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Social Determinants and Dynamics of Health Inequality in Nigeria

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Abstract

This paper sheds light on the social determinants of health inequality in Nigeria by quantifying the dynamic relationship between socioeconomic indicators and child anthropomorphic outcomes. Applying multivariate regression analysis and the Blinder-Oaxaca decompositions on recent demographic and health survey [DHS] data the study shows that bad health is disproportionately concentrated on the poor and some geopolitical zones of the country. Differences in wealth account for about 58.0 per cent and 33.0 per cent of differences in child nutritional and underweight status between the poor and nonpoor. Although improving over time, these differences suggest better targeted social policy reforms in the country.

Key Words: Inequality, decomposition, health, socioeconomic status

JEL Classification:I14, I15, J11,

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I. Introduction

This study analyses socioeconomic determinants of health inequality and how they account for changes in health inequality, focusing on child health in the six geopolitical zones in Nigeria. Health problem is one of the major challenges faced by many developing countries especially in the Sub-Saharan Africa. Unfortunately, Nigeria is ranked low in terms of health achievement especially in the area of child health. The observed inequality in mean child health across the six geopolitical zones of the country is quite substantial. Even though Nigeria has made progress in reducing child mortality and child malnutrition over the years, available statistics show that the country is still lagging behind compared to her peers. The patterns of health status in Nigeria mirror many other Sub-Saharan African (SSA) nations but are worse than would be expected given Nigeria's GDP per capita (Gustafsson-Wright, , et.al, 2008**)**. Figure1 shows the trend of Nigeria's under-5 mortality rate and those of other countries with data compiled from the United Nations database.

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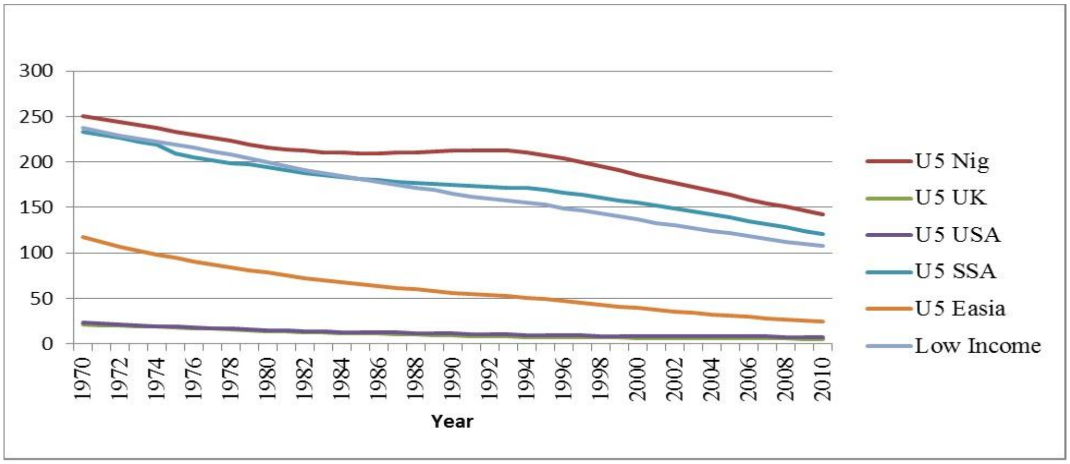
Figure 1: Dynamics of Under-5 Mortality Rate in Nigeria and Other Countries

