DIETARY PATTERN, SOCIOECONOMIC STATUS AND CHILD HEALTH OUTCOMES IN GHANA: APPLICATION OF MULTILEVEL ANALYSIS

JACOB NUNOO[1]

FREDERICK NYANZU

Abstract

Child welfare, especially issues bordering on child health, continues to be one of the core issues of development and therefore has featured prominently in most global development agenda especially the Millennium Development Goals (MDGs) and its successor, the Sustainable Development Goals (SDGs). This study revisits the issue on the determinants of child health using the 2012 Ghana version of the Multiple Indicator Cluster Survey with a sample size of 7364, to investigate how infant diet practices impacts child health in Ghana. We estimate the impact of dietary pattern and other socioeconomic characteristics and regional effect on child anthropometric indicators using multilevel estimation technique to control for clustering effect. We found dietary pattern to have a positive impact on child health. In addition, we realised that both mothers' characteristics and regional effect play a role in the growth of the child but mothers' characteristics seems the most driving force when mother effects and regional effect are put at play. It is recommended that parent should adhere to the appropriate diet requirement for their children for better health outcome. Also, it is imperative for policies to be geared towards parents as a first step in ensuring a better child health. In addition policies and programmes directed to the regions, especially the three Northern part of Ghana is very crucial in supporting a positive child health development for children in Ghana.

Key Words: Child Health Outcome, Dietary Pattern, Socioeconomic Status, Multilevel Analysis, Ghana

[1] Corresponding Author's Address: Department of Economics, UCC, Cape Coast
jacob.nunoo@ucc.edu.gh

Introduction

Child welfare, especially issues bordering on child health, continues to be one of the core issues of development and therefore has featured prominently in most global development agenda especially the Millennium Development Goals (MDGs) and its successor, the Sustainable Development Goals (SDGs). Specifically, the fourth target of the MDG (under the broad goal of reducing child mortality) was to reduce by two-thirds, between 1990 and 2015, the under-five mortality rate. This issue again received a renewed interest in the Sustainable Development Goals (SDGs) under its targets 2 and 3 agenda. Specifically, by 2030 the SDGs targets 2.1, 2.2 and 3.2 seek to end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and adequate food all year round; end all forms of malnutrition, including achieving by 2025, the internationally agreed targets on stunting and wasting in children under five years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons and end preventable deaths of new-borns and children under 5 years of age.

The renewed interest is motivated by the critical role good nutrition plays in child development. Undeniably, good nutrition is essential for a child's intellectual and physical development. Adequate and proportional intake of essential macro and micro nutrients is very important to prevent infectious cardiovascular disease (CVDs) and contagious disease. Ensuring that children have adequate nutrition is an important step towards building not only a healthy childhood but also healthy adulthood and a healthy nation. Aside the benefits of reduced public expenditure, a healthy population is no doubt critical in building human capital for national growth and development. Thus, the saying, "a healthy nation is a wealthy nation." Consequently, adequate nutrition is one of the pillars of public health.

The World Health Organisation (WHO) referred good nutrition as the adequate well balanced diet combined with regular physical activity (WHO, 2011). Poor nutrition among children manifests itself in underweight, stunting and wasting. Global estimate of malnutrition indicates that malnutrition is skewed towards Africa and South Asia. Sub-Saharan Africa (SSA) was seen to have the highest prevalence of malnutrition at about forty (40) percent of all children under five years to be stunted, another nine (9) percent wasted, twenty-one (21) percent underweight and seven (7) percent were overweight, (UNICEF, 2013). It is again on record that between 1990 and 2014, stunting prevalence globally declined from 39.6 per cent to 23.8 per cent, and the number of children affected fell from 255 million to 159 million. In 2014, just over half of all stunted children lived in Asia and over one third in Africa (UNICEF/WHO/World Bank, 2015). These rates raise concern about Africa's ability to devise resiliency in striving towards the achievement of the SDG goals 2 and 3

In recent times some efforts has been invested into quantifying the adverse effect of poor nutrition. UNICEF/WHO/World Bank (2015) states that about half of all deaths in children under five are attributable to undernutrition. This has led to loss of about 3 million young lives a year. Other studies have also suggested that malnutrition is the underlying cause of a number of diseases and child deaths: diarrhoea (61%); malaria (57%); measles (52%); pneumonia (45%) and child death (53%) (Black, Morris, & Bryce, 2003; Bryce, Boschi-Pinto, Shibuya, Black, & WHO Child Health Epidemiology Reference Group, 2005). In view of this, various steps have been taken to minimize the incidence of malnutrition via strategies such as food and nutrition security.

The 2014 Ghana Demographic Health Survey (GDHS, 2014) report points out marked differences in relation to child growth. Placing emphasis on height-for-age, a measure of linear

growth (stunted - a condition reflecting the cumulative effect of chronic malnutrition) and weight-for-age, are often seen between different subgroups of children within a country. The report shows that 19 percent of Ghanaian children are stunted (below -2 SD) and 5 percent are severely stunted (below -3 SD), a decrease from the figures of 28 percent and 10 percent, respectively, reported in the 2008 GDHS survey. Although the story show that progress is being made but there is still the need for concern. This is because the report gives an indication that stunting increases with age, peaking at 28 percent among children age 24-35 months which is very high on average compared to the world average. By region, stunting ranges from 10 percent in Greater Accra and while it is worse to 33 percent in the Northern region. This even adds to the assertion that there seems to be disparity in children growth. And this is skewed to the three northern part of Ghana.

