Introduction

Adequate nutrition is critical to children's growth and development as the period from birth to age two is especially important for physical, mental, cognitive growth, health and development. Poor nutritional status during childhood and its lasting impact on economic growth and health is well documented in the literature (Glover-Amengor et al, 2016**).** Children who suffer undernutrition remain a major public health problem confronting many low and middle-income countries. Approximately half of all deaths of children under age five is attributed to undernutrition, translating into the loss of about 3 million young lives a year (UNICEF, 2017).

Child malnutrition remains a major challenge in Ghana despite the country's remarkable progress in fighting the prevalence of malnutrition among children under five years. In Ghana, the prevalence of height-for-age (stunting) among children is 19 percent while that of weight-for-height (wasting) and weight-for-age (underweight) is 5 and 11 percent respectively. There also exist regional variations in the country as the prevalence of malnutrition is high in the Northern sector than in the Southern sector. Also, in terms of sex, both stunting and severe stunting is slightly higher in male children (20% and 5% respectively) than in female children (17% and 5% respectively) (GDHS report, 2014).

Women empowerment has been a major contributor to the nutritional outcomes of children since women are primary caregivers and hence can influence their children's nutrition indirectly through their own nutritional status as well as directly through childcare practices. This is because inappropriate nutrition of mothers during pregnancy has the tendency of affecting the child's development and its effects is irreversible (Bhagowalia et al. 2012; Smith, 2003; Alderman, 2013; Bold et al., 2013).

Many studies have found positive association between women's empowerment and child nutrition. While empowerment is measured differently in each study, improving a woman's autonomy or capacity is considered to have a positive impact on child nutrition (Shroff et al, 2009). For instance, in Pakistan, women's intra-household status (which is measured by age at first marriage; percentage age difference between woman and spouse; difference between woman's and spouse's years of education, woman's income, and unearned income from remittances) was positively associated with food security and improved nutritional status among their children (Guha-Khasnobis & Hazarika 2006; Alderman, 2013). Further, Emily et al., (2009) explored the effect of women's autonomy on children's health among traditionally nomadic pastoralist

population in northern Kenya. They tested the hypothesis that women with higher levels of autonomy would have children with better nutrition. Results of the study indicated that while women's autonomy had no effect on younger children between the ages of 0–35 months, children's nutrition as measured by weight-for-age scores showed that, greater levels of women's autonomy were significantly associated with improved nutrition among older children from the ages of 3 years to 10 years. These results suggest that women's autonomy is an important factor in relation to children's health in some circumstances (Emily et al., 2009).

This study seeks to also contribute to the women empowerment – child nutrition literature by examining the relationship between women empowerment measured in three ways: her years of schooling relative to that of her husband, attitude toward domestic violence (measured by whether beating is justified if she neglects her responsibility towards the child) and her autonomy (measured by whether she makes decision regarding the health of the child), and three measures of child nutrition: height-for-age (stunting), weight-for-age (underweight) and weight-for-height (wasting) among children under the age of five.

Literature Review

The focus of the study is to determine how women empowerment affect the nutritional status of children under the age of five. This section therefore seeks to define the concept of women empowerment and review the literature on how women empowerment affects the nutritional status of children under the age of five.

Definition and measurement of women empowerment

The issue of Women's empowerment as a multidimensional concept has been widely recognized as an important objective in global development. However, the meanings and terminologies associated with the concept as well as the procedures for systematically measuring and tackling changes in the levels differ (Schuler et al., 2005). Even though empowerment has been perceived to apply to women and as well as other disadvantaged groups, it is essential to acknowledge that women's empowerment encompasses some unique additional elements (Narayan 2002 & Schuler, 2013).

Women's empowerment can be hypothesised as the ability to make choices or ability to access quality of life or how she can exercise power within the gender framework (Imai et al., 2014 & Schuler, 2013). It should be noted that empowerment and poverty reduction concepts apply not

only to women but also other people who are disadvantaged in the society and hence efforts towards empowering women must be especially cognizant of the implications of broader policy action at the household level (Sidney et al., 2002). On the other hand, empowering women has been seen as a reflection of the outcomes of intra-household resources allocations (for instance, child anthropometric indicators) (Imai et al., 2014).

Since there is an overlap in the specification of women empowerment and bargaining power, the focus of this study will be to define women's empowerment as; (i) mother's relative educational attainment measured by the ratio of mother's and father's schooling years; (ii) presence of domestic violence measured as whether beating is justified if she neglects her responsibility towards the child or children; and (iii) - decision by wife regarding healthcare for the child.

Relationship between women's empowerment and nutritional status of children

Based on previous literature, many studies have found positive association between women's empowerment and child nutrition. While empowerment is measured differently in each study, improving a woman's autonomy or capacity is considered to have a positive impact on child nutrition (Hannan, 2002). For instance, a study done by Bisharat (1990) analyzed the effect of mother's autonomy on child nutritional status within a multiple regression framework. He tried to find out whether it is the availability of other potential child-care substitutes, particularly the grandmother that influences child nutrition rather than household structure. Variables like household income, mother's education, area of residence, and child's sex were used in the analysis. Results showed a strong negative influence associated with having a mother whose autonomy in the household is low. Also, Imai et al in 2014, investigated whether mother's empowerment measured by her education attainment relative to the father's, autonomy and domestic violence was related to nutritional status of children using the National Family Health Survey in India. Quantile regression estimates showed a positive relationship between women's empowerment and nutritional status of children (Imai et al., 2014).

A study by Emile and Steele (2009) explored the effect of women's autonomy on children's health. Research was conducted among the Rendille, a traditionally nomadic pastoralist population living in northern Kenya. Using data collected from 435 women and 934 of their children, they tested the hypothesis that women with higher levels of autonomy would have children with better

nutrition. Results of the study indicated that while women's autonomy had no effect on younger children between the ages of 0–35 months, children's nutrition as measured by weight-for-age scores showed that, greater levels of women's autonomy were significantly associated with improved nutrition among older children from the ages of 3 years to 10 years. These results suggest that women's autonomy is an important factor in relation to children's health in some circumstances (Emile & Steele, 2009).

Theoretical Consideration

Following Imai et al., (2014), the study uses the cooperative bargaining model under the non-unitary model framework which places much emphasis on the bargaining power and choices of the individual. Under the cooperative model, either spouse is assumed to obtain their satisfaction from their own consumption of commodities and public goods while the bargaining process is influenced by environmental parameters (EEP) (McElroy, 1990; McElroy & Horney, 1981 as cited in Imai et al., 2014).

