should be used always and consistently throughout the text. In results Authors often referred only to immunization - in results Authors quoted "children of higher educated mother and father were significantly 4.93 times (CI: 3.37-7.22) and 4.03 times (CI: 2.98-5.44) more likely to be vaccinated than the children of uneducated mother". I guess that the sentence is incomplete as the second figure refers to the comparison between educated and uneducated fathers - in discussion Authors quoted "Unlike other studies, we observed higher immunization coverage rate among children aged 48 to 59 months, which indicates the poor performance of current immunization programs. Therefore, strong commitment would be necessary to increase the number of full immunization coverage." The sentence seems to underpin that a change in immunization programs has occurred during time and could justify the higher full immunization coverage observed in older children. In that case, a bias would be present - In table one poliomyelitis is reported on the same line of TBC - In table three there are still p-values equal to 0.000 - No explanations of PCV and MR abbreviations are provided

Reviewer(s)' Comments to Author:

Reviewer: 2

Reviewer Name: Chiara de Waure

Institution and Country: University of Perugia, Italy

 Please state any competing interests or state 'None declared': None declared

Please leave your comments for the authors below

The paper has been improved according to previous comments but there are still some (mostly minor) pending issues. They are as followed:

Comment: -   the term "full immunization coverage" should be used always and consistently throughout the text. In results Authors often referred only to immunization

Response: Author likes to thank the reviewer for his kind review and valuable comments. The term full immunization coverage is now revised throughout the text as suggested.

Comment: -   in results Authors quoted "children of higher educated mother and father were significantly 4.93 times (CI: 3.37-7.22) and 4.03 times (CI: 2.98-5.44) more likely to be vaccinated than the children of uneducated mother". I guess that the sentence is incomplete as the second figure refers to the comparison between educated and uneducated fathers

Response: Author agrees with the reviewer concern. Text has revised now to remove the inconsistencies. Please see pages 8 and 9.

Comment: -   in discussion Authors quoted "Unlike other studies, we observed higher immunization coverage rate among children aged 48 to 59 months, which indicates the poor performance of current immunization programs. Therefore, strong commitment would be necessary to increase the number of full immunization coverage." The sentence seems to underpin that a change in immunization programs has occurred during time and could justify the higher full immunization coverage observed in older children. In that case, a bias would be present

Response: We agree with reviewer's concern. The text has revised as suggested. Please see page 10.

Comment: -   In table one poliomyelitis is reported on the same line of TBC

Response: Poliomyelitis is now omitted from the BCG row. Please see table 1 page 16.

Comment: -   In table three there are still p-values equal to 0.000

Response: P values equal to 0.000 are now replaced to <0.001 accordingly. Please see table 3 pages 18-19.

Comment: -   No explanations of PCV and MR abbreviations are provided

Responses: Authors agree with the reviewer's concern. Terminology 'Pentavalent' and 'Measles' are now updated accordingly in the figure 1 legend (page 19).