Author's response to reviews

Title: Application of ordinal logistic regression analysis in determining risk factors of child malnutrition in Bangladesh

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Author's response to reviews: see over
Cover Letter

September 17, 2011

Dear Editor-in-Chief, The Nutrition Journal Editorial Team,

We wish to thank both reviewers for their valuable comments and suggestions. We have tried to include and eliminate the necessary items according to their suggestions. We have mentioned the corrections below according to the comments of the reviewers and your suggestions.

Reviewer 1

1. From the results of POM and PPOM, the authors claim that all the variables considered in the study are significant predictors of child malnutrition. But they didn’t justify about the low value of $R^2$ in the Table 2 ($R^2 = 0.1029$) and Table 4 ($R^2 = .1046$), which mean that only 10% is explained about the malnutrition that is caused by these predictors.

The coefficient of determination $R^2$ for the linear regression model serves as a standard to summarize the overall strength of a given model (Draper and Smith (1998). On the other hand, some pseudo-$R^2$ statistics are calculated for assessing the predictive strength of the logistic regression model (Bo Hu, Jun Shao and Mari Palta; 2006). However, there is no clear interpretation of the pseudo-$R^2$’s in terms of variance of the outcome in logistic regression like $R^2$. In SPSS for Ordinal logistic regression, three types of Pseudo $R^2$ are available – Cox and Snell, Nagelkerke, and McFadden. We utilize Mcfadden Psudue $R^2$. McFadden (1973) defined pseudo $R^2$ as one minus the ratio of the log likelihood with intercepts only, and the log likelihood with all predictors. If the slope parameters are all 0, McFadden's R2 is 0, but it is never 1.

A pseudo R-squared statistic without background has little meaning. A pseudo R-square only has meaning when compared to another pseudo R-square of the same type, on the same data, predicting the same outcome. In this situation, the higher pseudo R-square indicates which model better predicts the outcome. In our article, the Pseudo $R^2$ was 0.1029 in POM, while it was 0.1046 in PPOM indicating later model as the better one.
We have just included the value in the tables but not mentioned any interpretation due to its misleading explanation. It is not possible to interpret like $R^2$. We just wanted to compare the two models POM and PPOM.

So now we include a line regarding Pseudo $R^2$s in the paragraph of “Partial Proportional Odds Model” - The pseudo $R^2$ of POM (0.1029) and PPOM (0.1046) also reflect the same result.

References:

2. The necessary descriptive statistics including the sample size of covariates with ordinal outcome in term of malnutrition status can give better picture of using ordered logit. This is missing and it will be good for the readers, if some descriptive analysis with a table is added.

We have included a descriptive table titled “Table 2: Children’s Nutrition status according to selected independent variables” showing malnutrition status of children according to all considered co-variables as well as their association. In the first phase of the Result section, we included the following passage:

“The prevalence of child malnutrition according to selected background characteristics are shown in Table 2. The proportion of severely malnourished and moderately malnourished children were found higher among the children aged 12-23 months (18% & 41%), having <24 months birth interval (13% & 35%), illiterate (17% & 38%) and acutely malnourished mothers (18% & 40%), worst child feeding status (16% & 36%), and experienced with several diseases like diarrhea, ARI, and fever (near about 50% malnourished separately). Moreover, near about three-fourth children lived in poorest households were most vulnerable to malnutrition. All the selected independent variables were significantly associated with the children’s malnutrition status (Chi-square statistics and p-values are mentioned in Table 2).”
3. The graphical method to assess the validity of parallel slope assumptions can also be provided. In this regard we included the following sentences in the second paragraph of ’Model Fitting’:

Graphical method has also been employed for checking the parallel slope assumptions for all co-variables.

Later the method is described as:

“For graphical tests of parallel slope assumptions, PROC LOGISTIC procedure of SAS 9.2 is used to obtain the estimated logits of the two separate BLR for at least moderate undernutrition (logit\{P[Y\leq1]/P[Y=2]\}) and for at least severe undernutrition (logit\{P[Y=0]/P[Y\geq1]\}). The mean (±SD) of estimated logits of every categories of an explanatory variable has been calculated and then plotted against corresponding categories of that explanatory variable.”

And we have explained the result of the graphical test in another sub-heading “Graphical Test of Proportional Odds Assumption” and constructed a figure titled “Figure 1: Graphical Test of Proportional Odds Assumption” which has been placed in the last page of the article.

**Results of Graphical Test of Proportional Odds Assumption**

“The line diagrams of all the explanatory variables are shown in Figure 1. The graphical test of proportional odds assumption indicates that the estimated average logits for all categories in the distinct variable are almost parallel in shape except the children age. The average logits of different categories for the children age did not support the parallel assumption of POM. This picture is also revealed by the individual score test.”

In Discussion a line is also included in the first paragraph: “Graphical test of proportional odds assumption reveals the same result.”

4. As the confidence interval (CI) is more informative than p-values, it is good if Table 3 includes the confidence intervals for odds ratio.

According to reviewer’s comment we have added CI beside p-values. Now the ‘Table 3’ becomes ‘Table 4’. The values are yellow coloured in the Table 4.
Reviewer 2

1. More literature of risk factors of child malnutrition would be helpful to readers in understanding previous research.

We have mentioned in Background section that most of the previous works used Binary logistic regression model for identifying risk factors of child malnutrition [Ref:7-11]. Moreover, predictor variables were selected according to previous research works [ref:7-11, 39-43]. So we think no more literature is required regarding risk factors of child malnutrition.

2. In Table 1, Stata uses a negative sign before the logit coefficients in the PO model equation (SAS uses a positive sign). In the expression of the two PPO models, Stata uses P>j vs. <= j for the probability comparison (see Williams, 2006). You may put a footnote below the table.

