The Effect of Maternal Education on Child Nutritional Status in the Democratic Republic of Congo

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Abstract

Investing in women's education is widely advocated as a key intervention strategy for promoting child health. Using data from the 2001 DRC-Multiple Indicators Cluster Survey, this study assesses the effect of maternal education on child nutritional status in the Democratic Republic of Congo. The sample constitutes 9,820 children aged 0-59 months. Analyses are based on Chi-square tests and Logit Generalized Estimating Equations.

The results of this study showed that the effect of maternal education on the nutritional status of children depend on the nutritional indicator used (stunting, wasting, or combined malnutrition), the region of residence, and the socioeconomic strata. Therefore any study on the determinants of children nutritional status should be based on a clearly defined nutritional indicator. In addition only national policies integrating education, access to food and use of health service are pivotal to improve child health and nutrition.

Key words: nutritional status, anthropometric failure, under-five children, maternal education, Democratic Republic of Congo, socioeconomic factors, conflict affected area.

Introduction

The nutritional status of children influences their health status, which is a key determinant of human development. Malnutrition is associated with about 60% of under-five mortality in sub-Saharan Africa (Unicef, 1998). Therefore, improvement of children nutritional status increases the chances of child survival and is considered as a precondition for their contribution to community as well as human development (Unicef, 1998). Investing in women's education is widely advocated as a key intervention strategy for promoting child health.

In the Democratic Republic of the Congo (DRC), the proportion of women with secondary or higher education increased from 16% in 1984 to 30% in 2001 and that of women without formal education decreased from 50% to 20% during the same period. However, the increases have not translated into significant gains in child health. Health indicators among children under-five have either gotten worse or remained unchanged. For example, the prevalence of children with wasting increased from 10 per cent in 1995 to 16 per cent in 2001, while prevalence of children with stunting decreased from 34 per cent in 1995 to 31 per cent in 2001. Likewise, Infant Mortality Rate (IMR) rose from 137 per thousand live births in 1984 to 148 in 1995 (Congo, 2002; Zaire, 1996).

These paradoxical indicators could be due to the particular context of the DRC. After 32 years of dictatorship from 1965 to 1987, the country continued to experience armed conflicts and political instability since 1990. This situation deleteriously affected the

country's economic system and destabilized the population living conditions leading to increased poverty.

The purpose of this study was to assess the association between maternal education and children nutritional status in the DRC and identify the mediating as well as moderating factors. A good uunderstanding of ways in which maternal education affect child nutritional status in a post conflict country like the DRC will inform the country's efforts in achieving the health-related Millennium Development Goals (MDGs).

1. Past Research

Interest in understanding the pathways through which maternal education influences child survival in developing countries is increasing since the paper by Caldwell (1979). However, findings from existing studies have shown mixed results about the effect of maternal education on child nutritional status. The effects of maternal education on children's nutritional status remain controversial in the literature. Depending on the unit of analysis, the socio-economic and the cultural context, some studies have shown that mother's education matters while other studies did not (Caldwell, 1979; Baraigi, 1980; Solon et al., 1985) Desai and Alva, 1998; Gwatkin et al., 2000a; Gwatkin et al., 2000b)

Mostly using data from the World Fertility Surveys (WFS) or the Demographic and Health Surveys (DHS), the bulk of studies have shown that children of educated mothers experience lower mortality as well as lower malnutrition prevalence than children of uneducated mothers (Caldwell, 1979; Gwatkin et al., 2000a; Gwatkin et al., 2000b).

Desai and Alva (1998) found significant effect of maternal education on height-for-age in only 5 out of 22 countries they studied. Other studies have demonstrated selective effect of maternal education on child malnutrition. Baraigi (1980) and Solon et al. (1985) found that maternal education is associated with lower prevalence of malnutrition among under-five children in richest household whereas the relationship between maternal education and child malnutrition was not significant among the poorest. In contrast, Doan (1988) as well as Reed et al. (1996) observed significant positive effect of maternal education on child nutritional status among children living in the intermediate wealth index households. On the other hand, Reed et al. (1996) reported unexpected negative association between maternal education and child nutritional status. The fact that most educated women work outside the home without simultaneously ensuring adequate child care could explain this finding. More recently, Pongou et al. (2006) found non-significant effect of maternal education on child nutritional status in Cameroon.

Three factors could explain the inconsistency in the association between maternal education and child nutritional status observed across the literature. First, the beneficial effects of education are only significant when resources are sufficient (Reeds et al., 1996). Second, although indicators of child malnutrition used (stunted, wasting and/or underweight) reflect distinct biological processes and are associated with different factors, they are not mutually exclusive, rather they overlap. Some children who are stunted may also be wasting and/or underweight. Likewise, some children who are underweight and/or wasting may also be stunted. Depending on the level of overlapping between anthropometric failure and the predominant malnutrition aspect, the effect of

maternal education could be significant or not. Third, maternal education is measured differently: number of years at school, the last class completed, or the high level attended.

Against this background, this study assesses the effect of maternal education on unadjusted[1] as well as adjusted child nutritional status indicator in DRC.

2. Analytical Framework

Numbers of studies have modeled the effects of maternal education on child health outcomes through four non-excluded models: socioeconomic status, women empowerment and autonomy, health knowledge and attitudes, and health and reproductive behavior.

Socioeconomic status

According to this model, maternal education is a proxy for socioeconomic status at the individual and household levels (Cleland and Van Ginneken, 1988; Frost et al., 2005). The most educated women come from high socioeconomic strata of the society. They tend to have better work opportunities and high incomes compared to non-educated women. Educated women are also more likely to marry husbands with high education level, and belonging to high socio-economic class of the society (Cleland and Van Ginneken, 1988; Barrett and Browne, 1996). In addition, they tend to live in more

[1] Unadjusted indicator or crude indicator does not take into account whether the child suffer from another type of malnutrition whereas the adjusted indicator does.

economically developed areas such as urban areas with access to safe water, sanitation systems, and health facilities. In parallel, children from high socio-economic households with mothers working in formal sectors are well fed, less exposed to infectious diseases, and have access to health services (preventive and curative cares). Therefore, there is an inverse relationship between the mother's education and child under-nutrition (Frost et al., 2005; Mukuria et. al, 2005).

Women empowerment and autonomy

This model assumes that women's education contributes to their empowerment and participation in decision-making including that regarding child nutrition as well as use of health services (Kravdal, 2004). Women empowerment and autonomy include: (1) opportunity for women to take part and be heard in discussions with parents, husbands, or in laws regarding use of preventive health services, child's nutrition, and treatment of sick children; and (2) access to economic market and women's rights regarding their sexual as well as reproductive behaviour. These different dimensions of women's autonomy impact on child nutritional status through their participation in decision-making regarding reproduction behaviour (birth interval, number of children), child feeding patterns, and use of health services.

Health knowledge and attitudes

Women's education improves maternal health knowledge including that about child nutrition and hygiene. Education facilitates mother's learning about causation, prevention, recognition, and treatment of disease (Frost et al., 2005). In addition to basic

health knowledge, education also is a factor of acculturation by breaking away from tradition and increasing acceptance of ideas and practices associated with modern medicine (Cleland and Van Ginneken, 1988; Kuate-Defo, 1997). Thus, children of educated women live in more hygienic environment, have higher prevalence of vaccination than their counterparts, receive appropriate care in case of disease, and therefore have better nutritional status than others.

Health and reproductive behaviour

Reproductive and health behaviour provide another pathway through which women's education impact child health outcomes including child nutritional status. Forste (1998) found negative association between maternal age and child stunting in Bolivia. Likewise short (preceding as well as subsequent) birth intervals are associated with a high risk of child stunting (Forste, 1998). In parallel, previous studies have shown that educated women have better nutritional status, give birth at low risk ages, have longer birth intervals and have lower fertility (Cleland and van Ginnekken, 1988; Black, 1999; Ramakrishnan et al., 1999; Mukuria, 2005).