It is assumed that a household is made up of a mother, *m*, a father, *f*, and a number of children, *k*, seen to be a "public good" for both parents. Children are not decision makers and for easiness parents care about the nutritional status or health care of their children. let x_j be the jth person consumption (*j= m, f),* and *q* be the (average) health quality of children. The *jth* person utility is defined as $U_j\ (x_j, q_j / A_j)$. Here, A_j, EEP is seen as vector consisting of exogenous factors that determine the preference of the individual *j*. A_j may depend on the factors determined outside the households such as unearned income for *j* as well as his or her individual characteristics. Each individual is assumed to choose x_j (own consumption) to maximize q (child health). In this setting the household utility function is defined as $_{\mathrm{E}}U_m(x_m$, q; $A_m) + (1 - \mathrm{E})\ U_f(x_f$, q; $A_f)$ where $_E$ represents the bargaining power of the mother (wife) in the household (*0< $_E$ <1*). The household utility maximization problem is specified as follows:

$$\text{Max } U^H = {}_{\mathrm{E}}U_m\ (x_m, \mathrm{q}; A_m) + (1 - \mathrm{E})\ U_f(x_f, \mathrm{q}; A_f) \quad \text{.....(1)}$$

$$x_m, x_f, q$$

Subject to:

$$\mathrm{I} = p_m x_m + p_f x_f + p_{\mathrm{c}}\mathrm{q} \text{.....} \quad (2)$$

I is a household's income, p_i is the private good for the mother or the father, and p_c is the shadow price of public goods that is children in this case. In general q^*(health quality of child) will depend on parameters such as $_E\, p_c, I, p_i \ and \ A_i$ as follows:

$q^* = q^*(_E, I, p_m, p_f, p_c, A_m, A_f)$ ... ... (3)

The model highlights decision made by the household in relation to the health of the child. For instance, "bargaining power" $_E$ present women empowerment represented by female educational attainment and participation of female in the labour force given that the mother is more likely to value q than the father, the stronger the bargaining power of the mother is reflected in higher $_E$. A_i reflects each household members attitude towards health care. Also, it is expected that economic growth increases the household income level and improve the health of the children (Imai et al., 2014). It should be noted that the "bargaining power" $_E$ is considered as an exogenous variable determined by female education as a reflection of cultural factors.

Data

The Ghana Demographic and Health Survey, 2014 (GDHS 2014) is used for the study. GDHS is a nationally representative survey of women and men aged beween15-49 and 15-59 respectively. It is the sixth in a series of population and health survey that has been conducted in Ghana. The primary purpose is to generate reliable information on fertility, family planning, infant and child mortality, maternal, child health and nutrition (GSS, 2014. Nutritional status of children is estimated as Z scores weight-for-height (wasting), height-for-age (stunting) and weight-for-age (underweight) for children below the age of five. The Z score measures are used as postulated by the World Health Organization (WHO) in 2006.

$$Z\ score\ = \frac{Xi - X_{median}}{\delta^x} \qquad (4)$$

X_i for instance is height of child i, X_{median} represents the median height of the reference group of the same age and sex and δ^x represents the standard deviation from the mean of the reference population. This study classifies children with a Z score below -3 as "severely stunted, and those with Z score between -3 and -2 as "moderately stunted". Also underweight and wasting are also defined in this study following the same procedure for calculating stunting. Children with Z score below -4 is defined as "acutely malnourished. This will help to examine the determinants of acute malnutrition at the tail end of the distribution. Even though biologically this cannot be determined,

however, given that WHO classifies children with 'Z score below -3 as severely stunted", then the level of malnutrition for children below -4 should be acutely severe and hence would have severe consequences in their later life (Imai et al, 2014 and Gupta et al, 2005). In addition, as the factors that influence overweight and underweight in children are likely to be different, factors affecting those in the other ranges is also considered.

Econometric Specification

The purpose of the econometric analysis is to unearth the determinants of child malnutrition in Ghana by testing (i) "whether the mother's empowerment as measured by mother's relative bargaining power is associated with the nutritional status of her children?" and (ii) "Which other factors (including those related with children, infrastructure, household and policy) are connected with children's nutritional status?". In order to achieve the objectives, multiple estimation technique is applied in order to distinguish this study from those done in Ghana. Following Imai et al. (2014), quantile regression (QR) technique as well as ordinary least squares (OLS) is used to estimate different coefficient estimates at different points in the conditional distribution of nutritional status, rather than at the mean.

Ordinary Least Square

With reference to the theoretical review explained above, a simple version of the bargaining model is presented. However, it must be emphasized that it is difficult to identify variables that will exactly fit the model as explained above. Notwithstanding the challenges, a reduced form equation approach is used with the child nutritional status as a function of the bargaining indicators and household characteristics, since the Ghana Demographic and Health Survey data does not include the variables such as prices specific to father's or mother's consumption or the individual unearned income. *i* is used to denote the *ith* child (or a unique number) identifying a particular child) and *h* for the *hth* household (a household identification number) in a total sample at time *t* (year). We estimate q_{ih}, a nutritional status indicator (namely Z score of height for-age, weight for-age, or weight-for-height) which is adapted from Imai et al (2014) as:

$$q_{ih} = q_{ih}\,(E_h,\ D_i,\ X_h,\ Z_h,\ H_i, \mathrm{R}, \mathrm{P}) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (5)$$

A_m and A_f (or A_m/A_f) is assumed to be captured by a single variable E_h which represents the mother's relative (to father's) bargaining power. The variable, E_h is the measure of women's

empowerment and comprises our central independent variable. As explained, women's empowerment (E_h) is proxy by (i) the proportion of mother's years of schooling to father's years schooling ([schooling years of mother]/[schooling years of father]); (ii) a dummy variable on whether the father (husband) is justified in hitting or beating the mother (wife) when the mother (wife) neglects her responsibility towards the child (1 for Yes,0 for No); (iii) a dummy variable on whether the mother (wife) decides on the healthcare of the child (1 for Yes, 0 for No). Given that there could be a problem of endogeneity of women empowerment, E and decision of household on quality of health, the study instrumented mother's years of schooling relative to the father by the differences in ages of both mother and father. However, after the instrumental variable estimation it was realized that the women relative education variable did not pass the endogeneity tests and not presented here in.

D_i represents a vector of characteristics of the *ith* child; either male or not; age of the child; squared of child age; and the birth order of the child either the second, third, or fourth child. X_h is a vector of household specific variables, such as household characteristics and compositions, including, mother's age; mother's age squared; household size, mother's occupation (Agric sector, manual job and service) and whether a household has access to a radio and flush toilet. Z_h is a vector of variables capturing the social; environmental; or infrastructural factors specific to the *hth* household: time necessary for getting water; H_h is a policy variable that would affect child's health. Whether any member of the household to which a child belongs has access to a health insurance or a healthcare scheme? Health insurance or a healthcare scheme is broadly defined to include government sponsored health insurance scheme or private medical insurance schemes.

Quantile Regression

It is prudent to evaluate the consequence of various variables on child nutritional status on different points in its conditional distribution since behavioural response to predictors (e.g., mother's bargaining power) is likely to be different between malnourished child and an overweight child. The quantile regression for the θth percentile takes the form:

$$\min_{b\in R^N}[\sum_{i\in(i:q_i\geq X_I b)}\theta\,|q_i - x_i b| + \sum_{i\in(i:q_i<X_I b)}(1-\theta)|q_i - x_i b|] \ldots\ldots\ldots (6)$$

Where $0 < \theta < 1$, q_i is a dependent variable (Z score of the child nutritional status), and x_i vector represent the explanatory variable in the fifth equation. Studies over the years have shown results

for θ=0.10, 0.25, 0.50, 0.70, and so on, but this study chooses the median of each nutritional group for θ to evaluate the (approximate) determinants of nutritional condition for each group. For instance, if we find that 10 percent of children are acutely undernourished (Z score < -4), θ value of 0.05 is used. Also, it should be noted that because of the issue of heteroscedasticity among the error term of each group, bootstrap estimates of asymptotic variance are calculated with 1000 repetitions.

