Author's response to reviews

Title: Household and community socioeconomic and environmental determinants of child nutritional status in Cameroon

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Author's response to reviews: see over
Responses to the Editor and the reviewers

General

We revised our paper based on the comments made by the reviewers on the previous version. The revised paper aims to:

(i) study the socioeconomic and environmental determinants of child nutritional status in Cameroon at the household and community levels; child nutritional status is measured by weight-for-age z-scores (WAZ) and height-for-age z-scores (HAZ);

(ii) assess changes in the effects of these determinants in the 1990s which was a period of economic reversal in the country, especially using consistent and comparable indicators;

(iii) examine how the effects of household economic status vary by child age.

We use the 1991 and 1998 Cameroon DHS data pooled together to conduct these analyses. We also document trends in nutritional status and related factors, but refrain from analyzing factors that are associated with changes in child nutrition as suggested by Reviewer 1, which is beyond the scope of a single paper. We have conducted such an analysis, presented in a working paper (see http://www.hsph.harvard.edu/hcpds/wpweb/Pongou_wp1502.pdf).

The current version of our paper also places our study in a global perspective as advised by Reviewer 2. Religion as an independent variable has been dropped in the revised version to reduce the number of variables, and the multivariate analysis is now more detailed. We summarize all the graphs in a table (table 3a) because of the space constraint of the paper.

Detailed Responses to Reviewer 1:

- Our paper responds to the three goals above
- We address issues related to interactions between economic status and child age in the Statistical Methods section of our paper
- While some of our results are similar to those found by Fotso & Kuate-Defo (2005), there are important new methodological and empirical advances in our work;
- Fotso & Kuate-Defo analyzed the prevalence of malnutrition (as measured by the proportion of children with weight or height 2 standard deviations below the median weight-for-age or height-for-age of the NCHS/CDC/WHO international reference population; we consider the whole distribution of these variables by considering weight-for-age and height-for-age z-scores, consistent with the Epidemiological literature that health hazards occur along a continuum of undernutrition.
- We use novel methods to construct cross-year comparable measures of economic status and access to health care (here called maternal health seeking behavior (MHSB)) for analyses of 1991 and 1998.
• We control for region of residence, which in Cameroon is clearly a confounder of the SES-malnutrition relationship because SES and overall access to health care markedly vary by region, and there are also marked regional disparities in health.

1. Major Compulsory Revisions

1.1 Details on multi-level modeling: In the revised paper, we specified a two-level random intercept model, the first level being children/household and the second level being clusters; households and children were considered at the same level because there were just a few children (less than 2) per household. For the general form of the equation, refer to the statistical method section of the paper. We fitted this model using STATA 9 using the “xtmixed” command. The bivariate associations (as shown by graphics) did not use multilevel modeling because we wanted to show variations in child nutritional status across the categories of our independent variables not accounted for clustering of observations. This information is now provided in the Statistical Methods section.

1.2 Sample size: The sample size (children and clusters) in multivariate analysis is given in the revised paper (see tables 3b-c).

1.3 Undernutrition indicator variable: Weight-for-age has been used in most epidemiological studies (see the systematic review of Fishman et al 2004 and the World Health Report 2002) as well as in studies investigating the socioeconomic determinants of child nutritional status (see waters et al. (2004) for instance). Consistent with the reviewer’s comments, the revised paper also includes height-for-age.

1.4 Economic status and MHSB used as quintiles in multivariate analyses: The revised paper uses economic status (ES) and MHSB quintiles in the first instance, but shows in italic (see tables 3b-c) the effects of these factors used as continuous variables, all other variables remaining unchanged. We also used continuous ES index in interaction terms (to examine how the nutritional effects of this variable vary by child age) because using ES quintiles would have resulted in numerous interaction terms (4*5=20 dichotomous variables) and difficult interpretation.

1.5 Cross-year changes in Economic status as reflected by economic status quintiles of the pooled data: This issue is now addressed in the revised version (see table 2a).

1.6 Interaction terms: Issues regarding interaction terms in general have been now clearly addressed in the Statistical Methods section of the revised paper.

1.7 Interactions between economic status and other variables: Our aim was to explore how the effect of economic status may vary across child ages. Exploring variation in this effect by maternal education, although interesting, would have taken us out of the scope of the paper.

1.8 Interaction terms: See point 1.6.
1.9 Breastfeeding duration: In the revised paper, we addressed the issues raised by the reviewer by categorizing breastfeeding duration as “never breastfed”, “still breastfeeding”, “breastfed 0-4 months”, “breastfed 5-6 months (reference category)”, “breastfed 7-18 months”, and “breastfed 19 months or more”. Our purpose was to compare children whose breastfeeding duration was lower or greater than 5-6 months (optimal duration of exclusive breastfeeding) to those who had breastfed 5-6 months (reference category). Since some children were still breastfeeding by the survey, a dummy indicator for this category was necessarily included in our analysis.