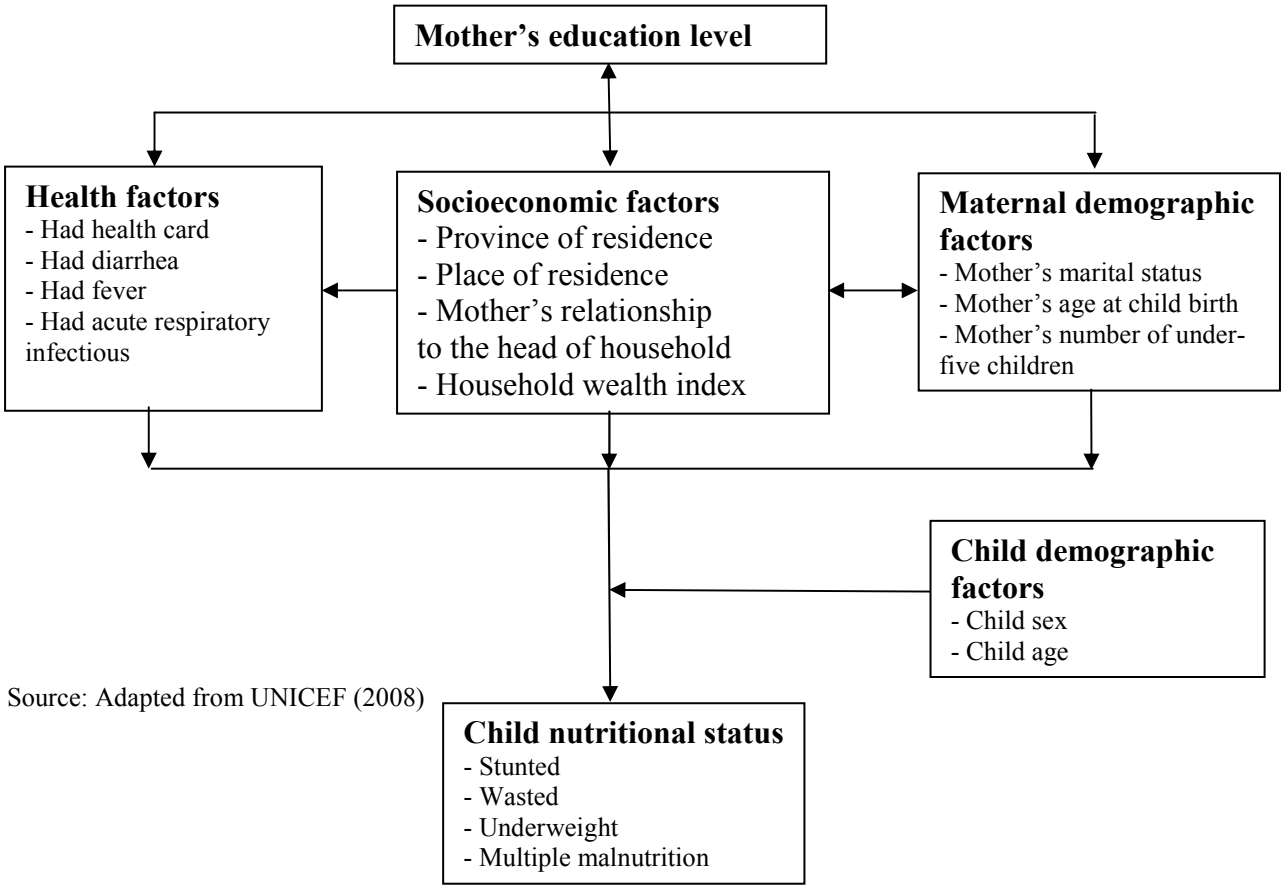
To sum up, the review of the above models and literature shows that there are interaction effects between different models: socio-economic characteristics of educated women – their autonomy and empowerment – their knowledge and attitude toward health problem and their reproductive behaviour (Figure 1). A woman's education is associated with her socio-economic background. Socio-economic strata and her education impact on her knowledge and attitudes vis-à-vis reproductive and health issues. In turn women

knowledge and reproductive health attitudes guide her reproductive and health behaviour. Child nutritional status is determined by the interaction between the four models.

In light of these models, this study analysis focuses on three kinds of variables summarized in Figure 1:

- Exposure variable (maternal education level)
- Dependent variable (nutritional status of children)
- Control variables including demographic, health related and socio-economic characteristics.

Figure 1 – Maternal education and child nutritional status, analytical framework



Source: Adapted from UNICEF (2008)

These variables were chosen on the basis of their associations with the likelihood of women's education and child nutrition status as observed in previous studies in sub-Saharan Africa (Desai and Alva, 1998; Smith and Haddad, 2000; Pongou et al., 2006a; Pongou et al., 2006b).

3. Data and Methods

3.1 Data

Data on 9,820 children[2] aged 0-59 months who participated in the 2001 DRC Multiple Indicators Cluster Survey (MICS2), a nationally representative investigation of children and women, were used for this study. MICS2 covered all the 11 provinces in the country, the 28 Districts and all the principal cities (province and territorial capital city). In addition, out of 143 municipalities ("territories"), 128 were included in the sample. The questionnaire was in French although interview was done in local language. Fieldworkers were trained on the administration of the questionnaire in the local language.

Details on sampling, questionnaires, fieldwork operations and evaluation of data quality are reported elsewhere (Congo, 2002; http://www.childinfo.org/mics2_drc.html).

Evaluation of the completeness and/or heaping or digit preference of dependent, independent and control variables assumes that the data used are of good quality. The proportions of missing values for all the key variables are under 2%. However, there is some tendency to heaping on a number ending in 0 or ending in 5 with reference to child

[2] Sometime, the total is less than 9,820 due to missing values.

age, child weight and child height although this heaping is not observed at the level of anthropometric indicators (height-for-age, weight-for-age and weight-for-age).

Table 1 displays the distribution of children by mother's education according to the main covariates used in the study.

[Table 1, about here]

Background characteristics by mother's education, according to the selected control variables, show a higher proportion of children from the most educated women (secondary or higher education) in urban areas, in Kinshasa-capital city, among single mothers, and among children living in the richest households. By contrast, the proportion of children from the most educated mothers is lower in all provinces under war in 2001 (Equateur, Orientale, Nord-Kivu, Sud-Kivu and Maniema). It might be possible that majority of the most educated women with higher socioeconomic status had left these provinces because of war and economic hardship.