Results

This section discusses the main findings from the models presented in section 6. Table 1 presents the coefficient estimates of women empowerment indicators, namely, (i) the ratio of mother's years of schooling to father's years of schooling (mother's relative education); (ii) whether beating of wife is justified if she neglects her responsibility towards the children (presence of domestic violence); or (iii) wife is allowed to make decision in the household regarding the health of the child (autonomy). Average education of the mother and the father of the child is used as a control variable for the relative bargaining power. Results of the coefficients of all the other explanatory variables are presented in Table 2, 3 and 4.

Women's empowerment estimates

In the subsequent paragraph, results of the three measures of women empowerment variables are discussed.

Mother's years of schooling relative to the father's

The results for mother's years of schooling relative to that of the father differs from the OLS and QR estimations. Even though mother's years of schooling relative to that of the father was not statistically significant in explaining the nutritional status of children for the full models of OLS (height-for-age, weight-for-age and weight-for-height), the quantile regression (QR) results suggest important differences at different points in the conditional distribution of height-for-age (stunting), weight-for-age (underweight) and weight-for-height (wasting). In all the estimations, average years of schooling for the mother and the father was controlled for to

appreciate the conditional correlation that may exist between their relative differences in educational attainments. Average education was significant and positive for almost all the estimations for both OLS and QR.

First of all, mother's years of schooling relative to the father and average years of schooling was controlled for to see how this affects the health status of the child. The results showed that relative empowerment was significant in reducing over-nutrition among children with Z score > 2 and 3 for height-for-age as shown in Table 1 and 2. Also, even though it was not statistically significant in explaining wasting and underweight among children using OLS estimation technique, the QR results showed that it was statistically significant and positive in improving the nutritional status of children who are acutely wasted and underweight (Z score < -4) as well as severely wasted (Z score < -3) at 1 percent level of significance as shown in Table 1. The stepwise regression for height-for-age and weight-for-age for mother's years of schooling relative to the husband (Table 1) showed that a child whose mother is relatively better educated tends to have a better nutritional status in some cases. At the upper end of the distribution, the coefficients of mother's years of schooling relative to that of the father was negative and significant at 1 percent in reducing the rate of over-nutrition in children for height-for-age. Also, after controlling for other explanatory variables, mother's relative education was statistically significant in reducing over-nutrition among children for height-for-age as shown in Table 2. This underscore the fact that mother's relative education tends to impact greatly on those at the upper end of the distribution (over-nourished children) for height-for-age as well as for those with Z score < - 4 and Z score < -3 for weight-for-height and Z score of < -4 for weight-for-age. This suggest that children of mothers with little education relative to husband's tends to be over-nourished as well as undernourished which may be harmful to the health of the child.

Presence of Domestic Violence

Domestic violence, measured as whether a husband is justified by beating the wife if she neglects her responsibility towards the children is negative and statistically significant for OLS and for most of the nutritional scores for the QR at 5 percent as shown in Table 1. Even though in Table 2, 3 and 4 domestic violence was not statistically significant for the OLS estimations, the QR showed that domestic violence negatively affects children with Z score between -1 to 1 for stunting and underweight children as well as negative and significant for children at the upper tail of the conditional distribution for children weight-for-height. This means that lack of women's

empowerment (domestic violence) is associated with child malnutrition. In the nut shell, it can be said that children with mothers who have less empowerment are likely to have poor nutritional status compared to their counterpart who do not.

Autonomy in decision making of the mother

Mother's autonomy in decision making in the day to day activities is proxied by "she makes decision regarding the health of the child" was statistically significant for stunting and underweight children for OLS estimation as shown in Table 1. The QR results for Table 1 also indicates that autonomy helps improve the nutritional status of children with Z score < -2 to 1 for stunting and underweight children. When other explanatory variables were added, autonomy of the mother was not statistically significant in explaining the nutritional status of children for the OLS however, the QR showed that autonomy is positively related to improving the health status of undernourished children for stunted and underweight children as shown in Table 2 and 3. The results of the QR suggest that the positive association for height-for-age and weight-for-age is more clearly observed for children who are under-nourished to normal. Taking the case of weight-for-age, the coefficient estimate is positive and significant with the estimate larger (0.243) for malnourished (Z score < -2) children. This means that having autonomy is associated with improvement in the height-for-age and weight-for-age. This finding underscores the fact that mother's autonomy could play a vital role in reducing stunting and underweight in children under the age of five.

Table 1: A summary of the relationship between bargaining power of mother and prevalence of child malnutrition in Ghana

		Undernourished			Normal			Over-nourished	
	OLS	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
variables	**Height-for-age**	**Z score -4**	**Z score -3**	**Z score -2**	**Z score -1**	**Z score 0**	**Z score 1**	**Z score 2**	**Z sore 3**
Mother's years of	-0.0252	0.0602	-0.0294	-0.00353	-0.00381	-0.0354*	**-0.0345****	**-0.0408****	**-0.0423****
Schooling/father's	(0.0154)	(0.0957)	(0.0514)	(0.0337)	(0.0175)	(0.0188)	(0.0170)	(0.0170)	(0.0171)
Average years of	**0.0597*****	0.00347	**0.0916*****	**0.0892*****	**0.0722*****	**0.0606*****	**0.0619*****	0.0614***	0.0618***
Schooling	(0.00574)	(0.0594)	(0.0255)	(0.00955)	(0.00676)	(0.00771)	(0.00739)	(0.00652)	(0.00645)
Constant	-1.296***	-4.901***	-3.897***	-3.076***	-2.231***	-1.635***	-1.398***	-1.319***	-1.308***
	(0.0493)	(0.314)	(0.164)	(0.0840)	(0.0611)	(0.0615)	(0.0587)	(0.0559)	(0.0562)
	Weight-for-age								
Mother's years of	-0.0119	**0.138*****	0.0252	-0.0128	-0.000620	-0.00863	-0.0132	-0.0144	-0.0162
Schooling/father's	(0.0132)	(0.0391)	(0.0271)	(0.0304)	(0.0205)	(0.0151)	(0.0133)	(0.0129)	(0.0127)
Average years of	**0.0435*****	**0.132***	**0.0751*****	**0.0517*****	**0.0500*****	**0.0398*****	**0.0458*****	0.0432***	0.0420***
schooling	(0.00480)	(0.0778)	(0.0275)	(0.0120)	(0.00737)	(0.00495)	(0.00574)	(0.00585)	(0.00586)
Constant	-0.981***	-5.418***	-3.835***	-2.687***	-1.919***	-1.281***	-1.057***	-0.995***	-0.974***
	(0.0402)	(0.508)	(0.215)	(0.0822)	(0.0638)	(0.0424)	(0.0500)	(0.0531)	(0.0526)
	Weight-for-height								
Mother's years of	0.00165	**0.168*****	**0.145*****	0.00754	0.00634	0.00943	-0.00317	-0.00250	0.00482
Schooling/father's	(0.0139)	(0.0185)	(0.0431)	(0.0304)	(0.0266)	(0.0207)	(0.0177)	(0.0178)	(0.0177)
Average years of	**0.0123****	**0.141*****	**0.124*****	0.0264	**0.0198****	**0.0121***	**0.0123****	**0.0111****	0.00889*