1.10 Differential changes in nutritional status: As indicated in the introduction, we have pooled our data and we address the issue of differential changes in nutritional status (see table 3d).

1.11 Interpretation of differential changes in nutritional status: Our comments are now more cautious about the statistical significance of differential changes in nutritional status across different categories of the same variables.

1.12 Age-specific effect of economic status and role of breastfeeding: We have addressed points 1.6, 1.8 and 1.9 based on the reviewer’s comments. Our current interpretation of the results is also more cautious about the possible role of breastfeeding.

2- Minor essential revisions

2.1 Comparability of mortality figures: We now use the DHS 1998 figure of under-five mortality in Cameroon.

2.2 References to region as a confounder of SES-malnutrition relationship: We give two references to justify why region of residence is a likely confounder of the SES-malnutrition relationship in Cameroon. The relatively large variability of climate and infrastructure also justifies inclusion of this variable to test the hypothesis of its significance.

2.3 Changes in national economy: Changes in national economy are given in the discussion.

2.4 Sample sizes: Sample sizes for multivariate analyses are given in tables 3b-c.

2.5 Statistical significance of independent variables: The statistical significance of the effects of independent variables on WAZ and HAZ is given in the revised paper (see tables 3b-c).

2.6 Disaggregation of analyses at the province level: The DHS sampled the East, South and Center provinces as a whole, and provinces sub-samples were not representative; so disaggregating analyses at the province level was not possible.
2.7 **Construction of community environmental index:** In the revised version, based on the reviewer’s comments, we omitted source of non-drinking water in the construction of community environmental index; this variable is also now based on the proportion of children in households with access to hygiene facilities, facilitating the interpretation of results.

2.8 See the text.

2.9 **Ferguson et al:** We have corrected the reference by Ferguson et al., and checked all other references.

**Detailed responses to Reviewer 2**

**Major Compulsory Revisions**

1 **Malnutrition in Cameroon and relation to the global trends:** The revised paper places our study in the broader context of current global patterns of malnutrition.

2 **Theoretical basis for all variables:** The theoretical basis for all variables chosen is stated in the revised version.

2A **Individual and household variables considered at the same level:** Individual and household variables were considered at the same level (level 1) in the analysis. Because there were less than 2 children per household on average, it would be incorrect to consider clustering of observations within households.

2B **Analysis level and description of economic status and MHSB:** Household economic status (ES) and maternal health seeking behavior (MSHB) are level 1 variables for the reason given previously (see 2A). The first paragraph of page 6 (of the previous version) does not introduce new variables, but simply describes the variables ES and MHSB noted on page 5 (now pages 7 and 8 in the revised paper).

2C **Text organization and predictors of ES and MHSB:** We described the construction of ES and MHSB (page 6 of the previous version, and pages 7 and 8 in the revised paper) right after giving a brief summary of the variables used in our analysis (page 5 of the previous version), where most readers would expect this explanation. We welcome further suggestions for re-ordering in consultation with the editor.

It is true that socio-demographic characteristics related to mothers are used to predict ES and MHSB indices; all the variables used to predict ES index are mentioned in the text and include age and sex of the head of the household, mother’s education and occupation, and urban or rural place of residence; also mother’s education and occupation, and urban or rural place of residence are used to predict MHSB beyond the indicators variables. All these variables are believed to predict these indicators (see for instance Ferguson et al for ES).
3 Community environmental index: Consistent with the literature on community determinants of child health, the community environmental index used in our study reflects the hygiene of the environment (or immediate neighborhood) in which a child lives. It is constructed by aggregating household-level data (see full description in the variables definitions section).

4. Details on multi-level modeling: We ran a two-level random intercept model. In the revised paper, each variable was interacted with two dichotomous variables indicating the year 1991 and the year 1998, respectively, and the interaction terms were included in the model together with a dichotomous variable indicating the year 1998. This allowed to estimate the effects of the independent variables on WAZ and HAZ in each year.

4A Statistical significance: The statistical significance of each independent variable is indicated in the revised paper, and derives from the p-values as given by STATA 9.

4B Interpretation of the results: The interpretation of the results when they differ between the two years is addressed in the revised paper.

4C P-values: The p-values are not included because of space limitation; however, we indicate the statistical significance of each variable based on the p-values as given by STATA 9.

Minor Essential Revisions

1 Table 1: Table 1 has been corrected according to Reviewer 2’s suggestions.

2 Statistical significance: Statistical significance is given in the revised version of multivariate results (see tables 3b-c).

3 Reference category: “Reference” has been added to indicate the reference category.

Discretionary Revisions

1 Nutritional status indicators: Weight-for-age and height-for-age z-scores were used in the revised paper. Also, a table (table 2b) is presented describing changes in child nutritional status using continuous as well as categorical indicators.

2 Description of trends: The sentence describing general trends has been corrected in the revised version according to the reviewer’s suggestions.

3 Policy implications: We discuss some of the implications of results for programs in discussion and conclusion. We refrained from excessive discussion of policy implications due the length constraint of the paper.