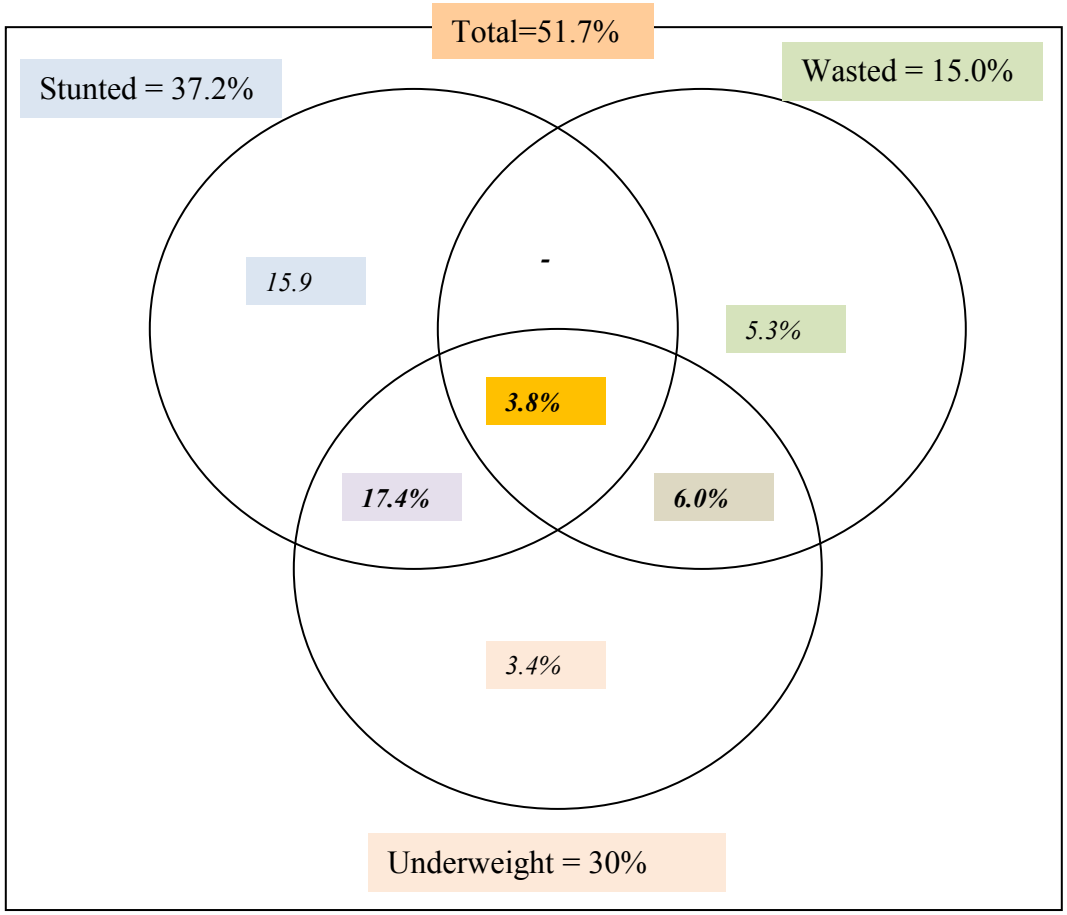
3.2. Measurement

Outcome: child malnutrition

Child malnutrition is conventionally determined through anthropometric measures. According to World Health Organization (WHO), compared to the international reference, (1) children with two standard deviations or more below the median weight-for-age are underweight; (2) those with two standard deviations or more below the

median height-for-age are stunted; and (3) children with two standard deviations or more below the median weight-for-height are wasted. However, these indicators overlap. From these anthropometric measures, we create adjusted anthropometric indicators of child nutritional status with reference to the "*Composite Index of Anthropometric Failure" (CIAF)* (Svedberg, 2000; Nandy et al., 2005). This variable includes the following seven categories: (i) no failure; (ii) wasting only; (iii) wasting and underweight; (iv) wasting, stunting and underweight; (v) stunting; (vi) stunting and underweight; (vii) stunting only; and (viii) underweight only. Figure 2 presents these different categories of malnutrition in DRC.

Figure 2 – Child malnutrition in Democratic Republic of Congo by indicator



To avoid small number in our analysis, our variable about nutritional status encompasses the following five categories: (i) adjusted stunting (AS) or stunting only; (ii) adjusted wasting (AW) or wasting only; (iii) adjusted underweight (AU) or underweight only; (iv) simultaneous multiple anthropometric failures (SMAF) including children with at least 2 malnutrition problems; and (v) unadjusted stunting or wasting and/or underweight (USWU). This last category provides a single, aggregated figure of the number of undernourished children in a population regardless of malnutrition type. We also use the traditional indicators called in this paper unadjusted stunting (US), unadjusted wasting (UW) and unadjusted underweight (UU). This allows us to compare the effect of maternal education on child nutritional status according to the category of indicator.

For analytical purposes, we transform each malnutrition measurement into dummy variable: (1) malnourished children; and (2) children without the index malnutrition indicator. The variable is coded "yes" or "no" for malnourishment.

Considering the non-adjusted prevalence, 37 percent of children are stunted, 15 percent are wasted and 30 percent are underweight. Comparison with other African countries in the same period (2000/2002) shows that prevalence of stunted as well as prevalence of underweight children in DRC is around the sub-Saharan African average, but the prevalence of wasted children is higher that of the continent for the same period (http://www.statcompiler.com/tablebuilder).

However, these indicators calculated from height-for-age, weight-for-age, and weight-for-height are unadjusted, and are not mutually exclusive. Adjustment of the three classical indicators shows that overall 52 per cent of children under five years in the DRC are malnourished (stunted or wasted and/or underweight). Among children who are suffering from anthropometric failure, 48 per cent are suffering from one anthropometric problem, while 52 per cent are suffering from multiple anthropometric failures. Children suffering from chronic malnutrition (stunting) represented the majority of all children with anthropometric failure (Figure 2). In the subsequent sections, we will analyze association between maternal education and child malnutrition status comparing adjusted and unadjusted indicators.

Predictor: maternal education

Maternal education is defined as the highest level of schooling attended, but not necessary completed. This variable has three categories: no education, primary, secondary education or more.

Covariates

Three categories of control variables will be used according to our analytical framework and available information in the dataset. They are:

Child and mother demographic characteristics including child age in completed years (0-4); child sex; mother's marital status (single, in union and formerly in union); maternal age at child birth; and mother's number of children aged less than 5 years. We used this

last variable as proxy of birth interval not available in our dataset. High number of under-five children from the same mother assumes short birth interval although this could be biased by infant and/or under-five mortality.

The health related variables include the possession of health card (proxy of attending preventive health service such as vaccination), the child had fever, acute respiratory infection (ARI) and/or diarrhea during the last 2 weeks preceding the survey.

The socioeconomic characteristics encompass place of residence, province of residence, mother's relationship to the head of household, and household wealth index.

3.3 Methods

To assess the impact of maternal education on child nutritional status, we use descriptive methods (frequency distribution), Chi-square and multivariate analysis based on the Logit Generalized Estimating Equation (GEE) with exchangeable correlation covariance matrix. The GEE method has the ability to produce estimates of regression coefficients and standard errors that are efficient and robust by accommodating clustering or correlation in data. This is because the data used contain more than one child per household and/or per woman. These women are clustered within their community and/or province of residence.

The analysis is performed in three stages regardless of the method (chi-square or logistic regression). First, we assess the crude effect of maternal education on each indicator of child malnutrition (bivariate analysis). Second, we performed analysis using the theoretical model presented in the analytical framework (demographic, health related and socioeconomic). We ran a separate model for each set of explanatory variables to identify mediating and/or moderating factors among the selected control variables. Lastly, we included all variables from each model in the final model to capture the maternal net effect.

4. Results

4.1 Descriptive analysis

Tables 2 -5 provide for each indicator proportion of malnourished children by maternal education and chi-square test at bivariate level and by strata.

4.1.1. Maternal education and child stunting

Consistent with previous studies, maternal education is negatively associated with the prevalence of non-adjusted stunting. Prevalence of stunting decreases by around 6

percentage points from mothers with no education to mothers with primary education. Likewise, around 12 percentage points separate children whose mothers had a primary education and those whose mothers had a secondary or higher education (Table 2).

[Table 2, about here]

Analysis of the association between maternal education and prevalence of malnutrition among under-five children by selected child and mother's demographic variables shows globally a negative relationship as observed at bivariate analysis. Overall, children whose mothers are not educated have the highest prevalence of malnutrition, whereas those whose mothers are educated experienced the lowest prevalence of malnutrition. However, the effect of maternal education ceases to be significant for mothers with 3 or more children under five and for mothers who never got married.

None of the health related variables inhibited the initial association between maternal education and child stunting. Even so, this relationship disappears for some provinces and some levels of household wealth index. In fact, the association between maternal education and child stunting is not significant in Eastern provinces including Orientale, Nord-Kivu, Sud-Kivu and Maniema. Likewise, considering the household wealth index measure, the effect of maternal education is significant only in the extreme cases (poor and very rich), whereas the difference is not significant in the intermediate categories (middle and rich).

Analysis of "adjusted[3]" stunted indicator shows no association between maternal education and the prevalence of stunting. Overall, findings from stratified analysis confirm those from bivariate with few exceptions.

First, analysis of child stunting by mother's education controlling for child and mother's demographic characteristics, we found that stunting is significantly lower among children of the most educated mothers; but only for children aged less than 1 year old. The prevalence of malnutrition is lower among children whose mothers have only primary education and are aged 35 years old or above; and/or children of none educated women who never married.

Second, considering health related variables, children of the most educated women experienced lower stunting than others if they did not suffer from fever during the last 2 weeks before the survey. Last, in Kasai-Occidental, children whose mothers have primary education experience lower stunting compared to others.