Schooling	(0.00507)	(0.0179)	(0.0381)	(0.0161)	(0.00845)	(0.00682)	(0.00503)	(0.00549)	(0.00533)
Constant	-0.342***	-4.954***	-4.673***	-2.578***	-1.646***	-0.889***	-0.467***	-0.368***	-0.335***
	(0.0420)	(0.153)	(0.380)	(0.159)	(0.0726)	(0.0555)	(0.0441)	(0.0480)	(0.0473)

Variables	**Height-for-age**	**(1) Z score -4**	**(2) Z score -3**	**(3) Z score -2**	**(4) Z score -1**	**(5) Z score 0**	**(6) Z score 1**	**(7) Z score 2**	**(8) Z score 3**
Mother's years of	-0.0221	0.0484	0.0242	0.00585	-0.00131	-0.0295*	**-0.0362***	**-0.0392****	**-0.0398****
schooling/father's	(0.0160)	(0.102)	(0.0495)	(0.0373)	(0.0148)	(0.0175)	(0.0190)	(0.0187)	(0.0187)
Average years of	**0.0559*****	0.0300	**0.0836*****	**0.0740*****	**0.0633*****	**0.0590*****	**0.0611*****	0.0590***	0.0584***
schooling	(0.00618)	(0.0694)	(0.0251)	(0.0114)	(0.00729)	(0.00750)	(0.00673)	(0.00695)	(0.00695)
Autonomy	**0.105***	-0.108	0.269	**0.293*****	**0.197****	**0.150***	0.100	0.121	0.127
	(0.0630)	(0.452)	(0.210)	(0.113)	(0.0806)	(0.0821)	(0.0662)	(0.0767)	(0.0795)
Domestic violence	**-0.141****	0.0820	**-0.386****	-0.110	**-0.193*****	**-0.170****	**-0.160****	**-0.171****	**-0.153****
	(0.0622)	(0.504)	(0.182)	(0.103)	(0.0731)	(0.0755)	(0.0666)	(0.0682)	(0.0681)
Constant	-1.298***	-4.910***	-3.958***	-3.149***	-2.270***	-1.671***	-1.404***	-1.342***	-1.335***
	(0.0730)	(0.455)	(0.221)	(0.123)	(0.103)	(0.0868)	(0.0791)	(0.0912)	(0.0935)
	Weight-for-age								
Mother's years of	-0.00625	**0.165*****	0.0309	-0.0109	-0.0133	-0.00458	-0.0115	-0.0127	-0.0142
Schooling/father's	(0.0138)	(0.0573)	(0.0334)	(0.0360)	(0.0229)	(0.0167)	(0.0118)	(0.0118)	(0.0118)
Average years of	**0.0411*****	0.0316	**0.0784****	**0.0504*****	**0.0409*****	**0.0370*****	**0.0379*****	0.0377***	0.0381***
schooling	(0.00512)	(0.0796)	(0.0323)	(0.0137)	(0.00731)	(0.00534)	(0.00646)	(0.00633)	(0.00639)

Autonomy	**0.102****	0.308	0.221	0.232	**0.187*****	**0.100***	**0.109***	**0.116***	0.103*
	(0.0512)	(0.641)	(0.274)	(0.150)	(0.0719)	(0.0546)	(0.0625)	(0.0617)	(0.0613)
Domestic violence	**-0.103****	-0.242	-0.0812	-0.0777	-0.112	**-0.130****	**-0.129****	**-0.106***	-0.117*
	(0.0494)	(0.522)	(0.354)	(0.161)	(0.0749)	(0.0529)	(0.0599)	(0.0605)	(0.0611)
Constant	-1.016***	-5.203***	-3.980***	-2.781***	-1.951***	-1.305***	-1.047***	-1.017***	-0.992***
	(0.0582)	(0.612)	(0.276)	(0.169)	(0.0822)	(0.0640)	(0.0680)	(0.0675)	(0.0669)
	Weight-for-height								
Mother's years of	0.00752	**0.169*****	**0.142****	0.00569	0.00846	0.00995	0.00143	0.00850	0.0190
schooling/father's	(0.0147)	(0.0619)	(0.0670)	(0.0320)	(0.0333)	(0.0197)	(0.0196)	(0.0183)	(0.0176)
Average years of	**0.0118****	**0.142*****	**0.141*****	0.0235	0.0116	0.0115	0.00898	0.00662	0.00617
schooling	(0.00542)	(0.0279)	(0.0410)	(0.0196)	(0.0102)		(0.00585)	(0.00498)	(0.00482)
Autonomy	0.0580	-0.0598	-0.514	0.109	0.160	0.0737	0.0400	0.0476	0.0518
	(0.0521)	(0.289)	(0.339)	(0.166)	(0.111)	(0.0736)	(0.0612)	(0.0560)	(0.0589)
Domestic violence	-0.0532	0.000342	-0.191	-0.0255	-0.0700	-0.0600	**-0.130****	**-0.148****	**-0.150****
	(0.0527)	(0.220)	(0.276)	(0.205)	(0.112)	(0.0684)	(0.0540)	(0.0573)	(0.0598)
Constant	-0.381***	-4.909***	-4.212***	-2.653***	-1.718***	-0.924***	-0.441***	-0.349***	-0.339***
	(0.0602)	(0.339)	(0.403)	(0.201)	(0.117)	(0.0906)	(0.0643)	(0.0615)	(0.0653)
Observations	**2,369**	**2,369**	**2,369**	**2,369**	**2,369**	**2,369**	**2,369**	**2,369**	**2,369**

Robust standard errors in parentheses

***** p<0.01, ** p<0.05, * p<0.1**

Household access to healthcare scheme

Household access to health insurance was proxied by "whether any member of the household has access to health insurance or healthcare scheme either private or government. The results suggest that household access to health insurance or healthcare scheme is associated with better nutritional status. The estimated coefficient of health insurance on stunting, underweight and wasting was not only significant but also quite large for all the estimation techniques. The results imply that policy intervention aimed at improving health care access to all especially mothers will help improve the nutritional status of children in terms of height-for-age, weight-for-age and weight-for-height.

Other covariates

This section discusses other explanatory variables used in estimating the OLS and the QR. It must be noted that there exit some variations in terms of the coefficients estimated using OLS and QR. For instance, in some cases, the results of the QR are different from the OLS with different signs at the different point of conditional distribution. For instance, the age of the child is negative and significant with its squared positive and significant for all the estimation techniques for height-for-age implying that as the child ages there is the possibility that the values for height-for-age improves. A similar situation is observed in Table 3 even though it was not significant for children with Z score < -4 and < -3.

Environment

The result on Table 2 and 3 shows that time necessary for getting water is negative and statistically significant in some cases for height-for-age and weight-for-age for QR even though same cannot be said for weight-for-height. This is expected in the sense that, water is an essential commodity that every household needs for their daily activities such as drinking, washing and for other hygienic purposes however fetching of water is seen as one of the responsibilities of mothers and hence there exist a trade-off between this activity and taking care of the child.