Also, from the World Bank statistics, from the year 2008 to 2014, the statistics for HAZ WHZ and WAZ indicates that there is significant drop in the issues. However, more needs to be done on this child health issue, especially that of as shown in the trends and patterns below.

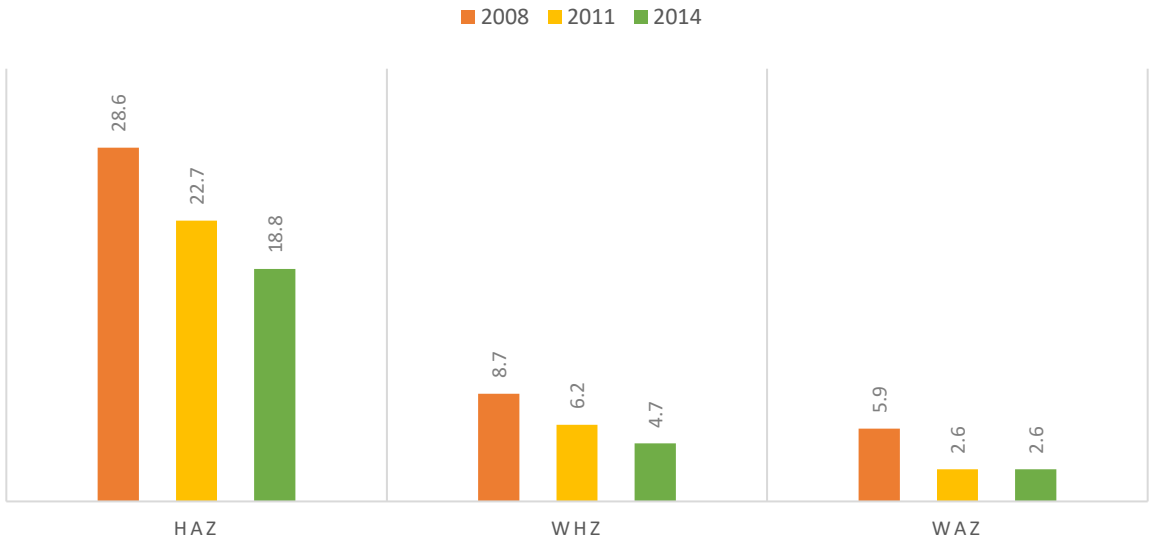

Fig 1: Trends and Patterns in Children under 5 Growth in Ghana
Source: Authors construct from World Bank Indicators 2016.

Figure 1 shows that all the three indicators for measuring child health have been decreasing. An indication that effort are made towards achieving good child growth, the drop seems to be doubled in both the WHZ and WAZ with the exception of HAZ. Hence the need for further effort to be made in such areas as a mechanism for reducing child poor growth in Ghana.

The foregoing issues brings to light why investigating child health outcome in developing countries, specifically Ghana is indeed an important concern that deems appropriate for investigation. In the light of this, the paper seeks to investigate the effects of mothers' socioeconomic characteristics and regional effect on the health of the child. In additions, the paper employ multilevel estimation technique, a methodology that distinguish this study from previous studies to investigate in detail, the sources of variation in child health for appropriate policy recommendations. This study looks at child health status as our outcome variable. This outcome variable is nested within parent's characteristics or effect as well as regional effect. This behaviour of the study sets the data into a hierarchical form. Whenever data is grouped (or nested) in more than one category it is of concern to know whether the effect of the outcome variable vary by entity (different groups) or not. This has advantages on generalisation which is a weakness in regular

regression. Regular regression ignores the average variation between entities and may at times have generalisation problems. Hence, to cater for the clustering effect in the data and heterogeneity problem, we employed multilevel estimation technique to cater for any biases that is likely to occur in the estimated results. The rest of the paper is organized as follows; the second section review related literature, followed by a discussion of the methodology. The last section looks at the results, conclusions and policy recommendations.

Review of Related Literature

One measure that has become of interest in the discourse on child health outcomes is nutritional status of children. This is so because poor nutrition among children manifests itself in underweight, stunting and wasting. These dimensions of nutrition and childhood diseases have become global public health concerns, especially in low-income countries. Adequate nutrition is one of the pillars of public health (Elmadfa & Meyer, 2010). WHO referred to good nutrition as the adequate well balanced diet combined with regular physical activity (WHO, 2011). Adequate and proportional intake of essential macro and micro-nutrients is very important to prevent infectious cardiovascular disease (CVDs) and contagious disease. The role played by nutrition in the prevention of disease and the preservation of good health conditions is being brought to the public attention now more than ever (Baingana & Bos, 2006).

According to Guillbert (2002), diet and nutrition are important factors in the promotion and maintenance of a good health outcome in one's life course. A good diet and health outcome are determinants in risk factors for chronic Non-Communicable Disease (NCDs) and therefore holds a very important position in the prevention activities. Baingana and Bos (2006) observed that Non-Communicable Disease (NCDs) are also gaining grounds in sub-Saharan Africa. Studies on global burden of disease shows that 20% of deaths in sub-Saharan Africa were caused by NCD, with the top 10 condition in terms of disability and mortality in low and low-middle income countries (Lopez; Mathers; Ezzati; Jamison & Maurray 2006). Bosu (2007) reported that in Ghana, prevalence of lifestyle disease such as stroke, hypertension, type 2 diabetes, and other canine distemper virus are on the increase and are now among the upper ten in-patients cause of death which is normally associated with the kind of food one takes and the kind of lifestyle one leads. On the other hand, nutritional situation in Africa is characterised by high rate of malnutrition which is meant to be the number of diseases related to deficiency or excesses intake of one or more nutrients (Gopalan, 1992) coupled with various forms of that persist in all countries of Africa.