4.1.2. Maternal education and child wasting

As for unadjusted stunting, the proportion of children suffering from unadjusted wasting decreases as maternal education increases (Table 3). However, the initial relationship disappears in some cases: children younger than 2 years of age, mother formerly in

[3] Adjusted stunting includes only children with stunting without other malnutrition problems.

union; and children who ever had diarrhea and/or acute respiratory infection. Likewise, association between maternal education and wasting is not significant in some provinces such as Bas-Congo, Equateur, Orientale, Nord and Sud Kivu as well as the two Kasai. Considering, the relationship to the head of household and the household wealth index, association between mother's education and unadjusted wasting is only significant if the mother is a spouse and/or the household is poor. Otherwise, the relationship is not significant.

[Table 3, about here]

While prevalence of unadjusted wasting decreases as maternal education increases, children of the most educated women are more likely to experience adjusted wasting than their counterparts in DRC. The significance of this relationship changes across demographic and socioeconomic characteristics as well as health related categories.

With reference to child and mother's demographic characteristics, initial association between mother's education and the prevalence of adjusted wasting ceases to be significant for children younger than 1 year of age or older than 2 years. Likewise, the initial difference is not significant considering children whose mothers have more than 2 under-five children and/or are not in union.

Considering health related characteristics, the initial relationship is not significant for children who experienced health problem in 2 weeks before the survey (diarrhea, acute

respiratory infection and/or fever) as well as do not have a health card (a proxy of preventive health service use).

The initial relationship between maternal education and prevalence of adjusted wasting disappears also after controlling for the socio-economic variables (place of residence, province, and mother's relationship to the head of household and household wealth index). In this case, the worst nutritional status of children of the most educated women only remains significant in urban areas and/or if the mother is a spouse.

4.1.3. Maternal education and child underweight

Overall, the prevalence of unadjusted underweight among children of non-educated women is double that observed among children of the most educated women (Table 4). This trend is observed among all demographic, health related and socio-economic categories although it ceases to be significant if the mother has more than 3 under-five children and/or lives in the province of Maniema.

[Table 4, about here]

Children of the most educated mothers (secondary or high) experience lower prevalence of adjusted underweight. However, this relationship is not regular as the higher prevalence is observed among children of mothers with primary education. As observed

for the previous adjusted indicators (stunting and wasting), the relationship between maternal education and adjusted underweight is selective.

Stratified analysis of adjusted underweight by maternal education shows that demographic characteristics as well as health related variables cancelled partially the initial association. Findings show also that socio-economic characteristics play mediating role in the relationship between maternal education and adjusted underweight. The association observed at the bivariate analysis is significant only among female children, children aged less than 1 year old, children born when mother is aged 20-34, and/or children of women in union. Likewise, the maternal education differential is not significant for children who suffered from diarrhea, fever and/or ARI. Controlling for possession of health card, place of residence, mother's relationship to the head of household, the household wealth index and province of residence (except in Maniema) cancels the observed association between maternal education and adjusted underweight.

4.1.4. Maternal education and child multiple malnutrition

Table 5 presents prevalence of children suffering from unadjusted stunting or wasting and/or underweight (USWU) by mother's education according to the selected control variables. It also describes prevalence of children suffering simultaneously from at least two anthropometric failures (stunting and underweight or wasting and underweight or stunting, wasting and underweight).

[Table 5, about here]

Maternal education is negatively associated with the prevalence of USWU in DRC. The prevalence of USWU is about 7 percentage points more for children of non-educated mothers compared to those whose mothers have primary education. About 11 percentage points separate children of primary educated mothers and those whose mothers have secondary education or higher. However, as adjusted stunting, USWU is not significant for children whose mothers have more than 3 under-five children. The same results are observed in Nord-Kivu, Sud-Kivu and Maniema, as well as in the middle household wealth index group.

Analysis of the simultaneous multiple anthropometric failures (SMAF) by maternal education shows significant negative relationship between the two variables. In addition, none of the control variables cancel the initial association except among children whose mothers have more than 3 children aged less than 5 years and/or children living in Maniema.

To sum up, the association between maternal education and prevalence of child malnutrition depends on the nature (adjusted or not) of index indicator and on demographic, health and socioeconomic categories. In addition, whereas overall the relationship between maternal education and prevalence of malnutrition is negative and monotone, in Kinshasa regardless of anthropometric failure analyzed, this relationship

has a convex (reversal U) with the higher malnutrition prevalence among children of women with primary education.

4.2 Multivariate analyses

Odds ratio from logistic regression models are presented in Table 6. The first column, model 1 gives the bivariate effect of maternal education on each aspect of child nutritional status. Model 2 presents the effects of maternal education on children's nutritional status after controlling for mother's and child demographic characteristics. Models 3 and 4 present the effects of maternal education on children's nutritional status after including respectively health related variables and socio-economic characteristics. The last column presents the full model.

[Table 6 about here]

Overall, findings from different multivariate analyses confirm the positive association commonly found in population research between maternal education and child health for unadjusted indicators and multiple simultaneous anthropometric failures. Children of educated mothers have a lower probability of being malnourished.

4.2.1 Stunting

Results from logistic regression models confirm the maternal education differential in child stunting observed from descriptive analyses. The likelihood of "unadjusted"

stunting decreases as maternal education increases in all the models. However, introducing controls for province of residence, place of residence and household wealth index (model 4) reduces the effect of maternal education by about 30%.

Likewise, the bivariate maternal education effect on "adjusted stunting" is not significant. Nevertheless, the likelihood of being only stunted becomes lower and statistically significant among children of non-educated mothers after controlling for the province of residence. This pattern was observed in general at the descriptive level although the difference was only significant in Kasai-Occidental.

4.2.2 Wasting

As for "unadjusted" stunting, children of non-educated mothers are more likely to experience "unadjusted" wasting compare to those whose mothers have secondary education or higher. Nonetheless, no difference is observed between children whose mothers have primary-school education and those of secondary-level educated mothers. The same trend was observed in the descriptive analysis because none of the control variables cancel the initial association observed at bivariate level.

Paradoxically, the likelihood of observing "adjusted" wasting is higher among children whose mothers have secondary education or higher compared to others. However, this positive effect of maternal education on the likelihood of being only wasted disappears after controlling for the socioeconomic related variables (place of residence, province and household wealth index).

4.2.3 Underweight

Like for "unadjusted" previous nutritional indicators (stunting and wasting) the likelihood of experiencing only underweight among under-five children in DRC decreases as maternal education increases. Nevertheless, the introduction of variables reflecting socio-economic characteristics (province and household wealth index) attenuates the difference between different levels of maternal education. For instance compared to children of the most educated women, the risk of experiencing unadjusted underweight decreases from 2.5 (bivariate model) to 1.9 (models 4 and 5) for children of no educated mothers. Likewise, the odds ratio for children of mothers with primary education decreases from 1.9 (bivariate model) to 1.5 (models 4 and 5) for children of mothers with primary education.

Maternal educational differences in child "adjusted" underweight prevalence from logistic regression models are not regular. In fact, if overall the lowest likelihood of "adjusted" underweight is observed among children of the most educated women (secondary education or high), the highest prevalence is observed among children whose mothers have primary education. In addition, the highest risk of "adjusted underweight" observed among children whose mothers have primary education seem to be mediated by socio-economic related variables.

4.2.4. Multiple malnutrition

The likelihood of experiencing "unadjusted" stunted or wasted and/or underweight (USWU) by maternal education has the same pattern like that of experiencing "unadjusted" stunting as well as "unadjusted" underweight. Children of non-educated women have about 2 times the risk of experiencing (USWU, US, UU) than children of the most educated women. Likewise, introduction of region of residence and household wealth index in the models (4 and 5) reduce this effect, although it remains significant.

The maternal educational differences in simultaneous multiple anthropometric failures (SMAF) have the same pattern with that the effect of maternal education on "unadjusted" underweight. This is because all children with SMAF are underweight although some underweighted children are neither stunted nor wasted.

5. Discussion

This study examined the effect of maternal education on child nutritional status in the DRC. Children's nutritional status, based on anthropometric measures, included stunting, wasting, underweight and simultaneous multiple malnutrition.