Characteristics of the child

The results show that male children are more stunted as compared to their female counterparts while female children are more wasted than male children (Table 2 and 4). Given that previous research suggests that the sign of sex dummy of a child over the years can differ across countries (Imai et al., 2014), the results from this study confirms the situation that pertains in Ghana. This is because, this assertion is supported by the GDHS 2014 report which asserts that males are better

off in terms of wasting and worse off in terms of stunting. In Table 2, higher birth order was associated with poor nutrition (Z score < 1). This assertion is supported by Rahman (2016) who examined the net effect of birth order on child nutritional status in Bangladesh using logistic regression and found that higher order (fourth and fifth birth) was associated higher rate of stunting among children. Even though same cannot be said with regard to wasting, according to Horton, 1998 and Kahn, 2014, birth order effects are seen to be very strong in the case of stunting which represents the long-term nutritional status of children and less obvious in the case of wasting for children under the age of five.

Household characteristics

As the number of members in the household increases, the care given to each child reduces as resources must be shared among them equally and hence impact negatively on their health (Imai et al., 2014). From the empirical results, it can be seen that as the number of members in the household increases it negatively impact on height-for-age and weight-for-age at 5 percent level of significance as seen in Table 2 and 3. That is to say that, having larger household size is associated with lower levels of nutrition especially for height-for-age and weight-for-age. Age of the mother on the other hand is positive and significant with its squared negative and significant which for the upper tail of the distribution for weight-for-age which implies that older mother tends to have better nourished children with a non-linear effect for weight-for-age. The results in Table 2, 3 and 4 shows that households that own a radio is associated with better nutritional status for height-for-age and weight-for-age in most of the cases at 5 percent level of significance. However, it can be seen that its effect is slightly higher in children with Z score < - 4 for height-for-age (acutely stunted) and for those with Z score < -4 for weight-for-age (acutely underweight). This implies that presence of radio in the household may be a medium through which a household can access information on nutrition. The study further indicates that household with access to flush toilet tend to have children with better nutritional status for OLS and those with Z score <-1 for weight-for-age as shown in Table 3. Even though it is significant and positive for the OLS, the QR showed that its effect is high on children with Z score < -1. This assertion therefore implies that children with poor toilet facility is associated with poor nutrition. This is because according to Badasu et al., (2010) children who experience severe deprivation in term of sanitation and toilet facilities goes a long way to affect their health. He asserted that there could be the possibility of transfer of infection from one person to the other as these facilities are shared. This suggests that

if improved toilet facilities are made available to households it will go a long way to reduce the rate of malnutrition among under five children in the household. However, having access to improved toilet facility may not be enough to ensure improvement in nutritional status hence the need for the implementation of proper hygienic practices.

Occupation of the mother

Maternal occupation is known in the literature to have either positive or negative effect on child health in relation to the type of work done by the mother. This study categorised maternal occupation into three groups (agriculture, service and manual work) to analyse how it relates to child health. The findings from the study showed that mother's engaged in agricultural activities as well as service activities tend to have children with better health status than their counterparts who are engaged in manual work. In Table 2 agriculture and service was positive and statistically significant for OLS and at the lower tail of the distribution for QR at 10 percent level of significance for height-for-age. This assertion supports the work done by Susan in Kenya that children with mothers in the agricultural sector tends to have better nutritional status than their counter part who are not (Susan, 1996). However, the analyses differ for prevalence of wasting among children. From Table 4 it can be seen that children with mothers engaged in manual work have better nutritional status (weight-for-height) than their counterparts in the agriculture and service sectors. This assertion supports the findings of Adeladza (2009) who asserted that children whose parents engaged in manual work (mechanical or factory) tends to have better weight-for-age Z score compared to their counterparts who are not. This could be due to the fact that parents in this category probably get higher income and also enough time to cater for the children.

Table 2: Women empowerment and Prevalence of Stunting among children under age five

		Undernourished			Normal				Over-nourished
Variables	**Height-for-age**	**(1) Z score -4**	**(2) Z score -3**	**(3) Z score -2**	**(4) Z score -1**	**(5) Z score 0**	**(6) Z score 1**	**(7) Z score 2**	**(8) Z score 3**
Mother's years of	-0.00854	0.0166	-0.0204	-0.00484	0.00276	-0.0205	-0.0359**	**-0.0412****	**-0.0394***
Schooling/ father's	(0.0145)	(0.0865)	(0.0553)	(0.0323)	(0.0166)	(0.0139)	(0.0178)	(0.0204)	(0.0208)
Average school	**0.0269*****	0.0419	**0.0750*****	**0.0432*****	**0.0397*****	**0.0307*****	**0.0252*****	0.0233***	0.0233***
	(0.00687)	(0.0448)	(0.0284)	(0.0134)	(0.00996)	(0.00839)	(0.00761)	(0.00758)	(0.00760)
Autonomy	0.0779	0.280	-0.00532	**0.200***	**0.156****	**0.189*****	**0.116***	0.110*	0.113*
	(0.0595)	(0.352)	(0.204)	(0.104)	(0.0761)	(0.0723)	(0.0676)	(0.0650)	(0.0653)
Domestic violence	-0.0936	-0.0603	-0.102	-0.0928	-0.0967	**-0.118***	**-0.128****	**-0.102***	-0.100
	(0.0577)	(0.319)	(0.214)	(0.0958)	(0.0796)	(0.0691)	(0.0621)	(0.0619)	(0.0618)
Child age	**-0.928*****	**-1.156*****	**-0.783*****	**-0.758*****	**-0.853*****	**-0.890*****	**-0.954*****	-0.946***	-0.948***
	(0.0633)	(0.368)	(0.252)	(0.108)	(0.0823)	(0.0744)	(0.0688)	(0.0689)	(0.0688)
Squared age	**0.178*****	**0.281*****	**0.168*****	**0.155*****	**0.173*****	**0.176*****	**0.186*****	0.185***	0.185***
	(0.0147)	(0.0859)	(0.0617)	(0.0258)	(0.0185)	(0.0172)	(0.0163)	(0.0164)	(0.0164)
Health insurance	**0.200*****	**1.040*****	0.201	**0.208****	**0.127***	**0.161****	**0.178*****	**0.192*****	**0.192*****