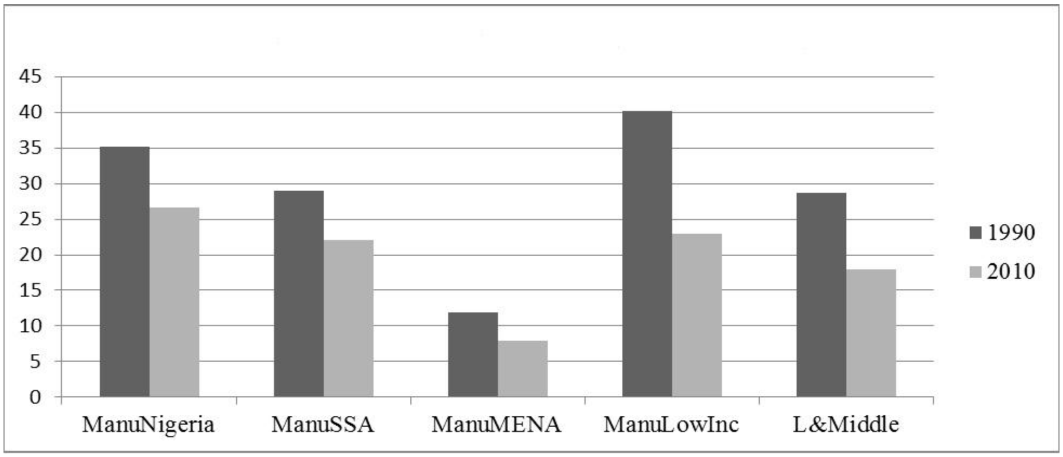


Source: United Nations Common Database and authors' computations

The figure1 above shows that under-5 mortality rate in Nigeria has been consistently higher than both the Sub-Saharan African (SSA) and low income country average since the 1970s, despite the downward trend. Again, compared to East Asian developing countries, the country is a worst performer. The East Asian countries are converging to the developed country average (for example, the United Kingdom (UK) and United States of America (USA)) under five mortality rate. Nigeria' mortality gap from the developed world is still as high as 147 deaths per 1000 as at 2010.

Figure 2 shows the rate of malnutrition for children between 0 and 5 years of age for the period 1990 and 2010. It can be seen from the figure that in 1990, Nigeria's under malnutrition rate was better than only the average of low income (ManuLowInc) countries. By 2010, the Nigerian under-5 malnutrition rate was worse than the average of low income countries. Compared to the Sub-Saharan (ManuSSA) and Low and Middle Income countries (L&Middle) average child malnutrition, Nigeria is still an under performer.

Figure 2: Malnutrition Rate for Children 0 – 5 Years in Nigeria and Country Groupings



Source: United Nations Common Database and authors' computations

However, Nigeria is a very large country with a population of over 150 million, in six geopolitical zones, 36 states, and 774 local government areas. It has over 200 ethnic nationalities with wide variations in geographical, cultural, socioeconomic compositions and historical tendencies which were amalgamated into one nation through colonial policy. It is hypothesized that these different compositions would lead to different health outcomes among the populations. Surprisingly, very little is known empirically about the extent these differences relate to health inequalities both within and across the six geopolitical zones in the country. Furthermore, urbanization in Nigeria is occurring rapidly but at different rates in different parts of the country. On average the percentage of the population living in urban areas is expected to rise from 42.0 per cent to 55.4 per cent by 2015. The country's population is largely young: the median age is 18.7 years and about 45.0 per cent of the population is under the age of 15 (Population Reference Bureau, 2007). The implication is that large differences in health status of the component populations if not addressed properly and early enough, could adversely affect the quality of human capital potential of the country and, hence, economic growth.

International literature has found large cross-country variations in health outcomes but cross-country results are unlikely to explain much about the determinants of health inequality in Nigeria given the different institutional and macroeconomic environments across countries. Moreover, existing literature differ on the determinants of health and health inequality. One strand of literature finds that health inequality is strongly and positively associated with income inequality and social stratification (Hill and Yazbeck, 1994; Galobardes, et al., 2006; Marmot et al., 1984; Marmot and Brunner 2005; Marmot, et al 1997; Kagamimori, et al, 2009; Chandola et al 2006; Wilkinson, 1999; Kim and Ruger, 2006; Wagstaff, 2002; Epstein, 2007; Cutler, et al 2008; Thomas, 2009, among others). Another strand of literature finds however, that there are controversial results about the hypothesis that an individual`s health depends not only on the individual's income but on the distribution of income (that is relative income) within where he resides (Judge, *et al* 1998; Smith, 2004; Wilkinson and Pickett, 2006; Seeman, *et al* 2008, among others). Yet another strand argues that it is health that determines social status which in turn affects health (for example Wagstaff, 2002; Chandola, *et. al*, 2005; Thomas, 2009, among others).

On the other hand, previous research in Nigeria has been focused on issues such as inequality in the provision of healthcare (Ibiwoye and Adeleke, 2008), the distributive effect of healthcare financing (Ichoku and Fonta, 2006; Ichoku , Fonta, and Onwujekwe, 2009), the demand for healthcare (Onwujekwe and Uzochukwu, 2005; Amaghionyeodiwe, 2008), inequalities in self-rated health (Ichoku et al, 2011), as well as on the macroeconomic analysis of population health (Omotor, 2009; Anyanwu and Erhijakpor, 2009). This study therefore provides a new insight into the empirical literature on the determinants of health in Nigeria by focusing on inequality in child health. In broad terms, the study ascertains if inequality in health outcomes in Nigeria can be explained by disparities in socioeconomic status (SES) of individuals. The study also ascertains if regional differences in health outcome are due to regional differences in SES and other factors and if such differences vary overtime. Hence, our study is unique in the sense that it focuses on zonal variations in health and conducted under a similar set of institutions and macroeconomic conditions using a recent demographic and health surveys dataset for Nigeria.

This paper is, therefore, structured into four sections. Section I is the introduction; section II deals with the methodology and data; section III deals with the presentation of results and discussions on findings; while the policy recommendations and conclusion are treated in section IV.