In light of this study, four keys results could be discussed. First, differences in the effects of maternal education on children's nutritional status in the DRC depend on the index malnutrition indicator (stunted, wasted, underweight, multiple malnutrition) as well as whether the indicator is crude (unadjusted) or net (adjusted). Second, the province of

residence influences the relationship between maternal education and child nutritional status although the nature of this influence (moderating, mediating or inhibiting) depends on the index indicator. Third, wealth index and place of residence moderate the maternal education effect on child nutritional status. Last, demographic and health related variables do not play a key role in explaining the impact of maternal education on child nutritional status in DRC.

Consistent with findings from previous studies (Baraigi, 1980; Solon et al., 1985; Desai and Alva, 1998; Frost et al., 2005), this study confirms that maternal education is a determinant of child health. The likelihood of experiencing anthropometric failure is lower among children of women with secondary education or higher. The effect of maternal education is particularly strong on unadjusted or crude malnutrition indicator (stunted, wasted and underweight) and on the simultaneous multiple malnutrition indicators. None of the covariates (control factors) explain fully the variation in the prevalence of child malnutrition by mother's education except moderating effect from socioeconomic variables. Frost et al. (2005) found similar results in Bolivia. It is possible that there are other pathways through which maternal education affects children's nutritional status.

Three factors could explain the negative effect of maternal education on unadjusted and multiple malnutrition prevalence. First, unadjusted malnutrition indicators are linked with each other and are probably associated with other childhood health problems that are less prevalent among children of educated mothers. Second, schooling provides women with

knowledge about health issues, increases their power in intra-household decisions, and makes their use of healthcare services more effective. In addition, the most educated women are less exposed to traditional norms with negative effects on health (Reed et al., 1996; Desai and Alva, 1998). For instance, 38 per cent of children aged 12-23 months of women with secondary education or higher are fully immunized compared to 13 per cent and 20 per cent for mothers with no education and primary education, respectively. Further, whereas 35 per cent of children aged less than 6 months of mothers with primary and secondary are exclusively breastfeeding, only 24 per cent of similar children are exclusively breastfeeding among the non-educated mothers.

Third, the most educated women live in higher socio-economic households or good environments, and are able to breakdown logistical, geographical and financial barriers to healthcare utilization. In DRC, among children whose mothers have a secondary education, 70% live in urban areas and 52% in the richest households. These proportions are respectively to 11% and 3% for children whose mothers are not educated.

However, the lack of effects of maternal education on unadjusted child nutritional status in Eastern provinces or among children living in households of middle living standards is puzzling. Three factors could explain these findings. First, the most educated women living in households with higher socio-economic living standard may have left the conflict province (Nord-Kivu, Sud-Kivu and Maniema). Second, it is possible that educated mothers fail to realize the full advantage of their education if they live in conflict affected areas and/or if they live among lower education clusters. The proportion

of children whose mothers have secondary education is lower in the three provinces (Nord-Kivu, Sud-Kivu and Maniema). This observation is consistent with the fact that the health facilities and economic devastations brought by conflict will affect anyone living in these provinces regardless of education level as suggested by Pongou et al., 2006a as below:

> *"In rural areas the absence of such community factors exposes children born to educated and low-educated mothers to similar community poverty (e.g. lack of health care facilities or potable water, seasonal shortages of food, unhygienic environment, etc.)"* (Pongou et al., 2006:654).

In contrast, the lower difference between children of uneducated mothers compared to those of most educated in Kinshasa confirms this effect. This was observed in most developing countries (Desai and Alva, 1998; Smith and Haddad, 2000). In addition, these studies pointed out that the association between maternal education and child nutritional status is especially weak in the context where female school enrolment rates are high as it is the case in Kinshasa compared to other provinces.

Third, education may have a positive effect in the richer and poorer segments of the population through the variety of available choices. In the context of scarce resources or of abundance, maternal education could make a difference by empowering mothers (decision on type of nutrition and/or use of preventive medicine). These findings corroborate those observed in Cameroon (Pongou et al., 2006a) where the advantage associated with maternal education increased during the 1990s crises particularly in urban areas. In fact, urban infrastructure increases the availability of food and health care, and provides potential for improved environmental conditions; and then allows the more

educated mothers to have higher access to alternative choices. This may explain why differential trends in malnutrition among children of different maternal educational groups are entirely explained by household socio-economic and geographical factors.

With reference to adjusted nutritional indicators (stunted, wasted, underweight) results are mixed. Child nutritional advantage from maternal education is only observed if one considers adjusted underweight. In addition, this advantage is not significant after controlling for socio-economic factors (model 4 and model 5). In contrast, children of mothers with secondary education or higher experience higher adjusted stunting and wasting. The higher prevalence of adjusted malnutrition indicators or no significant maternal education differences in the adjusted malnutrition indicators in DRC depending on the index indicator and/or controlling factors introduced in the model support findings from Reed et al. (1996) and Pongou et al. (2006).

Two reasons could explain these results. First, it is possible that most educated women work outside the home without simultaneously ensuring adequate child care (Reed et al., 1996) although this hypothesis could not be tested because of data limitations. Second, most of the children whose mothers have lower education level (no education or primary) have simultaneous multiple malnutrition problems whereas most children whose mothers have secondary education or higher have only single malnutrition problem (adjusted indicators). In fact, the unadjusted indicators are not mutually exclusive. They overlap each other and are similar to simultaneous multiple malnutrition indicators.

From a methodological point of view, this study shows limitations of unadjusted malnutrition indicators and interest of adjusted indicators. In fact, unadjusted indicators are overlapping each other and therefore overestimate the maternal education effect on child nutritional status.

Conclusion

In the past 15 years, the DRC has experienced severe social instabilities and high mortality due to repeated armed conflicts. Malnutrition and mortality rates in the country are now amongst the highest in sub-Saharan Africa. Using data from the 2001 DRC Multiple Indicators Cluster Survey (MICS2), this paper assessed the impact of maternal education on children nutritional status, taking into account the clustering of children within families, household and conflict/non-conflict affected provinces. This paper used adjusted and unadjusted indicator of child nutritional status.

Although this paper identified maternal educational attainment as a key determinant of children's malnutrition in DRC independent of control variables (province of residence, place of residence (urban or rural)) this might not be the whole truth.

First, between 1984 and 2001, increase in proportion of educated women contrasts with proportion of malnourished children at macro-level; while negative association between maternal education and child malnutrition is observed at individual level. Geographical and/or temporal comparisons of the effect of maternal education on child health should

be done with caution taking into account the level of analysis (macro, household, mother, or child level).

Second, maternal education does not impact child nutritional status in certain socio-economic strata among which the conflict affected Eastern provinces and/or intermediate living standards household. Though largely consistent with findings from other malnutrition studies, our results with respect to the conflict Eastern provinces are influenced by many confounding factors related to conflicts such as the lack of food, economic hardship and lack of health care. Actions to promote food security and income growth and increase access to education should be part of the DRC's post conflict reconstruction programme.

Last but not least, maternal education effect on child nutritional status depends on the indicator used to capture child nutritional status. If maternal education decreases the likelihood of experiencing unadjusted indicators as well as of simultaneous malnutrition anthropometric failures, its impact on suffering from a single adjusted anthropometric failure is mixed.

Therefore, efforts to achieve the MDG-4 target of reducing child mortality rates by two-thirds between 1990 and 2015 and post conflict reconstruction should be holistic and comprehensive. Parallel investments in programmes aimed at addressing the basic human needs of food, poverty eradication, universal primary education, accessibility to safe

drinking water and healthcare service, and women's empowerment can accelerate the achievement of MDG-4.

