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DYAD-G2 Statistical Analysis Plan: Mother and Father Perceptions of the iLiNS DYAD-G Interventions and its Effects

Background and Objectives

Small-quantity lipid-based nutrient supplements (SQ-LNS) were designed to prevent undernutrition during the critical "first 1,000 days". In the iLiNS DYAD-G randomized controlled trial in Ghana, the provision of SQ-LNS to mothers during pregnancy increased mean birth size, particularly among first-time mothers (Adu-Afarwuah et al., 2015) and maternal plus child supplementation with SQ-LNS increased mean attained size at 18 months of age (Adu-Afarwuah et al., 2016). In a follow-up study, we collected data from mothers and fathers of children who participated in the DYAD-G trial about their perceptions of supplementation, the DYAD-G intervention, and the effects of the intervention.

The primary objectives of this analysis are as follows:

1. Describe mothers' and fathers' perceptions of maternal supplementation during pregnancy and lactation.
2. Describe mothers' and fathers' perceptions of child supplementation from age 6 months to 2 years.
3. Describe mothers' perceptions of their children's reactions to consuming SQ-LNS.
4. Evaluate the effects of maternal and child supplementation with SQ-LNS on mothers' perceptions of the effects of the intervention.
5. Explore the effects of maternal and child supplementation with SQ-LNS on fathers' perceptions of the effects of the intervention.

Description of the Intervention

The iLiNS DYAD-G randomized controlled trial and the effects of the provisions of SQ-LNS on birth outcomes, growth, and development have been described elsewhere in detail (Adu-Afarwuah et al., 2015; Adu-Afarwuah et al., 2016; Prado et al., 2016). In short, maternal and child supplementation with LNS increased birth size (weight, weight-for-age z-score (WAZ), and BMI-for-age z-score (BMIZ)) (Adu-Afarwuah et al., 2015) and maternal plus child supplementation increased mean attained size (length, length-for-age z-score (LAZ), weight, and WAZ) at 18 months of age (Adu-Afarwuah et al., 2016), though child development at 18 months was not affected (Prado et al., 2016).

The main DYAD-G trial was conducted between December, 2009 and March, 2014. The 'DYAD-G2' follow-up study collected data from the mother, her child (the index child), and other members of the index child's family between January, 2016 and December, 2016 when the index children were between 4 and 6 years of age. As a component of the follow-up data collection activities, we collected data on mothers' and fathers' perceptions of the intervention and its effects on the mother, the index child, and other household members.

We aimed to survey all mothers from the main trial and had originally planned to survey a random subsample of 40% of fathers. Because of difficulty scheduling interviews with fathers, we expanded the sample and attempted to interview all fathers. Primarily because the fathers were difficult to reach at home during the day, had moved out of the study area and could not be located, or had separated from the study mother since the main trial, the number of fathers who were successfully interviewed was

well below the target sample size, and the fathers who were interviewed likely represent a selected sample of all fathers. For these reasons, all analyses of fathers' perceptions will be considered exploratory.

Description of Variables

Outcome Variables

As further explained in the **Analysis Principles** section below, each numbered variable below will be analyzed as a primary outcome to determine whether maternal and child supplementation with SQ-LNS had an effect on mother/father perceptions of supplement use and perceived effects of the intervention on the mother, the index child, and other household members. Some primary outcomes will be treated as 'gatekeeper' outcomes for further exploratory analysis of sub-outcomes. These gatekeepers are indicated in the list below by the presence of a lettered sub-outcome. The nature of each outcome variable is noted in parentheses.

1. It is ok for children who are between 6 months and 2 years to be given supplements (dichotomous)
2. The supplement had a negative impact(s) on the mother during pregnancy (dichotomous)
    a. Specific negative impacts of the supplement on the mother during pregnancy (set of dichotomous variables)
3. The supplement had a negative impact(s) on the mother during lactation (dichotomous)
    a. Specific negative impacts of the supplement on the mother during lactation (set of dichotomous variables)
4. The supplement had a positive impact(s) on the mother during pregnancy (dichotomous)
    a. Specific positive impacts of the supplement on the mother during pregnancy (set of dichotomous variables)
5. The supplement had a positive impact(s) on the mother during lactation (dichotomous)
    a. Specific positive impacts of the supplement on the mother during lactation (set of dichotomous variables)
6. The supplement had a negative impact(s) on the index child (dichotomous)
    a. Specific negative impacts of the supplement on the index child (set of dichotomous variables)
7. The supplement had a positive impact(s) on the index child (dichotomous)
    a. Specific positive impacts of the supplement on the index child (set of dichotomous variables)
8. The supplement had an impact(s) on the other household members (dichotomous)
    a. Specific impacts on other household members (set of dichotomous variables)
9. The index child's health is different compared to other children (dichotomous)
    a. Specific differences in the index child's health compared to other children (set of dichotomous variables)
10. Supplement's role in index child's future performance in school (ordinal)
11. Supplement's role in index child's future cognitive development (ordinal)
12. Supplement's role in index child's future ability to do physical work (ordinal)
13. Supplement's role in index child's ability to earn money as an adult (ordinal)

Descriptive Variables

The following variables will be presented as descriptive results and not analyzed for differences by intervention group:

1. Reasons mothers might use supplements during pregnancy
2. Reasons mothers might use supplements during lactation
3. Reasons mothers might not use supplements during pregnancy
4. Reasons mothers might not use supplements during lactation
5. Reasons mothers/parents might give supplements to their children aged between 6 months and 2 years
6. Reasons mothers/parents might not give supplements to their children aged between 6 months and 2 years
7. Supplement mother received from the iLiNS project

The following variables were collected only from the LNS group. These variables will be presented as descriptive results:

1. Negative impacts of supplementation attributable to maternal LNS, child LNS, or both (LNS group only)
2. Positive impacts of supplementation attributable to maternal LNS, child LNS, or both (LNS group only)

The following variables were collected only from mothers in the LNS group. These variables will be presented as descriptive results:

1. Recollection about whether child received LNS from iLiNS Project
2. Were there times mother did not give LNS to index child
3. Reasons mother did not give LNS to index child
4. Child reaction at end of participation in iLiNS study
5. Frequency child asked for LNS in the first few weeks after end of participation
6. Did mother give anything to child as replacement for LNS after child stopped receiving LNS
7. What did mother give as replacement for LNS
8. Compared to other children, difference in the foods index child liked to eat when s/he was receiving LNS (yes/no)
9. Compared to other children, what difference in the foods index child liked to eat when s/he was receiving LNS
10. Compared to other children, difference in the foods index child liked to eat after s/he stopped receiving LNS (yes/no)
11. Compared to other children, what difference in the foods index child liked to eat after s/he stopped receiving LNS

Covariates

The following variables will be considered as baseline covariates for the mothers' perceptions analyses:

- Index child gender
- Index child birth order
- Maternal height
- Maternal age
- Maternal education
- Female-headed household
- Household electrification

The following variables will be considered as effect modifiers for the mothers' perceptions analyses:

- Index child gender
- Index child birth order
- Maternal height
- Maternal age
- Maternal education
- Female-headed household
- Household electrification

The following variables will be considered as baseline covariates for the fathers' perceptions analyses:

- Index child gender
- Index child birth order
- Father's education
- Mother's education
- Female-headed household
- Household electrification

The following variables will be considered as effect modifiers for the fathers' perceptions analyses:

- Index child gender
- Index child birth order
- Father's education
- Mother's education
- Female-headed household
- Household electrification

Primary <u>Null</u> Hypotheses

For each primary outcome variable, we will test the following null hypothesis:

There is no difference in mothers'/fathers' perceptions of the specific effect of the intervention between households in which the mother-child dyad received LNS compared to households in which the mother-

child dyad did not receive LNS. That is, the IFA and MMN groups will be combined and compared to the LNS group.

Analysis Principles

Data Cleaning

To the extent possible, data cleaning happened concurrently with follow-up data collection. Queries were identified using SAS or Stata syntax and were relayed to the local home visit team manager. Queries were then resolved by seeking clarification from the field worker who completed the form and/or by re-contacting the respondent.

Data Coding

Many of the perceptions questions were open ended and allowed for multiple responses. Some responses were pre-coded, while others were specified as 'other' and typed in by the enumerator. Two researchers will independently organize all 'other' responses into new categories (or assign them to one of the pre-coded categories, if appropriate). The researchers will then compare their assignments. Where the assignments do not agree, they will come to a consensus on the appropriate assignment, using input from other researchers and/or the home visit manager where necessary.

Software

All analyses will be performed using Stata 14 statistical package.

Basis for the Analysis

The analysis will be by intent-to-treat. That is, by-group analysis will be according to group assignment regardless of any protocol violations. Missing data will not be imputed. For gatekeeper questions, responses of "does not know" or "does not remember" will be coded as missing. All tests will be two-sided at the 5% level of significance.

Attrition and Balance

Baseline covariates, birth weight, and child length-for-age z-scores at 18 months will be summarized by sample (maternal follow-up analytic sample and maternal lost-to-follow-up sample) using mean ± SD or median (Q1, Q3) for continuous and count variables and percentages for dichotomous variables. P-values for tests of differences in sample means between the maternal follow-up and maternal lost-to-follow-up groups will be reported.

Baseline covariates plus index child age on the date of the perceptions interview will also be summarized by group (LNS and combined IFA and MMN groups) for the maternal follow-up analytic sample only. To assess balance, p-values for tests of difference in group means will be reported.

Descriptive Analysis

Some mother and father perceptions, as noted above, will be presented descriptively and not analyzed for differences by intervention group. We will use graphs and/or tables to demonstrate frequency of responses for each descriptive variable.

Analysis of the Effect of the Intervention

The effect of the intervention on mothers' perception outcomes will be analyzed separately from fathers' perception outcomes. The effect of intervention group on each primary mother/father perception outcome will be assessed as follows according to the nature of the outcome variable:

- Dichotomous outcome variables will be analyzed using logit or probit regression models.
- Continuous outcome variables will be analyzed using ordinary least squares regression models.
- Ordinal outcome variables will be analyzed using ordered logit or ordered probit regression models.

All regression models will control for index child age at the time of the perceptions interview. For adjusted analyses, we will additionally control for baseline covariates that are significantly associated with a particular outcome at the 10% level of significance in a bivariate analysis.[1]

Effect modification will be assessed using interaction terms, and statistically significant interactions ($p<.10$) will be further examined using Stata's 'margins' command. For dichotomous effect modifiers, the treatment effect by effect modifier will be estimated. For continuous effect modifiers, the treatment effect at values along the range of the effect modifier will be estimated.

For gatekeeper outcomes (noted above), if the null hypothesis of no difference between groups is rejected, we will also conduct exploratory analyses to understand by-group differences in specific perceived impacts of the intervention. Specific perceived impacts will be analyzed if at least 10% of respondents mentioned the specific impact.

The effect of intervention group on each specific perceived impact will be assessed using logit or probit regression models. All models will control for index child age at the time of the perceptions interview. For adjusted analyses, we will additionally control for baseline covariates that are significantly associated with a particular outcome at the 10% level of significance in a bivariate analysis.

[1] Father's education, a potential baseline covariate in the fathers' perceptions analyses, is missing for approximately 17% of the fathers' perceptions sample. If father's education is significantly associated with a particular outcome, the adjusted analysis will be run with and without father's education.