	(0.0551)	(0.352)	(0.240)	(0.105)	(0.0718)	(0.0636)	(0.0597)	(0.0600)	(0.0600)
Toilet facility	0.0357	-2.352**	0.0395	0.0755	0.0306	0.00761	0.0185	0.0128	0.0124
	(0.0243)	(0.950)	(0.368)	(0.0492)	(0.0347)	(0.0354)	(0.0456)	(0.0509)	(0.0523)
Agriculture	**0.130***	**0.716***	0.422	0.0595	0.107	0.116	0.0979	**0.128***	0.134*
	(0.0690)	(0.369)	(0.305)	(0.125)	(0.0825)	(0.0812)	(0.0740)	(0.0753)	(0.0760)
Service	**0.122***	0.437	0.332	0.00458	0.0956	0.114	0.114	**0.151****	**0.154****
	(0.0659)	(0.353)	(0.281)	(0.116)	(0.0822)	(0.0807)	(0.0767)	(0.0752)	(0.0754)
Male child	**-0.0972****	0.162	-0.269	**-0.151***	**-0.116***	**-0.111***	**-0.110****	**-0.113****	**-0.118****
	(0.0493)	(0.271)	(0.178)	(0.0867)	(0.0649)	(0.0583)	(0.0550)	(0.0564)	(0.0568)
Radio	**0.142****	**0.800****	**0.693*****	**0.236****	0.0773	**0.132***	**0.108***	**0.130****	0.125**
	(0.0558)	(0.338)	(0.213)	(0.104)	(0.0626)	(0.0686)	(0.0612)	(0.0615)	(0.0623)
Household size	**-0.0310*****	-0.0239	-0.0417	**-0.0350***	**-0.0302****	-0.0253	**-0.0243****	**-0.0262****	-0.0252**
	(0.0109)	(0.0553)	(0.0319)	(0.0201)	(0.0153)	(0.0159)	(0.0118)	(0.0114)	(0.0114)
Mother's age	**0.0638***	-0.218	**-0.200****	0.00714	0.0678	0.0565	0.0535	0.0613	0.0651
	(0.0332)	(0.188)	(0.102)	(0.0502)	(0.0431)	(0.0495)	(0.0441)	(0.0434)	(0.0432)
Squared of age	-0.000686	0.00340	**0.00312****	1.98e-05	-0.000767	-0.000569	-0.000464	-0.000630	-0.000690
	(0.000500)	(0.00274)	(0.00152)	(0.000782)	(0.000626)	(0.000733)	(0.000655)	(0.000644)	(0.000643)
Time to water source	**-0.0048*****	0.00404	0.00109	-0.00377	**-0.00703*****	**-0.00608*****	**-0.00690*****	0.00719***	0.00695***
	(0.00147)	(0.00790)	(0.00352)	(0.00252)	(0.00175)	(0.00204)	(0.00184)	(0.00180)	(0.00177)
Second birth	0.0527	-0.0200	0.141	0.129	0.0947	0.0883	0.0213	-0.0183	-0.0188

	(0.0787)	(0.477)	(0.277)	(0.118)	(0.123)	(0.0943)	(0.0956)	(0.0971)	(0.0979)
Third birth	0.00631	-0.548	-0.0303	0.145	0.134	0.0292	-0.0187	-0.0458	-0.0504
	(0.0911)	(0.695)	(0.371)	(0.159)	(0.131)	(0.108)	(0.105)	(0.106)	(0.107)
Fourth birth	-0.162	-0.0956	-0.0457	-0.0588	-0.0770	-0.144	**-0.204***	-0.177	-0.177
	(0.101)	(0.641)	(0.352)	(0.158)	(0.150)	(0.119)	(0.117)	(0.119)	(0.120)
Constant	-1.617***	-2.186	-0.620	-2.480***	-2.598***	-1.915**	-1.480**	-1.520**	-1.580**
	(0.506)	(3.053)	(1.459)	(0.733)	(0.671)	(0.766)	(0.677)	(0.668)	(0.665)
Observations	2,307	2,307	2,307	2,307	2,307	2,307	2,307	2,307	2,307

Robust standard errors in parentheses

***** p<0.01, ** p<0.05, * p<0.1**

Table 3: Women empowerment and prevalence of underweight among children under-five

		Undernourished				Normal			Over-nourished
Variables	**Weight-for-age**	**(1) Z score -4**	**(2) Z score -3**	**(3) Z score -2**	**(4) Z score -1**	**(5) Z score 0**	**(6) Z score 1**	**(7) Z score 2**	**(8) Z score 3**
Mother's years of schooling/father's	0.00258	0.0379	-0.0149	-0.0244	0.00955	0.0100	-0.00674	-0.00473	-0.00615
	(0.0137)	(0.0563)	(0.0510)	(0.0333)	(0.0201)	(0.0155)	(0.0154)	(0.0156)	(0.0158)
Average school	**0.0306*** **	**0.0700** **	**0.0601** **	**0.0379** **	**0.0375*** **	**0.0336*** **	**0.0276*** **	0.0271***	0.0270***
	(0.00620)	(0.0348)	(0.0290)	(0.0174)	(0.00908)	(0.00778)	(0.00771)	(0.00780)	(0.00782)
Autonomy	0.0626	0.290	-0.0927	**0.243***	0.109	0.0801	0.0393	0.0314	0.0323
	(0.0522)	(0.289)	(0.225)	(0.132)	(0.0865)	(0.0683)	(0.0694)	(0.0675)	(0.0669)
Domestic violence	-0.0789	-0.200	-0.347	0.00413	-0.0854	**-0.124** **	**-0.111***	**-0.112***	-0.117*
	(0.0492)	(0.280)	(0.219)	(0.147)	(0.0718)	(0.0575)	(0.0649)	(0.0677)	(0.0678)
Child age	**-0.285*** **	0.514	0.313	**-0.245***	**-0.295*** **	**-0.247*** **	**-0.226*** **	**-0.216*** **	-0.233***
	(0.0550)	(0.350)	(0.329)	(0.138)	(0.0802)	(0.0667)	(0.0706)	(0.0742)	(0.0752)
Squared age	**0.0541*** **	-0.0572	-0.0544	**0.0729** **	**0.0684*** **	**0.0500*** **	**0.0400** **	**0.0361** **	0.0394**
	(0.0128)	(0.0751)	(0.0702)	(0.0310)	(0.0185)	(0.0154)	(0.0161)	(0.0166)	(0.0168)
Health insurance	**0.213*** **	**0.641** **	**0.423** **	**0.376*** **	**0.189*** **	**0.209*** **	**0.229*** **	**0.223*** **	0.218***
	(0.0492)	(0.268)	(0.211)	(0.131)	(0.0706)	(0.0606)	(0.0596)	(0.0593)	(0.0590)
Flush toilet	**0.0589** **	-1.341**	-0.704*	0.0627	**0.0744***	0.0498	0.0354	0.0370	0.0451
	(0.0271)	(0.634)	(0.422)	(0.0794)	(0.0389)	(0.0402)	(0.0415)	(0.0419)	(0.0419)

Agriculture	-0.0165	0.0587	-0.376	0.0899	-0.00797	-0.00946	0.0271	0.00628	-0.00782
	(0.0595)	(0.347)	(0.281)	(0.172)	(0.0833)	(0.0775)	(0.0809)	(0.0801)	(0.0798)
Service	-0.0511	0.0869	-0.244	0.0159	-0.00551	-0.0582	-0.0928	-0.102	-0.115
	(0.0580)	(0.319)	(0.250)	(0.147)	(0.0897)	(0.0722)	(0.0785)	(0.0786)	(0.0785)
Male child	0.0175	-0.222	-0.255	-0.0448	0.0227	0.0536	0.0221	0.000546	0.00105
	(0.0431)	(0.204)	(0.175)	(0.110)	(0.0664)	(0.0519)	(0.0517)	(0.0520)	(0.0523)
Radio	0.0478	**0.810*** **	-0.0951	0.173	0.0153	**0.0985***	0.0838	0.0554	0.0551
	(0.0486)	(0.310)	(0.226)	(0.116)	(0.0727)	(0.0552)	(0.0665)	(0.0677)	(0.0676)
Household size	**-0.0198****	-0.00441	-0.0384	-0.0210	-0.0189	-0.0163	**-0.0220****	-0.0169	-0.0182*
	(0.00951)	(0.0574)	(0.0507)	(0.0314)	(0.0143)	(0.0115)	(0.0110)	(0.0109)	(0.0108)
Mother's age	0.0349	0.0196	-0.0836	-0.0513	0.0170	0.0496	**0.0692***	**0.0794****	**0.0820****
	(0.0304)	(0.153)	(0.118)	(0.0590)	(0.0430)	(0.0366)	(0.0393)	(0.0397)	(0.0403)
Squared of age	-0.000404	0.000459	0.00212	0.000912	-0.000136	-0.000634	-0.000901	**-0.00105***	**-0.00110***
	(0.000450)	(0.00224)	(0.00172)	(0.000907)	(0.000612)	(0.000554)	(0.000591)	(0.000596)	(0.000605)
Time to water source	**-0.00339*****	0.000660	0.00101	-0.00276	**-0.00317***	-0.00207	**-0.00270***	**-0.00324****	-0.00303**
	(0.00123)	(0.00787)	(0.00679)	(0.00332)	(0.00188)	(0.00184)	(0.00144)	(0.00139)	(0.00138)
Second birth	0.0480	-0.0584	0.0152	0.119	0.0120	0.00747	0.0321	0.00880	0.0188
	(0.0729)	(0.362)	(0.284)	(0.172)	(0.124)	(0.0929)	(0.101)	(0.102)	(0.102)
Third birth	0.104	-0.0842	0.338	0.307	0.0342	0.0509	0.00517	-0.0321	-0.0140
	(0.0850)	(0.473)	(0.382)	(0.189)	(0.132)	(0.0946)	(0.101)	(0.104)	(0.105)
Fourth birth	0.0366	-0.613	-0.366	0.0134	0.0573	0.0751	0.0516	0.00390	0.0215