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Table 1 – Percentage of under five children by mother's education level according to selected socio-demographics factors

	None	Primary	Secondary&+	Total	Chi-square
Gender					
Male	48.3	49.4	51.7	49.8	6.8**
Female	51.7	50.6	48.4	50.2	
Child age (year)					
0	22.2	24.6	22.3	23.2	
1	21.5	22.3	22.6	22.2	
2	20	18.7	18.6	19	17.74**
3	17.5	16.8	19.4	17.8	
4	18.8	17.6	17	17.7	
Mother age at birth					
< 20	11.1	14	9.5	11.8	
20-34	62	67.1	75.9	68.4	184.1***
35 & high	26.9	18.9	14.6	19.8	
Number of under-five children living with mother					
1	37.4	35.3	36.9	36.4	
2	49.7	52.5	47.2	50	30.5***
3&+	12.9	12.2	15.9	13.6	
Mother marital status					
Currently in union	89.7	88.8	86.2	88.3	
Formerly in union	8.1	8	8.3	8.1	47.8***
Never married	2.3	3.1	5.5	3.6	
Had health card					
No	62.69	54.79	32.66	50.03	576.8***
Yes	37.31	45.21	67.34	49.97	
Had diarrhea last 2 weeks					
Yes	77.5	77.1	79.2	77.9	4.5
No	22.5	22.9	20.8	22.1	
Had Acute Respiratory Infection last 2 weeks					
No	86.2	89.8	93.7	90	87.62***
Yes	13.8	10.2	6.3	10	
Had fever last 2 weeks					
No	59	57.4	62.5	59.5	18. 9***
Yes	41	42.6	37.5	40.6	
Place of residence					
Urban	11	25.5	69.6	35.4	2446.0***
Rural	89	74.5	30.4	64.6	
Province of residence					
Kinshasa	2.7	5.8	34.4	13.9	
Bas-Congo	3.4	5.8	6.3	5.3	
Bandundu	10.6	12.5	12.4	11.9	
Equateur	17.6	12.2	4.8	11.4	
Orientale	11.3	12.4	5.6	10	2400.0***
Nord-Kivu	12.9	7	2.7	7.3	
Sud-Kivu	11.5	4.9	3	6.1	
Maniema	3.9	2.9	1	2.6	
Katanga	14.1	11.3	8.8	11.3	
Kasai-Oriental	5.9	12	13.8	10.9	
Kasai-Occidental	6.1	13.4	7.3	9.5	
Relationship to Head of household					
Head of Household	4.8	4.1	5.2	4.7	

Spouse	82.8	78.6	72.9	78	98.5***
Other	12.5	17.2	21.9	17.4	
Household Wealth Index					
Poorest	30.2	22.6	7.8	20	
Poor	26.3	22.8	9.2	19.5	
Middle	24.6	22.8	11	19.6	2827.5***
Rich	15.8	21.3	19.7	19.3	
Richest	3.2	10.5	52.3	21.6	
Total (%)	100	100	100	100	
Total Number	2,680	4,015	3,053	9,748	

Notes: *** p<0.01; ** p<0.05; * p<0.10. Source : 2001 DRC-MICS 2.

Table 2 - Prevalence of stunted by maternal education according to selected variables

	Non adjusted stunted				Adjusted stunted			
	None	Primary	Secondary	χ2	None	Primary	Secondary	χ2
Gender								
Male	46.6	42.8	30.9	85.5***	16.3	17.6	15.8	2.2
Female	43.6	35.5	24.8	113.1***	16.3	15.1	14.2	2.4
Child age (year)								
0	15.0	12.1	6.5	24.8***	6.6	5.6	3.5	6.4**
1	42.7	32.9	23.8	51.3***	12.9	10.4	10.9	2.2
2	47.1	45.4	31.8	33.6***	17.6	21.6	17.4	4.8*
3	59.2	57.3	41.0	45.9***	23.4	23.7	22.1	0.5
4	67.9	60.8	42.6	72.4***	23.6	26.5	25.1	1.3
Mother age at birth								
< 20	46.0	39.3	31.7	12.5***	14.1	18.2	17.6	2.4
20-34	44.5	39.5	27.2	143.5***	15.6	17.1	14.7	5.5*
35 & high	46.0	37.5	29.6	32.0***	18.6	12.4	15.0	11.1***
Number of U5 children								
1	43.1	35.8	27.0	60.5***	16.0	16.2	13.9	2.9
2	46.2	41.0	27.6	111.0***	16.6	16.3	15.1	1.3
3	46.4	40.7	31.1	21.4***	15.9	17.3	17.5	0.4
Mother marital status								
Currently in union	44.4	39.5	27.7	163.3***	16.4	16.6	15.7	1.1
Formerly in union	53.2	39.1	32.5	21.3***	17.6	15.2	13.1	1.8
Never married	41.0	27.8	25.0	5.7*	6.6	11.9	8.3	1.7
Had health card								
No	43.5	39.6	30.5	44.6***	16.1	15.7	15.2	0.4
Yes	47.7	38.6	26.7	142.1***	16.6	17.1	15.0	3.5
Had diarrhea last 2 weeks								
No	45.5	40.0	27.7	163.1***	16.6	17.6	15.4	5.0*
Yes	43.5	36.2	28.8	28.9***	15.1	12.2	13.8	2.7
Had Acute Respiratory Infection								
No	45.5	38.5	27.7	182.2***	16.6	16.5	15.1	3
Yes	42.0	44.4	32.1	8.4**	14.1	15.1	14.0	0.2
Had fever last 2 weeks								
No	48.1	39.4	26.3	181.4***	17.4	17.6	14.4	9.2***
Yes	40.6	38.7	30.7	28.1***	14.7	14.7	16.2	1
Place of residence								
Urban	41.2	32.4	23.3	58.8***	16.6	14.0	13.5	2
Rural	45.5	41.4	38.5	16.5***	16.2	17.2	18.5	2.6
Province of residence								
Kinshasa	22.5	32.5	16.8	29.8***	7.0	11.3	9.4	1.3
Bas-Congo	51.1	46.3	33.8	10.0***	10.9	16.9	16.2	1.9
Bandundu	44.2	39.4	32.1	10.6***	10.5	16.8	14.3	5.8*
Equateur	49.6	35.0	36.7	22.4***	18.9	16.4	21.1	2
Orientale	44.4	37.3	36.3	4.8*	20.4	18.6	21.6	0.8
Nord-Kivu	45.7	42.5	45.1	0.6	17.3	19.3	28.1	4.9*
Sud-Kivu	47.2	44.6	42.9	0.7	17.9	20.0	28.6	4.9*
Maniema	49.5	45.3	38.7	1.2	22.9	19.7	12.9	1.5
Katanga	38.9	42.0	31.8	7.4**	14.6	15.8	13.5	0.8
Kasai-Oriental	42.0	37.7	28.0	13.9	12.1	17.1	17.6	2.7
Kasai-Occidental	49.7	37.7	37.5	8.2**	16.6	12.1	19.6	7.8**
Relationship to Head of household								
Head of Household	50.8	40.4	35.2	7.2**	16.4	14.5	14.5	0.3
Spouse	44.8	40.5	28.0	146.4***	16.6	17.1	15.9	1.5
Other	44.6	32.2	26.1	35.1***	13.8	13.3	12.4	0.4

Household Wealth Index								
Poorest	48.3	40.1	32.1	23.7***	17.2	16.4	14.8	0.8
Poor	45.5	41.2	40.6	3.6	15.3	15.7	17.8	1
Middle	43.9	40.4	36.2	5.7*	14.9	17.4	17.2	1.8
Rich	42.7	37.6	36.5	4.3	19.7	17.5	20.6	2.4
Richest	31.4	32.7	20.1	33.2***	9.3	13.3	12.0	1.2
Total	45.0	39.1	27.9	188.7***	16.3	16.4	15.0	2.6

Source: 2001 RDC-MICS; Notes: *** p<0.01; ** p<0.05; * p<0.1

Table 3 - Prevalence of wasted by maternal education according to selected variables