II. Methodology and Data

II.1 Theoretical Framework

This paper derives its theoretical framework from the social causation perspective theory of health inequality (Marmot, et. al, 1991, among others). This hypothesis suggests that the stress associated with low social position, such as exposure to social adversity and lack of resources to cope with difficulty, might contribute to the development of mood disorder which causes poor health. The theory argues that a positive relationship exists between socio-economic status and vulnerability to mood disorder, with high rates of vulnerability found among individuals with lower educational and social achievements. According to this theory, this causal effect of socio-economic status on health is likely to be mainly indirect, through a number of more specific health determinants which are differently distributed across socio-economic groups. One aspect of this theory emphasizes the effect of material factors (Link, Stueve, and Phelan, 1998) and posits that people who have more resources in terms of knowledge, money, prestige, and social connections are better able to avoid risk and to adopt protective strategies that are available at a given time in a given place. As a result, they have better health. This framework therefore, provides a useful guide for specifying our empirical model of health outcome as shown in equation (1), which includes individual's socioeconomic variables-education and income (or asset index which is the proxy for income), after controlling for other health variables.

II.2 Model Specification

Following from the framework described above we specify the empirical health outcome model as:

$$H_i = \alpha_o + \alpha_1 \text{VitmA} + \alpha_2 \text{safewater} + \alpha_3 \text{sanitation} + \alpha_4 \text{electricity} + \alpha_5 \text{child\_demo} + \alpha_6 \text{hhdemo} + \alpha_7 \text{region} + \alpha_8 \text{educ} + \alpha_9 \text{sector} + \alpha_{10} \text{asset\_index} + \alpha_{11} \text{year\_dum} + \mu \quad (1)$$

where :

H_i	=indicator for child nutritional status which in this study are negative of height-for-age (haz) and weight-for-age (waz) z-scores. The z-scores are multiplied by -1 so that positive coefficients increase child malnutrition while negative coefficients reduce it.
VitmA	= vitamin A available to the child at least two months after delivery
Safewater	= availability of safe drinking water
Sanitation	= availability of sanitary toilet
Electricity	= household has electricity
Child_demo	= child demographics-age, and sex
Hhdemo	= household demographics-age of head, gender of head
Region	=indicator variable for the six geopolitical zones in Nigeria
Educ	= maternal education level
Asset_index	= asset index (used as a proxy for household income or welfare)

We conducted our analyses with two widely used socioeconomic variables in the literature namely, education level of mother and household income (asset index).

Mothers with higher level of education are likely to have healthier children since they are better able to understand and apply health knowledge on the upbringing of their children. Also, education is likely to influence health knowledge and hence, drives health behaviour and thus, generates inequality in health outcome. Such mothers are more likely to adopt better diet for the family as well as avoid seeking health care among nonqualified practitioners. Better educated women know more about health and how to produce health efficiently through good habits (Grossman, 1972; Kenkel, 1991; among others). Income is also another variable in the SES vector which is likely to drive health knowledge and health behavior and hence, create disparity in SES and health.

II.3 Estimation Issues and Econometric Methodologies

We are aware of potential endogeneity problem between Health and SES. Poor health can lead to low SES, low SES can lead to adverse health outcomes, or a third variable determines both health and SES. The existence of a reverse causal relationship between health and income is well explained in an empirical work by Case (2002). In spite of the wide literature on the positive relationship between income and health, the reverse causality is subject to controversy (Salardi, 2007). The application of two-stage procedure helps in overcoming this problem although it seems difficult to find the right instruments where the residuals are not correlated to the health variable. Following Martin and Haddad (2006), we constructed a long-run indicator of wealth, using principal components analysis, to substitute the income variable because according to them, a long-run wealth or asset index is less exposed to reverse causality with health conditions.

II.4 Oaxaca-type Decompositions

In order to relate inequality in health outcomes to socioeconomic status variables, we applied the Oaxaca decomposition on equation (1). The Oaxaca decomposition (Oaxaca, 1973), explains the gap in the mean of an outcome variable between two groups. The gap is decomposed into that part that is due to group differences in the magnitudes of the determinants of the outcome in question, on the one hand, and group differences in the effects of these determinants, on the other.