	(0.0947)	(0.473)	(0.400)	(0.239)	(0.154)	(0.111)	(0.119)	(0.121)	(0.123)
Constant	-1.432***	-6.627**	-2.895	-2.360***	-2.108***	-2.122***	-2.048***	-2.104***	-2.104***
	(0.464)	(2.602)	(1.998)	(0.892)	(0.696)	(0.557)	(0.585)	(0.593)	(0.604)
Observations	2,307	2,307	2,307	2,307	2,307	2,307	2,307	2,307	2,307

Robust standard errors in parentheses

***** p<0.01, ** p<0.05, * p<0.1**

Table 4: Women empowerment and prevalence of wasting among children under-five

		Undernourished				Normal			Over-nourished
Variables	**Weight-for-height**	**(1) Z score -4**	**(2) Z score -3**	**(3) Z score -2**	**(4) Z score -1**	**(5) Z score 0**	**(6) Z score 1**	**(7) Z score 2**	**(8) Z score 3**
Mother's years of schooling/father's	0.0105	-0.00433	-0.00982	-0.0126	0.00116	0.0141	0.00874	0.00533	0.00418
	(0.0147)	(0.0782)	(0.0751)	(0.0517)	(0.0224)	(0.0223)	(0.0211)	(0.0206)	(0.0201)
Average years of schooling	**0.0219*** **	0.0234	0.0218	0.00857	0.0169	**0.0192** **	0.0106	**0.0138***	0.0114
	(0.00680)	(0.0328)	(0.0323)	(0.0192)	(0.0115)	(0.00866)	(0.00715)	(0.00730)	(0.00740)
Autonomy	0.0271	-0.129	-0.109	0.0558	0.107	0.0638	-0.00644	-0.00727	-0.00414
	(0.0538)	(0.308)	(0.297)	(0.164)	(0.0983)	(0.0709)	(0.0672)	(0.0687)	(0.0691)
Domestic violence	-0.0558	-0.0541	-0.0324	-0.156	-0.0142	-0.0760	**-0.149** **	**-0.127** **	**-0.124***
	(0.0533)	(0.344)	(0.338)	(0.161)	(0.0913)	(0.0708)	(0.0601)	(0.0634)	(0.0640)
Age of child	**0.209*** **	0.299	0.324	**0.671*** **	**0.476*** **	**0.308*** **	**0.242*** **	**0.189** **	**0.187** **
	(0.0596)	(0.293)	(0.287)	(0.190)	(0.109)	(0.0917)	(0.0771)	(0.0743)	(0.0734)
Squared of age	**-0.0323** **	-0.0186	-0.0237	**-0.0930** **	**-0.0675*** **	**-0.0455** **	**-0.0427** **	**-0.0326***	**-0.0318***
	(0.0137)	(0.0699)	(0.0685)	(0.0428)	(0.0248)	(0.0204)	(0.0173)	(0.0169)	(0.0167)
Health insurance	**0.145*** **	0.144	0.187	0.184	**0.170***	**0.219*** **	**0.199*** **	**0.147** **	0.144**
	(0.0521)	(0.280)	(0.278)	(0.161)	(0.0903)	(0.0709)	(0.0669)	(0.0648)	(0.0644)
Flush toilet	0.0544	0.136	0.135	0.0547	0.0113	0.00142	0.0839	0.0795	0.0780
	(0.0370)	(0.143)	(0.138)	(0.0893)	(0.0503)	(0.0623)	(0.0575)	(0.0544)	(0.0528)

Agriculture	**-0.137****	**-0.533***	**-0.497***	0.116	-0.0433	-0.0261	-0.0513	-0.0700	-0.0675
	(0.0638)	(0.274)	(0.268)	(0.174)	(0.121)	(0.0885)	(0.0818)	(0.0810)	(0.0809)
Service	**-0.174*****	**-0.870*****	**-0.862*****	-0.109	-0.0665	-0.0714	-0.0998	-0.103	-0.116
	(0.0625)	(0.322)	(0.327)	(0.210)	(0.108)	(0.0879)	(0.0740)	(0.0770)	(0.0791)
Male child	**0.0815***	0.256	0.272	-0.113	0.0132	0.0771	**0.0908***	**0.0903***	**0.101***
	(0.0459)	(0.263)	(0.245)	(0.147)	(0.0815)	(0.0623)	(0.0547)	(0.0548)	(0.0551)
Radio	-0.0414	0.0599	0.0741	0.0321	0.101	0.0258	-0.0567	-0.0555	-0.0453
	(0.0527)	(0.289)	(0.278)	(0.132)	(0.0951)	(0.0763)	(0.0627)	(0.0630)	(0.0638)
Household size	-0.00109	-0.107	-0.105	-0.0212	0.0133	0.00695	-0.00950	-0.0101	-0.0109
	(0.00991)	(0.0789)	(0.0740)	(0.0340)	(0.0141)	(0.0118)	(0.0121)	(0.0121)	(0.0120)
Mother's age	-0.00779	0.0590	0.0525	**-0.139***	-0.0266	-0.00985	-0.00123	0.0108	0.0115
	(0.0322)	(0.153)	(0.149)	(0.0822)	(0.0501)	(0.0444)	(0.0357)	(0.0361)	(0.0366)
Squared of age	6.32e-05	-0.000158	-6.24e-05	**0.00208***	0.000238	4.91e-05	1.95e-05	-0.000181	-0.000211
	(0.000474)	(0.00229)	(0.00221)	(0.00123)	(0.000729)	(0.000681)	(0.000525)	(0.000520)	(0.000525)
Time to water source	-0.000481	-0.00851	-0.00856	-0.000554	-0.00262	0.000381	0.00147	0.00108	0.00107
	(0.00130)	(0.00939)	(0.00920)	(0.00375)	(0.00241)	(0.00221)	(0.00161)	(0.00147)	(0.00146)
Second birth	0.0245	**0.898***	**0.889***	**0.448****	-0.0193	0.0549	0.0548	0.0256	0.00458
	(0.0772)	(0.478)	(0.474)	(0.206)	(0.138)	(0.0979)	(0.0934)	(0.0944)	(0.0950)
Third birth	**0.158***	0.585	0.562	**0.377***	0.123	0.143	0.172	0.181	0.178
	(0.0888)	(0.488)	(0.491)	(0.228)	(0.122)	(0.137)	(0.108)	(0.114)	(0.115)
Fourth birth	**0.184***	-0.103	-0.103	0.406	0.180	**0.263****	**0.228****	**0.235***	0.206*