In the work of Sika-Bright and Ahorlu (2015) on infant feeding practices in Ghana, it was found that marital status of mother, level of education and employment status of mother and attitudes clinical nurses and mothers' opinion played major roles in shaping infant feeding practices among mothers. In addition, those who assist the mothers in taking care of their babies were also influential in mother's choice of infant feeding practice.

Methodology

Data

Data used for this study comes from Ghana Multiple Indicator Cluster Survey (MICS). The Ghana Multiple Indicator Cluster Survey (MICS) was carried out in 2011 by the Ghana Statistical Service. The Ghana MICs thus provides current information on health, social and economic circumstances of households, mothers and children. A total of 12,150 nationally representative sample of households were selected, 11,970 out of the selected households were identified for the interview. Of the identified household to be interviewed, 11,925 were interviewed. In all 10,627

women were interviewed and information was obtained on 7550 children under age 5 years (GSS, 2011). The Ghana Multiple Indicator Cluster Survey 2011, the fourth of its kind, is a nationally and international household survey programme developed by UNICEF. It is a representative sample survey of households, which has a portion on children aged 0-5 years. MICS was conducted as part of the fourth global round of MICS surveys. The data provides up-to-date information on the situation of children and women and measures key indicators that allow countries to monitor progress towards the Millennium Development Goals (MDGs) and other internationally agreed commitments.

Measurement of child dietary variable

In this study, the dietary variable is captured in two ways: first, it is measured in terms of the food groups a child consume (patterns in food groups) and second the number of times the child is given food in a day (frequency of food a child takes in a day). To measure patterns of diet a child takes, various organizations have come up with a number of indicators. Notable among these indicators are the World Food Programme's Food Consumption Score (FCS), the World Health Organization's Infant and Young Children Feeding guidelines (IYCF), the FAO/USAID calculates Individual Dietary Diversity Score (IDDS). In this study, food groups are measured by the appropriate food pattern a child consumed as specified by IYCF. The data makes available section that collected information on children food and liquids consumed in the previous day. The food items are categorized under the seven groupings by the Infant and Young Children Feeding (IYCF) (Swindale & Bilinsky, 2006). The groupings are as follows: (i) grains, roots and tubers; (ii) legumes and nuts; (iii) flesh foods (meat, fish, poultry and liver/organ meats); (iv)eggs; (v) vitamin-A rich fruits and vegetables; (vi) dairy products (milk, yogurt, cheese); (vii)other fruits and vegetables. If a child consumed at least one food item from a food group, the group was assigned a value of one. The groups score was summed to obtain the dietary diversity score which ranges from zero to seven, where zero represents non-consumption of any of the food items, and seven represent the highest level of diet diversification.

Definition of Nutrition status (Anthropometric indicators)

The study measured nutritional status by using three anthropometric indicators. Following Annim, Awusabo-Asare, Amo-Adjei and ICF International (2013), we used stunting stunted, which is measured as a child's height-for-age z-scores less than two standard ($< -2SD$ of height-for-age z-scores) to measure chronic undernutrition due to prolonged food deprivation; wasting, which is measured as a child's weight-for-height z-scores less than two standard ($< -2SD$ of weight-for-height z-scores) to measure undernutrition caused by a more recent deprivation; and used underweight which is measured as a child's weight-for-age z-scores less than two standard ($< -2SD$ of weight-for-age z-scores). In the descriptive statistics we use binary outcomes of these indicators to classify a child as stunted, wasted or underweight. However, we employed the raw z-scores which are continuous in our multiple regression analysis. In addition, we followed IYCF measurement on whether a child is being breastfed or not, and food groups or category a child is supposed to be given in a day. In addition, we considered the number of times (frequency) of the food groups the child is supposed to take in a day for the descriptive analysis.

In this study, we employed the WHO's Infant and Young Children Feeding guidelines in measuring our dietary pattern as our variable of interest. Dietary pattern in this study is in two folds; the frequency (number of times) the child is given food a day and dietary pattern number of food groups a child is supposed to take in a day. To cater for the clustering effect in the data and

heterogeneity problem, we employed multilevel estimation technique to cater for any biases that is likely to occur in the estimated results. The dependent variable, child health was measured with three anthropometric indicators; weight-for-age (wasting), weight-for-height (stunting) and weight-for-height (underweight).

Model specification and estimation technique

Three models were run, one for each indicator. Based on reviewed literature and the purpose of this study, factors contributing to child health are estimated as follows:

$$y_{ij} = \beta_0 + \beta_1 DPIYCF + \beta_7 medu_i + \beta_2 mage_i + \beta_8 wealth_i + \beta_3 cage + \beta_3 urb + \beta_{13} ethnic_i + \beta_{14} region_i + \epsilon_i \quad (1)$$

where: DPIYCF=Diet pattern under IYCF groupings; medu=mother's education; mage=mother's age; wealth =wealth quintile; sex=sex of child; cage=age of child; urban=whether household is in an urban area; ethnic=ethnicity of household head; region=which administrative region is household located and $j = (WAZ, HAZ, WHZ)$.

We employ the raw z-scores because it allows us to determine changes across observation instead of categories and also to solve the problem of clustering in the data. To estimate model (1) mixed linear regression analysis was employed (Three Stage Multilevel Analysis).