	Non adjusted wasted				Adjusted wasted			
	None	Primary	Secondary	χ2	None	Primary	Secondary	χ2
Gender								
Male	19.0	15.7	14.9	9.6***	5.4	4.2	6.6	9.9***
Female	16.4	13.4	11.8	13.1***	4.3	5.1	6.6	7.5**
Child age (year)								
0	19.7	16.0	15.0	5.6*	9.2	10.0	11.9	2.5
1	24.8	23.6	23.2	0.5	4.3	5.1	8.6	11.9***
2	16.6	11.6	12.3	7.6**	4.7	2.5	5.5	7.9**
3	11.1	10.8	6.4	9.3***	1.2	1.6	2.5	2.6
4	14.3	7.9	7.5	17.5***	3.0	1.7	2.9	2.7
Mother age at birth								
< 20	15.1	13.5	14.8	0.5	5.4	4.8	6.2	0.8
20-34	17.2	13.8	13.1	14.2***	4.2	4.3	6.8	19.9***
35 & high	19.9	18.0	14.1	6.2**	5.6	5.9	5.8	0.1
Number of U5 children								
1	18.7	14.6	14.2	10.2***	4.9	4.9	7.2	7.5**
2	17.5	15.1	13.5	8.8**	4.3	4.7	6.7	9.8***
3	15.1	12.4	11.3	2.6	5.8	3.9	4.9	1.7
Mother marital status								
Currently in union	17.0	14.3	12.8	18.0***	4.7	4.5	6.8	18.3***
Formerly in union	22.2	18.6	19.1	1.2	3.7	6.5	5.6	2.0
Never married	26.2	11.1	13.7	7.8**	6.6	4.0	4.2	0.7
Had health card								
No	17.6	15.3	12.3	13.4***	4.9	4.7	6.0	2.4
Yes	17.7	13.7	13.9	9.8***	4.3	4.6	6.9	13.1***
Had diarrhea last 2 weeks								
No	16.0	13.2	12.1	15.1***	4.7	4.6	6.4	10.2***
Yes	23.4	19.4	18.2	5.7*	4.8	4.7	7.2	5.4*
Had Acute Respiratory Infection								
No	16.8	14.0	13.3	14.2***	4.7	4.7	6.5	12.5***
Yes	23.0	19.8	15.5	4.5	4.6	4.4	7.8	3.4
Had fever last 2 weeks								
No	16.4	13.0	12.6	12.5***	4.7	4.3	6.4	10.3***
Yes	19.5	16.7	14.8	9.0***	4.7	5.2	6.9	5.9*
Place of residence								
Urban	19.3	14.0	13.4	7.5**	6.8	5.1	7.4	6.0**
Rural	17.5	14.8	13.5	10.9***	4.5	4.5	4.7	0.1
Province of residence								
Kinshasa	16.9	22.1	15.6	5.7**	9.9	7.8	8.4	0.3
Bas-Congo	16.3	8.2	12.0	4.6*	2.2	3.0	5.2	2.1
Bandundu	22.1	17.2	14.3	6.9**	6.3	6.2	6.4	0.0
Equateur	19.5	14.1	19.7	5.6*	6.4	4.9	9.5	4.2
Orientale	12.5	9.8	7.0	3.7	2.3	4.8	3.5	3.3
Nord-Kivu	13.0	8.9	3.7	7.6**	2.3	1.8	1.2	0.5
Sud-Kivu	15.0	16.4	4.4	8.2**	3.9	3.1	1.1	1.8
Maniema	15.2	14.5	6.5	1.6	1.9	4.3	0.0	2.2
Katanga	22.2	16.5	9.0	19.8***	4.2	4.0	4.9	0.4
Kasai-Oriental	19.1	12.7	15.4	4.1	7.0	4.0	7.1	4.8*
Kasai-Occidental	19.6	18.7	12.9	4.3	8.0	5.6	6.2	1.3
Relationship to Head of household								
Head of Household	22.7	13.3	17.6	4.4	3.9	4.2	8.2	3.3
Spouse	17.3	14.2	13.1	16.9***	4.7	4.2	6.9	20.2***
Other	18.3	16.6	13.5	4.6	4.8	6.7	5.1	2.1

Household Wealth Index								
Poorest	16.1	14.7	13.5	1.2	4.3	4.9	5.1	0.4
Poor	20.7	15.6	12.5	12.1***	5.0	4.2	5.0	0.7
Middle	16.9	13.5	15.7	3.5	3.5	4.7	5.9	3.2
Rich	16.1	14.9	13.5	1.4	5.9	4.7	7.0	3.5
Richest	20.9	13.7	13.0	4.4	9.3	5.2	7.1	2.7
Total	17.7	14.6	13.4	21.4***	4.7	4.7	6.6	15.3***

Source: 2001 RDC-MICS; Notes: *** p<0.01; ** p<0.05; * p<0.1

Table 4 - Prevalence of underweight by maternal education according to selected variables

	Unadjusted underweight				Adjusted underweight			
	None	Primary	Secondary	χ2	None	Primary	Secondary	χ2
Gender								
Male	41.2	35.2	23.3	113.0***	3.0	3.6	2.8	2.2
Female	37.9	29.8	17.3	153.5***	3.9	4.2	2.6	6.4**
Child age (year)								
0	21.0	15.7	7.5	48.2***	4.0	3.8	1.6	7.9**
1	46.0	38.2	26.7	52.3***	4.7	4.6	3.3	1.9
2	41.1	34.8	22.1	47.5***	4.1	5.7	3.2	5.2*
3	43.0	40.8	24.1	53.2***	3.2	2.7	2.5	0.5
4	48.8	39.7	22.7	77.3***	1.0	2.7	3.1	5.7*
Mother age at birth								
< 20	39.6	29.7	23.1	19.2***	2.4	2.9	3.5	0.6
20-34	40.1	32.4	19.6	206.5***	4.2	4.3	2.6	11.2***
35 & high	38.1	36.2	22.4	33.6***	2.4	3.4	2.7	1.6
Number of U5 children								
1	35.6	30.6	21.1	78.4***	3.2	4.4	2.9	4.8*
2	40.7	34.7	20.1	146.7***	4.1	3.8	2.7	4.4
3	37.4	30.6	19.6	33.6***	2.0	3.1	2.3	1.0
Mother marital status								
Currently in union	38.6	33.0	19.2	244.8***	3.6	4.0	2.8	6.4**
Formerly in union	47.7	33.9	29.8	17.6***	3.2	3.7	2.0	1.5
Never married	44.3	23.0	25.0	10.4***	0.0	2.4	2.4	1.5
Had health card								
No	38.6	34.3	22.3	77.1***	3.9	4.3	2.5	6.0*
Yes	40.9	30.9	19.5	163.9***	2.7	3.5	2.8	2.2
Had diarrhea last 2 weeks								
No	38.5	31.3	18.6	223.7***	3.5	3.6	2.4	7.7**
Yes	43.0	37.5	27.0	35.8***	3.3	5.1	4.1	3.0
Had Acute Respiratory Infection last 2 weeks								
No	38.7	31.6	20.1	222.7***	3.3	3.9	2.7	6.7**
Yes	44.4	42.4	24.9	22.5***	4.9	4.4	2.6	1.7
Had fever last 2 weeks								
No	39.9	30.9	19.2	181.8***	3.0	3.7	2.7	3.8
Yes	38.9	35.3	22.4	80.0***	4.2	4.2	2.7	5.0*
Place of residence								
Urban	33.8	27.1	16.8	73.8***	1.7	3.0	2.5	1.9
Rural	40.2	34.7	28.6	42.8***	3.7	4.3	3.3	2.0
Province of residence								
Kinshasa	22.5	29.9	15.5	29.6***	2.8	1.3	2.9	1.8
Bas-Congo	51.1	39.0	24.5	21.1***	3.3	7.4	3.1	4.7*
Bandundu	45.6	35.0	26.0	27.6***	3.9	5.2	3.5	1.8
Equateur	39.4	28.3	24.5	18.5***	2.8	3.7	1.4	2.3
Orientale	33.9	24.3	19.9	13.6***	4.0	2.2	2.3	2.3
Nord-Kivu	39.0	31.8	22.0	9.8***	4.1	4.6	2.4	0.8
Sud-Kivu	39.7	40.0	19.8	13.3***	3.9	5.6	3.3	1.2
Maniema	39.1	41.0	29.0	1.5	1.9	9.4	3.2	6.3**
Katanga	38.9	36.7	22.9	20.3***	3.2	3.3	1.9	1.4
Kasai-Oriental	40.1	29.6	19.7	26.5***	4.5	3.3	2.6	1.3
Kasai-Occidental	41.7	36.6	24.6	14.6***	3.1	3.2	2.7	0.1
Relationship to Head of household								
Head of Household	46.9	34.9	28.9	10.1***	1.6	4.8	2.5	2.8
Spouse	38.8	33.5	19.3	216.2***	3.6	4.0	2.8	5.4*