By using the default options in SAS for PROC LOGISTIC procedure, we get the coefficients have opposite signs to those of STATA and SPSS. But the use of DESCENDING option forces SAS to use a larger value in the dependent variable as success. Which produce results similar to STATA and SPSS in terms of value and sign.

There is an easy option in SAS to choose the indicator value in independent variable to get the exact order. But in STATA selects the first category as indicator value by default and compare the rest with it. As we have changed our variable according to the required order to select the correct indicator variable in STATA, we get the exact order in STATA as got in SAS.

According to reviewer’s comment, we have noted a footnote in ‘Table 1’ as - Stata uses P>j vs. <= j for the probability comparison in case of PPOM.

3. Descriptive statistics for the predictor variables would be helpful if provided.

We provided an extra table titled “Table 2: Children’s Nutrition status according to selected independent variables” for this purpose. Also include some sentences in the 1st paragraph of “Results” heading.
5. The sample size for each analysis is needed for Tables 2-4.
In all the 4 tables (now in Table 2-Table 5), we have included sample sizes for each analysis.

6. You need to provide the version of Stata used in the analysis.
We have mentioned the version of SPSS, STATA and SAS in last paragraph of sub-heading Model Fitting as “SPSS 17.0, STATA 11.1, and SAS 9.2 are utilized for the complex statistical analysis”.

According to your suggestion and Author’s Instruction, we have placed Ethical approval, Author’s Information and List of abbreviations in the suggested places.

**Ethical approval**
Since Demographic and Health Surveys (DHS) provide data for a wide range of monitoring and impact evaluation indicators in the areas of population, health, and nutrition, the data is widely accepted. In addition, DHS ideology is to allow access to data by researchers for the advantage of countries’ development efforts. Therefore, DHS release survey data to researchers after the publication of survey data. For accessing data, a request was sent to the DHS committee through the DHS website. After review, data access was approved on condition of legitimate research by which the population may benefit. Moreover the authority follows internationally accepted ethical standards and procedures in the required cases such as blood samples for HIV, anemia, malaria testing, and so forth. In this study such kind of sensitive tests were not required. Beside, informed consent was obtained from survey respondents at the beginning of the interview. For this reason ethical approval is not required from any institution for this study. We have included the following paragraph in “Methods” section.

The authority of DHS maintains all kinds of ethical standards and procedures for the survey and also take informed consent from the survey respondents before data collection. In addition, we have obtained approval from the DHS to use the data through the website of DHS. So no ethical approval is needed for the study from any other institutions.
Author's Information

Sumonkanti Das (SKD), Lecturer, Department of Statistics, Shahjalal University of Science & Technology (SUST), Sylhet, Bangladesh, obtained his graduation and M.S. in Statistics from the same university. His researches and publications focus on the following areas: Time Series Analysis, Stochastic Model Building, Bio-Statistics, Child Health and Nutrition, and Analytic Hierarchy Process. He carried out his M.S. Thesis on Child health and Malnutrition.

M. R. Rahman (MRR) is working as Statistical Programmer in Shafi Consultancy Bangladesh, Sylhet, Bangladesh. He completed his graduation and M.S. in Statistics from Department of Statistics, Shahjalal University of Science & Technology (SUST), Sylhet, Bangladesh. His interested areas of research are Bio-statistics, Time Series Modeling, and Child Health and Nutrition.

List of Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>ARI</td>
<td>Acute Respiratory Infection</td>
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<td>BDHS</td>
<td>Bangladesh Demographic and Health Survey</td>
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<td>BLR</td>
<td>Binary Logistic Regression</td>
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<td>BMI</td>
<td>Body Mass Index</td>
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<td>CI</td>
<td>Confidence Interval</td>
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<tr>
<td>CRM</td>
<td>Continuous Ratio Model</td>
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<tr>
<td>NIPORT</td>
<td>National Institute of Population Research and Training</td>
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<tr>
<td>OLR</td>
<td>Ordinal Logistic Regression</td>
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<tr>
<td>OR</td>
<td>Odds Ratio</td>
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<tr>
<td>POM</td>
<td>Proportional Odds Model</td>
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<tr>
<td>PPOM</td>
<td>Partial Proportional Odds Model</td>
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<tr>
<td>PPOM-R</td>
<td>Partial Proportional Odds Model - With Restrictions</td>
</tr>
<tr>
<td>PPOM-UR</td>
<td>Partial Proportional Odds Model - Without Restrictions</td>
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<tr>
<td>SM</td>
<td>Stereotype Model</td>
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<tr>
<td>WAZ</td>
<td>Weight-for-Age Z-score</td>
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<td>WHO</td>
<td>World Health Organization</td>
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Both Author's Information and List of Abbreviations are yellow coloured in the revised manuscript.
Further we have changed and added some points as below:

In Abstract we added a line regarding graphical test as “Graphical test has also been adopted for checking the proportional odds assumption.”

In Acknowledgement we added a line as “Special thanks to the reviewers for their valuable comments and suggestions that enrich the paper”.

In Method section a line has been moderated as below:

Child feeding status and mothers’ antenatal-postnatal care status are evaluated by constructing child feeding index and antenatal-postnatal care index respectively.

The Authors’ Contributions have also been updated as below:

SKD determined the study design, performed the statistical analysis, interpreted the data and drafted the typescript. MRR performed the statistical data analysis and critically reviewed the typescript. Both authors reviewed and approved the final version submitted for publication.

In Manuscript all the changes and additions are highlighted in yellow colour.

The name of second author has been slightly changed as M. R. Rahman instead of M. M. Rahman.

Please see the correction and provide further suggestions if needed and take necessary steps for possible publication.

With best regards,

Sincerely,

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