Justification for Multilevel Estimation

Over the years, reports have been that child health outcomes are skewed towards some regions and that there is the need for regional intervention (MICS Report, 2012). Hence, employing multilevel estimation technique will help to ascertain whether regional effect indeed play crucial role in child health development. In addition, the empirical model above is to investigate child health as an outcome of various factors measured at different levels. Model 1 consists of different level measures: child variable (dietary pattern, age of child, child sex); mother effect (mothers' education, mothers' age, wealth of the household) and regional effect (region of residence).

The structure of the data with the child health as our outcome variable is dependent on different levels of measurement and these sources of levels in the data measurement. It is therefore important to incorporate three-level structures in to our models when levels arise in the data structure. The differences in levels in the date need to be cater for so that we can appropriately attribute variation in child health outcome to sources of levels in the data structure (Moerbeek, 2004; van den Noortgate et al., 2005; Tranmer and Steele, 2001). This may lead us not to draw misleading conclusions about the relative importance of different sources of influence on the child health outcome. In the estimation of the model, we conceptualized a three-stage system of equations in which variation in our outcome variable, child health, is explained by dependency in mother characteristics and regional characteristics.

A Three-stage Formulation of the Child Health Model

In the model formulation, we first state lower level equation capturing child level measurement, a higher (second) level measurement capturing mother effect and third equation

capturing regional effect level variable. Our final three stage level modelling is estimated as follows:

$$CH_{ijk} = \beta_0 + \sum_n^3 \beta_n CX_{ijk} + \sum_{m=1}^5 \beta_m Z_{jk} + \beta_3 Reg_k + v_k + \mu_{jk} + e_{ijk} \quad (2)$$

$$v_k \sim N(0, \sigma^2)$$

$$u_{jk} \sim N(0, \sigma^2)$$
$$e_{ijk} \sim N(0, \sigma^2)$$

$CH_{ijk} = Child\ health, our\ outcome\ variable;\ CX_{ijk}, our\ child\ characteristics\ variable(\ );$
$Reg_k = region$
Traditionally, $i = child\ level, j = mother\ effect\ characteristcs\ and\ k = regional\ effect$
Where $\beta_0 + \sum_n^3 \beta_n CX_{ijk} + \sum_{m=1}^5 \beta_m Z_{jk} + \beta_3 Reg_k$ is termed the fixed part of the model and $v_k + \mu_{jk} + e_{ijk}$ are termed the random part of the model. The fixed part of the model specifies the overall mean relationship between the response and the predictor variables; that is, the relationship that applies in the average region. The random part of the model specifies how the region and mother specific characteristics relationships differ from this overall mean relationship. In the random part of the model, the random effects and residual errors are assumed independent of the three predictor variables.

Table 1. Definition and Measurement of Variables

Variable	Definition	Measurement
Male	Gender/sex of child	0=Female; 1=Male
Diet Frequency	The number of times a child is given the required food in a day	Measured as continuous variable
Urban	Residence status of the household	1=Urban; 0=Rural
Mother's Age	Age of the child's mother	Measured in years. Ranges from 15-45 years
Child's age	Age of child in categories	Measured as: 0=0-5; 1=6-11; 2=12-23; 3=24-35; 4=36-47;5= 48-59
Mother's education	Mothers highest educational attainment	0=None;1= Primary; 2=Middle/JSS; 3=Secondary and Above
Wealth quintile	An index of the wealth status of the household	0=Poorest; 1=Second; 2= Middle; 3=Fourth; 4=Richest
Ethnicity	Ethnic group to which the household head belongs	It is measured in categorical variable
Region	Region of Household	Set of dummy variables to capture the administrative regions in Ghana
Food pattern	Food diversity score	Measured as count of food items

Descriptive Statistics of the variables

The descriptive statistics of the relevant variables employed in this study are presented in Table 2. It shows less variability among the relevant variables used in this study. With the exception of our outcome variable, all the relevant explanatory variables indicate a lower standard deviation as compared to the means.

Table 2: Descriptive statistics of variables employed in the study

Variable	Observations	Mean	Standard Deviation.	Minimum	Maximum
HAZ	7364	-1.09846	1.312807	-5.98	5.85
WAZ	7364	-1.13494	1.146331	-5.96	5.75
HAZ	7364	-1.09846	1.312807	-5.98	5.85
Food diversity	7364	3.113428	1.695622	0	7
Diet frequency	7364	3.2628	1.169781	1	8
Mothers education level	7364	1.812615	1.000801	1	4
Mothers Age	7364	30.2441	9.922212	15	49
Wealth	7364	2.147682	1.338781	1	5
Sex of the Child	7364	0.510884	0.499914	0	1
Childs age	7364	3.903576	1.580942	0	5
Urban	7364	0.281275	0.449651	0	1
Ethnicity	7364	18.95293	9.541829	11	96
Region	7364	6.466037	2.953047	1	10

Source: Computed from MICS, 2011

Results and discussion

This section presents the test of associations (descriptive) and conditional effect of each of the three main variables of interest (Least Squares) on nutritional status of children. For both the descriptive and inferential analyses three outcomes of nutritional status, namely, height-for-age (stunting), weight-for-height (wasting) and weight-for-age (underweight) are used. We begin analysing the data by exploring relationship among the variables of interests.

Maternal education and food diet Pattern

Figure 2 show that children borne to parent with higher education levels had more diversified diet in the survey period. With no formal education having the least, we found that as education level increases the difference also increase. Thus, as far as child diet pattern is concern, children who are borne to parents with at least one form of education are likely to choose good and better food groups compared to children born to parents with no education. It is therefore imperative to intensify nutrition awareness at the basic school levels since it can lead to improvement in child nutritional intake.