Other	41.0	28.6	22.0	39.6***	3.6	3.6	2.5	1.5
Household Wealth Index								
Poorest	41.1	34.1	26.6	19.5***	3.7	4.1	4.2	0.2
Poor	42.9	35.9	28.8	18.8***	3.5	3.9	2.9	0.7
Middle	39.4	32.0	29.4	13.3***	3.2	3.9	3.6	0.6
Rich	32.0	31.3	23.1	14.3***	3.3	4.3	2.2	5.1
Richest	33.7	27.3	15.0	47.8***	3.5	2.8	2.5	0.4
Total	39.5	32.7	20.4	257.8***	3.5	3.9	2.7	7.8**

Source: 2001 RDC-MICS; Notes: *** p<0.01; ** p<0.05; * p<0.1

Table 5 - Prevalence of multiple malnutrition by maternal education according to selected variables

	Unadjusted multiple malnutrition				Simultaneous malnutrition			
	None	Primary	Secondary	χ2	None	Primary	Secondary	χ2
Gender								
Male	62.6	57.6	45.7	90.3***	38.2	32.1	20.5	113.3***
Female	58.5	50.0	38.0	121.9***	34.0	25.5	14.6	145.9***
Child age (year)								
0	36.8	31.3	22.9	30.2***	17.0	12.0	5.9	39.2***
1	63.2	53.7	46.1	37.0***	41.3	33.6	23.3	47.4***
2	63.4	58.9	45.0	42.2***	37.0	29.0	19.0	44.6***
3	67.7	66.1	48.7	53.4***	39.8	38.2	21.6	52.9***
4	75.4	67.9	50.7	73.2***	47.8	37.0	19.7	91.4***
Mother age at birth								
< 20	59.1	52.7	46.9	8.7**	37.3	26.9	19.7	23.1***
20-34	59.9	53.8	41.1	151.6***	35.9	28.1	17.0	187.5***
35 & high	62.2	54.5	43.3	40.0***	35.7	32.8	19.7	35.1***
Number of U5 children								
1	59.4	51.7	42.1	64.1***	35.4	26.2	18.1	81.6***
2	61.6	55.6	41.9	116.4***	36.6	30.9	17.4	136.2***
3	59.1	51.7	42.0	24.6***	35.4	27.5	17.3	35.6***
Mother marital status								
Currently in union	59.8	54.1	41.7	176.9***	35.0	29.0	16.4	237.6***
Formerly in union	69.0	55.6	48.4	20.5***	44.4	30.1	27.8	17.0***
Never married	57.4	38.9	37.5	7.8**	44.3	20.6	22.6	13.6***
Had health card								
No	59.6	54.7	43.4	66.8***	34.7	30.0	19.8	66.6***
Yes	61.8	52.6	41.3	122.6***	38.2	27.3	16.6	174.7***
Had diarrhea last 2 weeks								
No	59.8	53.6	40.4	180.8***	35.0	27.7	16.3	210.2***
Yes	62.9	54.4	48.1	27.3***	39.6	32.4	23.0	40.2***
Had Acute Respiratory Infection								
No	60.0	52.8	41.7	179.4***	35.4	27.7	17.3	221.4***
Yes	63.1	62.0	46.6	16.3***	39.6	38.1	22.3	18.6***
Had fever last 2 weeks								
No	62.0	52.7	39.9	172.0***	36.9	27.1	16.5	188.2***
Yes	58.3	55.2	45.4	42.0***	34.7	31.1	19.7	69.7***
Place of residence								
Urban	57.1	46.2	37.7	51.1***	32.1	24.1	14.4	80.7***
Rural	60.9	56.4	51.8	24.8***	36.5	30.4	25.2	45.3***
Province of residence								
Kinshasa	39.4	48.9	33.3	20.2***	19.7	28.6	12.7	37.0***
Bas-Congo	64.1	58.9	45.8	11.0***	47.8	31.6	21.4	20.7***
Bandundu	62.5	58.0	46.7	18.7***	41.8	29.8	22.6	28.4***
Equateur	64.6	49.6	55.1	22.2***	36.7	24.6	23.1	20.1***
Orientale	56.6	47.7	45.0	8.0**	29.9	22.0	17.5	10.9***
Nord-Kivu	58.7	52.9	51.2	2.8	35.0	27.1	19.5	9.4***
Sud-Kivu	61.6	63.1	49.5	5.3*	35.8	34.4	16.5	12.5***
Maniema	63.8	65.0	41.9	5.8*	37.1	31.6	25.8	1.6
Katanga	57.7	56.5	41.2	20.4***	35.7	33.4	21.0	17.6***
Kasai-Oriental	59.2	50.6	44.4	10.5***	35.7	26.3	17.1	24.0***
Kasai-Occidental	66.3	54.2	50.5	10.3***	38.7	33.4	21.9	14.4***
Relationship to Head of household								
Head of Household	67.2	53.6	51.6	8.1**	45.3	30.1	26.4	12.5***
Spouse	60.2	54.9	42.1	157.3***	35.3	29.6	16.5	209.5***
Other	59.6	48.6	39.5	38.9***	37.4	25.0	19.5	38.1***

Household Wealth Index								
Poorest	62.6	55.4	46.4	22.2***	37.4	30.1	22.4	22.3***
Poor	63.2	55.8	51.6	14.3***	39.4	32.0	26.0	18.8***
Middle	57.8	54.0	52.5	3.2	36.2	28.1	25.8	16.1***
Rich	57.6	53.5	50.7	4.8*	28.7	27.0	20.9	9.8***
Richest	52.3	45.7	34.2	27.9***	30.2	24.4	12.5	50.2***
Total	60.5	53.8	42.0	204.0***	36.0	28.8	17.7	250.0***

Source: 2001 RDC-MICS; Notes: *** p<0.01; ** p<0.05; * p<0.1

Table 6 – Maternal education and child malnutrition: logistic regression results

	Model				
	Bivariate	Demographic	Health related	Socio-economic	All
Unadjusted stunted (US)					
None	2.1***	2.3***	2.1***	1.4***	1.4***
Primary	1.7***	1.8***	1.6***	1.2***	1.3***
Secondary & +	Reference	Reference	Reference	Reference	Reference
Adjusted stunted (AS)					
None	1.1	1.1	1.1	0.8**	0.8**
Primary	1.1	1.1	1.1	0.9*	0.9
Secondary & +	Reference	Reference	Reference	Reference	Reference
Unadjusted wasting (UW)					
None	1.4***	1.4***	1.3***	1.5***	1.5***
Primary	1.1	1.1	1.1	1.2*	1.1
Secondary & +	Reference	Reference	Reference	Reference	Reference
Adjusted wasting (AW)					
None	0.7***	0.7***	0.7***	1	1
Primary	0.7***	0.6***	0.7***	0.9	0.8
Secondary & +	Reference	Reference	Reference	Reference	Reference
Unadjusted underweight (UU)					
None	2.5***	2.7***	2.4***	1.9***	1.9***
Primary	1.9***	2.0***	1.8***	1.5***	1.5***
Secondary & +	Reference	Reference	Reference	Reference	Reference
Adjusted underweight (AU)					
None	1.3*	1.3*	1.2	1.1	1.1
Primary	1.5***	1.5***	1.4**	1.3*	1.3
Secondary & +	Reference	Reference	Reference	Reference	Reference
Unadjusted stunted-Wasted-Underweight(USWU)					
None	2.1***	2.2***	2.1***	1.5***	1.5***
Primary	1.6***	1.7***	1.6***	1.2***	1.3***
Secondary & +	Reference	Reference	Reference	Reference	Reference
Simultaneous multiple anthropometric failures (SMAF)					
None	2.6***	2.8***	2.5***	1.9***	2.0***
Primary	1.9***	2.0***	1.8***	1.5***	1.5***
Secondary & +	Reference	Reference	Reference	Reference	Reference

Source: 2001 RDC-MICS; Notes: *** p<0.01; ** p<0.05; * p<0.1

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