	(0.0989)	(0.556)	(0.547)	(0.278)	(0.161)	(0.131)	(0.112)	(0.120)	(0.123)
Constant	-0.583	-4.856**	-4.828**	-1.240	-1.931**	-1.429**	-0.879	-0.864	-0.812
	(0.499)	(2.398)	(2.350)	(1.252)	(0.776)	(0.673)	(0.581)	(0.579)	(0.584)
Observations	2,307	2,307	2,307	2,307	2,307	2,307	2,307	2,307	2,307

Robust standard errors in parentheses

***** p<0.01, ** p<0.05, * p<0.1**

Conclusion and policy recommendations

Using quantile regressions and Ordinary Least Square, this paper explored the effects of women empowerment variables (such as a mother's years of schooling relative to husband, domestic violence and autonomy) and other variables such as household access to health insurance, household size, sex of child and birth order on children's nutrition (height-for-age and weight-for-age) at different point of conditional distribution using 2014 Ghana Demographic and Health Survey dataset. The study revealed that OLS estimates of the determinants of child weight-for-age and height-for-age, which effectively estimate the effects of intervention variables at the mean, can be misleading. First of all, the OLS estimation showed that children of mothers with better educational status have better nutritional status for both height-for-age and weight-for-age, however the quantile regression showed that the positive effect of parental education can be felt at the upper end of the conditional distribution rather than the tail end of the distribution. Sanitation proxied by flush toilet was significant in improving child health status. Third, household assets such as access to radio and health insurance was statistically significant for improving height-for-age and weight-for-age for OLS, and QR estimation techniques.

In the nut shell, the results underscore the importance of education, autonomy and domestic violence as a critical factor of improved nutritional status of children. Also, access to improved toilet facility, health insurance, and reduced number of household members and presence of radio are all important indicators improving the nutritional status of children. Future research should carry out rigorous evaluation on how father's role in the households would affect the nutritional status of children under the age of five. Also, policy intervention such as access to credit and its effect on child malnutrition should be suggested to rigorous analysis to know how these interventions impact on child health outcomes.

References

Adeladza, A. (2009). The influence of socio-economic and nutritional characteristics on child growth in Kwale District of Kenya. *African Journal of Food, Agriculture, Nutrition and Development*, *9*(7)

Block, S. A., Masters, W. A., & Bhagowalia, P. (2012). Does child undernutrition persist despite poverty reduction in developing countries? Quantile regression results. *The Journal of Development Studies*, *48*(12), 1699-1715.

Brunson, E. K., Shell-Duncan, B., & Steele, M. (2009). Women's autonomy and its relationship to children's nutrition among the Rendille of northern Kenya. *American Journal of Human Biology*, *21*(1), 55-64

Doan, R. M., & Bisharat, L. (1990). Female autonomy and child nutritional status: the extended-family residential unit in Amman, Jordan. *Social Science & Medicine*, *31*(7), 783-789.

Ghana Statistical Service (2003). Ghana demographic and Health Survey report. Ghana Statistical Service, Accra, Ghana.

Ghana Statistical Service (2008). Ghana demographic and Health Survey report. Ghana Statistical Service, Accra, Ghana.

Ghana Statistical Service (2014). Ghana demographic and Health Survey report. Ghana Statistical Service, Accra, Ghana.

Ghana Statistical Service. (2014). Ghana Demographic and Health Survey Report

Glover-Amengor, M., Agbemafle, I., Hagan, L. L., Mboom, F. P., Gamor, G., Larbi, A., & Hoeschle-Zeledon, I. (2016). Nutritional status of children 0–59 months in selected intervention communities in northern Ghana from the Africa RISING project in 2012. *Archives of Public Health*, *74*(1), 12.

Greene, W. H. (2008). The econometric approach to efficiency analysis. *The measurement of productive efficiency and productivity growth*, *1*(1), 92-250.

Guha-Khasnobis, B., & Hazarika, G. (2006). Women's status and children's food security in Pakistan. *Food Security: Indicators, Measurement, and the Impact of Trade Openness*.

Imai, K. S., Annim, S. K., Kulkarni, V. S., & Gaiha, R. (2014). Women's empowerment and prevalence of stunted and underweight children in rural India. *World Development*, *62*, 88-105.

Khan, M. (2014). *Effects of Birth Order on Child Nutritional Status* (Doctoral dissertation, © Lahore School of Economics).

Kishor, S., & Gupta, K. (2009). Gender equality and womens empowerment in India. National Family Health Survey (NFHS-3) India 2005-06.

Malhotra, A., & Schuler, S. R. (2005). Women's empowerment as a variable in international development. *Measuring empowerment: Cross-disciplinary perspectives*, *1*(1), 71-88

Mba, C. J., & Badasu, D. M. (2010). Deprivations Among Children in Ghana: Evidence from the 2006 Multiple Indicator Cluster Survey. *The Social Sciences*, *5*(5), 440-5.

Olack, B., Burke, H., Cosmas, L., Bamrah, S., Dooling, K., Feikin, D. R., & Breiman, R. F. (2011). Nutritional status of under-five children living in an informal urban settlement in Nairobi, Kenya. *Journal of health, population, and nutrition*, *29*(4), 357.

Rahman, M. (2016). Association between order of birth and chronic malnutrition of children: a study of nationally representative Bangladeshi sample. *Cadernos de saude publica*, *32*, e00011215

Ruel, M. T., Alderman, H., & Maternal and Child Nutrition Study Group. (2013). Nutrition-sensitive interventions and programmes: how can they help to accelerate progress in improving maternal and child nutrition? *The Lancet*, *382*(9891), 536-551.

Shroff, M., Griffiths, P., Adair, L., Suchindran, C., & Bentley, M. (2009). Maternal autonomy is inversely related to child stunting in Andhra Pradesh, India. *Maternal & Child Nutrition*, *5*(1), 64-74.

Smith, L. C. (Ed.). (2003). *The importance of women's status for child nutrition in developing countries* (Vol. 131). Intl Food Policy Res Inst.

Susan, C. (1996). Maternal occupation and the nutritional status of mothers and children under the age of five years in Msambweni location, Kwale District-Kenya

UNICEF. (2017). WHO, World Bank Group. Levels and Trends in Child Malnutrition in UNICEF/WHO/World Bank Group Joint Child Malnutrition Estimates Key Findings of the 2016 edition. New York: UNICEF; Geneva: WHO; Washington DC: World Bank

Van den Bold, M., Quisumbing, A. R., & Gillespie, S. (2013). *Women's Empowerment and Nutrition: An Evidence Review* (Vol. 1294). Intl Food Policy Res Inst