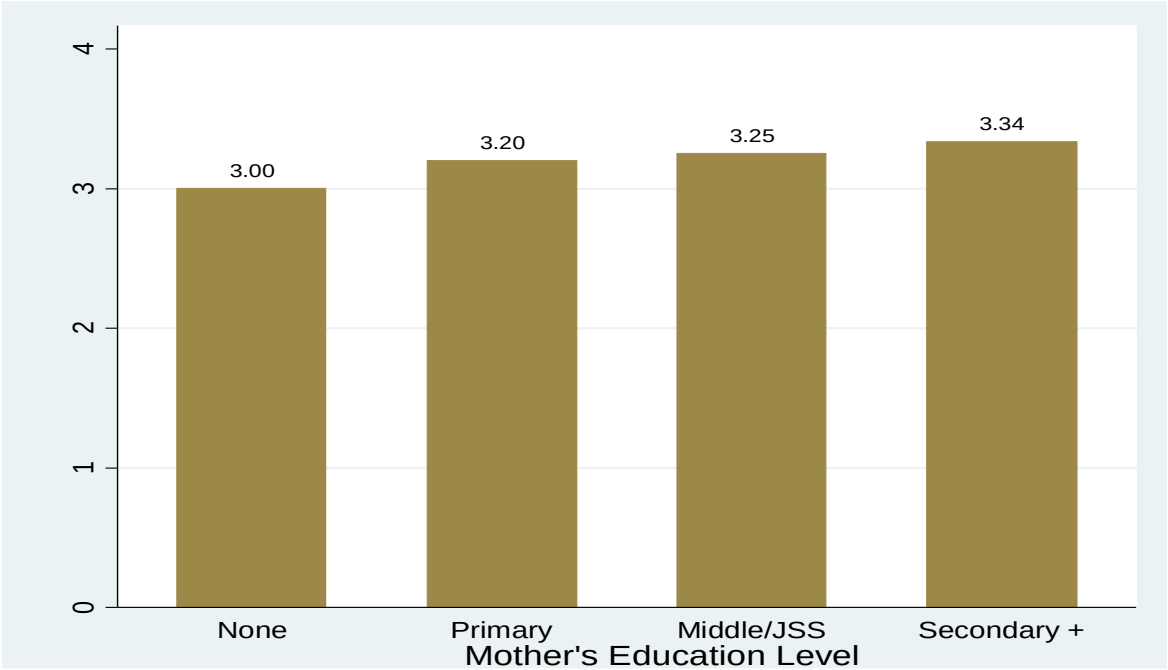

Figure 2: Distribution of Food Patter by Mother's Education Level
Source: Author's Computation from MICS, 2011

Regional distribution of food diversity among children less than 5 years

In terms of dietary diversity, Figure 3 shows that children in Greater Accra region which is the nation's capital had the most diversified diet pattern. This is followed by Brong Ahafo region. One striking feature is that regions such as Eastern and Western as one would have expected to have better food diversity than Upper West and Upper East regions did not show that as evident in the graph. This then calls for investigation into what might account for that.

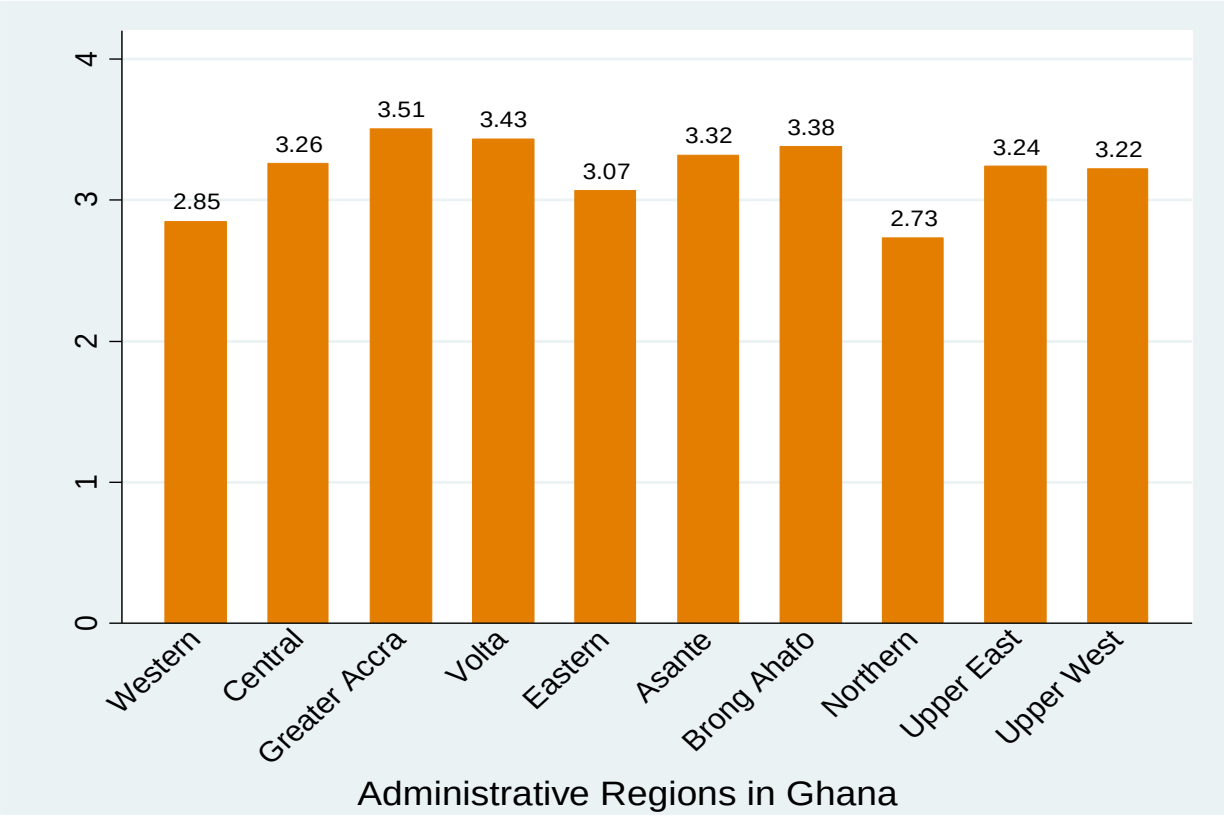

Figure 3: Distribution of Food Diversity by Administrative Regions in Ghana
Source: Author's Computation from MICS, 2011

Patterns in minimum diet a child is given when not under breastfeeding

Table 3 examines patterns in minimum diet a child is supposed to take when the child is not under breastfeeding over indicators such as mothers' education level, wealth quintile and age of child under 5. From Table 3, it can be observed that mothers' education increases with minimum food requirement a child is given. Mothers with no education level are seen not to accede to the required food supplement for children who are not breastfeeding. 52.1 % do not give the minimum required diet supplement a child is supposed to take when the child is not under breastfeeding while 47.9 % see to the minimum diet a child is supposed to take in a day. Mothers with primary, middle/JSS and secondary education and above are 47.6%, 42.6% and 42.6% more likely not to feed their child with the required food supplement, while 52.4%, 57.4% and 57.4% respectively are more likely to feed their ward with the required food supplement. These observation revealed that parent with at least some form of education tend to provide their wards with the appropriate food requirement. Similar result is also recorded in the wealth category. Majority of families who fall within the poorest wealth group fail to provide the appropriate food requirement for their wards. But the case seems to turn around as family wealth increases. This imply that parents who are poor may find it difficult to purchase or access the appropriate food supplement for their

children. This is likely to influence parents in the poorest category to provide for their children any food they find for their wards which can have negative implication on the growth of the child's development. As a child ages, it is evident from Table 3 that food supplement the child is supposed to take also increases. This observation shows that at tender age, the child is likely not to be given the appropriate food supplement but as the child ages, their required food consumption is adhered to. Implying mothers are likely to continue the adequate food supplement the child requires as the child ages and only when the child is not breastfeeding.

Table 3: Patterns in minimum diet a child is given across Mothers Education Level, Wealth, and Childs Age if child is not under breastfeeding

	No		**Yes**		**Total**	
	Frequency	row %	Frequency	row %	Frequency	row %
Mother's education						
None	1240	52.1	1139	47.9	2379	100
Primary	383	47.6	421	52.4	804	100
Middle/JSS	422	42.6	569	57.4	991	100
Secondary +	138	42.6	186	57.4	324	100
Total	**2183**	**48.5**	**2315**	**51.5**	**4498**	**100**
Wealth						
Poorest	1039	52.8	930	47.2	1969	100
Poor	414	46	486	54	900	100
Middle	285	42.9	380	57.1	665	100
Rich	243	45.5	291	54.5	534	100
Richest	202	47	228	53	430	100
Total	**2183**	**48.5**	**2315**	**51.5**	**4498**	**100**
Age						
0-5	5	100	0	0	5	100
6-11	6	60	4	40	10	100
12-23	151	52.2	138	47.8	289	100
24-35	593	48.3	636	51.7	1229	100
36-47	754	49.2	780	50.8	1534	100
48-59	674	47.1	757	52.9	1431	100
Total	**2183**	**48.5**	**2315**	**51.5**	**4498**	**100**

Source: Computed from MICS 2011

Estimation results on the effects of dietary pattern on child health outcomes in Ghana

The study used the three anthropometric indictors of child health measures and regressed it on dietary diversity, indicators of maternal education and ethnicity and other covariates of child health. The outcome of the study is presented on Table 4. As stated earlier, dietary diversity was measured on the bases of Young Children Feeding (IYCF) guidelines.

The results indicate that dietary patterns have positive relationship on the 3 health indicators (child health outcome). This relationship is significant in HAZ and WAZ but not significant in the WHZ model. At 5 and 10 percent significance levels, increasing the number of

food groups a child consumes by one causes HAZ and WAZ to increase by 0.030 and 0.037 respectively. This finding is in consonance with a study by Arimond & Ruel (2004). Plugging diet frequency into the model indicates that there is a positive relationship between the frequency of diet a child is given in a day and WAZ, WHZ indicators and a negative relationship between diet frequency and HAZ measure. Increasing the number of times a child is given food in a day, is associated with 0.034 decrease in HAZ, 0.009 increase in WAZ and 0.025 increase in WHZ. This is significant at 10 percent for HAZ and WHZ but not significant in the WAZ.

It could be observed from the Table 4 that mothers' education level only plays a less significant role in the child health outcome based on the three indicators (HAZ, WAZ, WHZ) used. In the HAZ model, it is evident that there is a positive association between mothers' education and child health but only mothers with secondary and above have significant effect. Mothers with at least secondary education have 0.126 HAZ higher than mothers with no education level. However, mothers with primary education have 0.064 WHZ higher than mothers with no education. In addition, mothers' age is found to correlate negatively with WAZ. Increasing mothers' age by additional year is associated with 0.003 reduction in WAZ at 10 percent significance level.

As expected, household wealth has a positive correlation with all our child health outcome measures. Children born to families within higher wealth quintiles tend to have better nutritional status (HAZ, WAZ and WHZ) than children born to families within the poorest wealth quintile.

Across age specification of the child and health status, it is evident that age of the child and health measure has a negative association. This indicates that as the child ages, there is a higher likelihood for the child to experience a poor state. The result shows that male children have negative correlation with all the child health measures. This result indicates that at 5 and 10 percent significance levels, male children have 0.062, 0.058 and 0.054 WAZ, HAZ and WHZ scores lesser than female children respectively. The observed relationship between sex and nutritional status could be as a result of biological differences as well as socio-cultural. Socio-culturally, gender preferences and preferential treatment may account for the observed differences. Indeed Fuse (2010) has shown that daughter preference is slightly higher than son preference in Ghana.

On the relationship between ethnicity and child health, we found that Ewes have better HAZ and WAZ scores than Akans. Similarly, children who are Grusi tend to have better weight for height than their Akan counterparts. The differences in child health and districts shows that child health outcomes differ across some ethnic groups in Ghana. This observation could be attributed to differences in feeding and post-partum practices across the different ethnic groups. The result confirms findings of work by Annim and Imai (2014) who indicates that child health outcomes differ among children of different ethnic decent.

Regional effect is another variable of interest that informed our choice of methodology to examine the extent to which regional differences plays a role in child health outcome. Results in Table 4 shows that differences in regional fixed effects play significant role in explaining child nutrition. Using Western region as the base outcome, it is observed that there is a negative association between HAZ in all the regions with the exception of Greater Accra in comparison to Western Region. At 1% and 10% significance levels, children in Northern and Upper East Region have 0.336 and 0.176 HAZ lower than children in Western Region respectively. At 1 percent significance level, children in Northern and Upper East Regions have 0.336 and 0.340 WAZ lower than children in Western Region and at 5 and 1 percent significance levels, children in Northern, Upper West and Upper East have 0.213, 0.207 and 0.277 WHZ units lower than children in Western Region. An important striking feature is that the difference between the anthropometric

score of children in Western region and the three northern regions tend to be higher. This could be attributable to the high poverty and deprivation rates in these regions.

In summary, there is considerable evidence that the model choice is appropriate per the post estimation results as indicated in the Log likelihood test (LR test) and intra-class correlation test (ICC). This confirms that both mother and geographical effects play significant role in the health outcome of children under 5 in Ghana. The ICC which measures each higher level effect on the outcome variable revealed some association on the outcome variable. In all the three models, both the regional and mothers' characteristics are (12.8%, 11.17%), (15.6%, 19.6%) and (12.6%, 15.4%) respectively for Height-for-age (HAZ), Weight-for-age (WAZ) and Weight-for-height (HAZ) in the order contribution to child health status. According Skrondal and Rabe-Hesketh (2004) there is no justification for the acceptance for ICC but ICC of two digits signifies significant effect of group effect. The ICC results for the outcome variable in the three models indicate that the region a child comes from can have influence on the developmental processes of the child as well as the mother's characteristics.

Table 4: Effects of Dietary Pattern, Mother's Socioeconomic Status on child health outcomes in Ghana.

Explanatory Variable	**Dependent Variable**		
Fixed Parameters	**Height-for-Age**	**Weight-for-Age**	**Weight-for Height**
Dietary pattern (IYCF Score)	0.0300**	0.0374***	0.0158
	(2.44)	(3.47)	(1.51)
Diet frequency	-.03387*	0.0085	0.0250*.
	(-1.68)	(0.71)	(2.14)
Mother's education	**(None=0)**		
Primary	0.015	0.0359	0.0636*
	(0.35)	(0.98)	(1.75)
Middle/JSS	0.0343	-0.0114	-0.026
	(0.73)	(-0.28)	(-0.65)
Secondary and above	0.126*	-0.0127	-0.0581
	(1.78)	(-0.21)	(-0.96)
Mothers Age	-0.00276*	-0.00161	-0.0009
	(-1.87)	(-1.28)	(-0.72)
Wealth quintile	**(Poorest=0)**		
Second	0.115** *	0.0764**	0.0115
	(2.72)	(2.10)	(0.32)
Middle	0.157** *	0.111**	0.0113
	(3.05)	(2.52)	(0.26)
Fourth	0.468***	0.294***	0.00347
	(8.27)	(6.08)	(0.07)
Richest	0.637***	0.511***	0.148**
	(8.63)	(8.80)	(2.36)
Male	-0.0617* *	-0.0580**	-0.0536*
	(-2.15)	(-2.36)	(-2.19)
Child Age (0-5=0)			

6-11	-0.511***	-1.171***	-0.823***
	(-7.55)	(-20.21)	(-14.20)
12-23	-1.221***	-1.572***	-0.985***
	(-18.23)	(-27.45)	(-17.18)
24-35	-1.062***	-1.403***	-0.694***
	(-15.16)	(-23.41)	(-11.58)
36-47	-1.197***	-1.269***	-0.498***
	(-17.09)	(-21.18)	(-8.31)
48-59	-1.264***	-1.275***	-0.510***
	(-17.86)	(-21.03)	(-8.41)
Urban	0.001	0.006	0.036
	(0.02)	(0.18)	(0.98)
Ethnicity (Akan=0)			
Ga/Dangme	0.132	0.0713	-0.0172
	(1.51)	(0.96)	(-0.23)
Ewe	0.281***	0.106*	-0.0663
	(3.99)	(1.76)	(-1.11)
Guan	0.0978	0.062	0.0422
	(1.12)	(0.83)	(0.57)
Gruma	-0.0441	0.0285	0.107
	(-0.58)	(0.44)	(1.66)
Mole Dagbani	0.0847	0.0302	0.00269
	-1.33	(0.55)	(0.05)
Grusi	-0.0866	0.104	0.281***
	(-1.04)	(1.46)	(3.95)
Mande	0.152	0.0345	-0.0556
	-1.35	(0.36)	(-0.58)
Region (Western=0)			
Central	-0.0392	-0.0923	-0.0811
	(-0.52)	(-1.43)	(-1.27)
Greater Accra	0.0133	-0.00419	0.00491
	(0.14)	(-0.05)	(0.06)
Volta	0.104	-0.0552	-0.159
	(1.04)	(-0.65)	(-1.88)
Eastern	-0.0495	0.00902	0.0445
	(-0.52)	-0.11	(0.55)
Ashanti	0.0105	0.0324	0.0403
	(0.12)	-0.44	(0.55)
Brong Ahafo	0.101	0.082	0.0653
	(1.13)	-1.06	(0.85)
Northern	-0.336***	-0.336***	-0.213**
	(-4.08)	(-4.75)	(-3.04)
Upper East	-0.176*	-0.340***	-0.277***
	(-1.94)	(-4.39)	(-3.59)
Upper West	0.127	-0.0687	-0.207**

	-1.44	(-0.91)	(-2.75)
Constant	-0.228*	0.0485	0.152
	(-2.29)	-0.57	(1.79)
Random Parameters			
Region (v_k)	0.0411**	0.0723*	0.051
	(0.017)	(0.039)	(0.065)
Mother effect(u_{jk})	0.038***	0.091	0.062**
	(0.002)	(0.061)	(0.021)
Constant (e_{ijk})	0.241***	0.301***	0.291*
	(0.006)	(0.009)	(0.159)
Observation	**7364**	**7364**	**7364**
ICC for region	12.8%	15.6%	12.6%
ICC for mother	11.7%	19.6%	15.4%
lr Test	80.75=0.000	65.05=0.000	12.41=0.000

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

Source: Computed from MICS 2011

Conclusion

The paper investigated different approaches to the interplay between clustering and variable regression effects (contextuality) on health outcomes of children under 5 health status and dietary habit. Our response variable which is child health outcome was a continuous variable measured with three anthropometric indicators; weight-for-age (wasting), weight-for-height (stunting) and weight-for-height (underweight). The current study sought to investigate the causal effect of dietary pattern on child health outcomes in Ghana by employing methodology that seeks to examine regional and mother effects on the child's growth process.

We found that there is a positive association between child age and dietary pattern. An indication that as a child ages, diet pattern also increases. This gives a promising hope in term of child health outcome and diet of the child as mothers are likely to consider the need to meet nutritional requirement of their children in their growth process. Dietary pattern significantly differs across mothers education levels and this is consistent with our apriori expectation. This is so because mothers who are educated know the importance of balance diet and its implication for their child's growth. This however put education as one of the policy indicators the government of Ghana and other stake holders can adopt to help improve child's nutritional demands to bring about good health outcome in the future. To ensure the achievement of this goal, it is expected that nutritional awareness is made a basic necessity at the lower education levels.

The results from our regression analysis shows that dietary pattern is associated with improvement in children under five years old in Ghana. This relationship is consistently observed in all the three indicators of child health but the effect vary across the various measures. Our results indicates that dietary pattern (given a child the required food groups per day) significantly affect height-for-age and weight-for-age but does not significantly affect weight-for-height. Hence, it can be concluded that taken the period prior to the survey, it is expected that dietary diversity will have less effect on weight-for-height (underweight) which arises as a result of prolong periods of food deprivation or malnutrition. This finding could suggest progress made by the Government of Ghana on its intervention in various public schools. And this add to the notion for care-givers on the school feeding programme to ensure diversified meals are always serve to the children to improve health. Again, our analysis of the frequency or number of times a child is fed indicated

that it is likely for a child to have a poor HAZ if stricter measure in impose on increased number of times the child is fed in a day. However, parents ensuring and paying attention to the standardized number of times a child is to be fed in a day would have better health for WHZ but will not have any effect on the child WAZ. Mothers are therefore advised to take keen interest in the feeding of their children as to the required number of times the child is supposed to be fed per the IYCF standards. It can also be added that female children have better health outcome across our three measures of health outcome than males. An indication that could mean that parents tend to look after and be more concern about the health of their female wards than male ones. Hence, it is imperative for mothers to be concern equally about the male child's up bring.

It is recommended that programs for social protection and poverty reduction should consider focusing on improving mother's financial stands because if these mothers are well off, there is the likelihood for a rippling effect to translate into better child health. Also programs and policies geared towards regions that are deplorable, especially the three northern part of Ghana are very crucial. This will immensely better the health outcome for the children in those regions. This will bring about long term strong human capital for the Ghanaian economy. Other alternative measures such as focus on prenatal period could also be beneficial for the parents in ensuring a proper child health. Shoring up the wealth of households at the bottom of the income distribution may also improve children's health. Policy that targets women financial position such as creating job avenues by the government for the women to earn income. This has the tendency to impact positively on the health outcome of their children.

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