The Oaxaca decomposition for any two groups say A and B (poor and non-poor, urban and rural, north and south), and an outcome variable Hi (height-for-age and weight-for-age z-scores), and a vector of predictors (including the constant), X (which are the regressors in equation (1) is described in the following equations. Following Jann (2008), the question Oaxaca decomposition tries to answer is how much of the outcome difference:

$$R = E(H_A) - E(H_B) \tag{2}$$

is accounted for by group differences in the predictors, where E(H) denotes the expected value of the outcome variable. Based on the linear model:

$$Y_\ell = X'_\ell \beta_\ell + \varepsilon_\ell, \quad E(\varepsilon_\ell) = 0, \quad \ell \in \{A, B\} \tag{3}$$

where β contains the slope parameters and the intercept, and ε is the error. Hence, the mean outcome difference can be expressed as the difference in the linear prediction at the group-specific means of the regressors. That is

$$R = E(H_A) - E(H_B) = E(X_A)'\beta_A - E(X_B)'\beta_B \tag{4}$$

since

$$E(Y_\ell) = E(X'_\ell \beta_\ell + \varepsilon_\ell) = \quad E(X'_\ell \beta_\ell) + E(\varepsilon_\ell) = \quad E(X'_\ell)'\beta_\ell$$

With $E(\beta_\ell) = \beta_\ell$ and $E(\varepsilon_\ell) = 0$ by assumption.

To identify the contribution of group differences in predictors to the overall outcome difference, equation 4 can be rearranged as follows:

$$\mathrm{R} = [\mathrm{E}(\mathrm{X_A}) - \mathrm{E}(\mathrm{X_B})]'\beta_\mathrm{B} + \mathrm{E}(\mathrm{X_B})'(\beta_\mathrm{A} - \beta_\mathrm{B}) + [\mathrm{E}(\mathrm{X_A}) - \mathrm{E}(\mathrm{X_B})]'(\beta_\mathrm{A} - \beta_\mathrm{B}) \tag{5}$$

This is a "three-fold" decomposition. That is, the outcome difference is divided into three parts:

$$R = E + C + I$$

The first component of equation (5) $E = [E(X_A) - E(X_B)]'\beta_B$, amounts to that part of the differential that is due to group differences in the predictors (the "endowment effect"). The second component $C = E(X_B)'(\beta_A - \beta_B)$, measures the contribution of differences in the coefficients (including differences in the intercept). The third component $I = [E(X_A) - E(X_B)]'(\beta_A - \beta_B)$, is an interaction term accounting for the fact that differences in endowments and coefficients exist simultaneously between the two groups.

The decomposition in equation (5) is formulated from the view point of Group B. That is, the group differences in the predictors are weighted by the coefficients of Group B to determine the endowment effect (E). In other words, the E component measures the expected change in Group B's mean outcome, if

Group B had Group A's predictor levels. Similarly, for the second component (C), the differences in coefficients are weighted by Group B's predictor levels. That is, the second component measures the expected change in Group B's mean outcome, if Group B had Group A's coefficients (Jann, 2008). Since the z-scores were multiplied by -1, negative coefficient in the Oaxaca decomposition results suggests that the variable reduces the gap in child nutritional status while a positive coefficient suggests the variable is widening child nutritional gap for the group of interest.

II.5 Decomposition of the Concentration Index

The Oaxaca decomposition can be used to explain socioeconomic related health inequality in the mean of health variable of interest between two groups such as the poor and the non-poor. On the other hand, decomposition of concentration index can help to measure and explain inequality in health across the entire distribution of some measure of SES. This is very useful for policy purposes. Wagstaff, et al (2003) demonstrate that the health concentration index can be decomposed into the contributions of individual factors to income-related health inequality, in which each contribution is the product of the sensitivity of heath with respect to that factor and the degree of income-related inequality in that factor. For any linear additive regression model of health (*y*), such as:

$$y = \alpha + \sum_k \beta_k x_k + \varepsilon \tag{6}$$

The concentration index for y, C, can be written as:

$$C = \sum_k \left(\frac{\beta_k \bar{x}_k}{\mu} \right) C_k + \frac{GC_\varepsilon}{\mu} \tag{7}$$

where μ is the mean of *y*, $\bar{x}_k$ is the mean of x_k, C_k is the concentration index for x_k (defined analogously to C), and $GC\varepsilon$ is the generalized concentration index for the error term (ε). Equation (7) shows that *C* is equal to a weighted sum of the concentration indices of the *k* regressors, where the weight for x_k is the elasticity of *y* with respect to x_k

$$n_k = \beta_k \frac{\bar{x}_k}{\mu} \tag{8}$$

The residual component of equation (6) reflects the inequality in health that cannot be explained by systematic variation across income groups in the x_k. Thus equation (6) shows, that by coupling regression analysis with distributional data, the causes of inequality can be partitioned into inequalities in each of the x_k. The decomposition also shows how each determinant's separate contribution to total income-related health inequality can be decomposed into three parts: (i) its effect on health (βk), (ii) its mean in the population (k_x) and (iii) its association with income rank (C_k). As such, the method therefore not only allows us to separate the contributions of the various determinants, but also to identify the importance of each of these three components within each factor's contribution.

II.6 The Data

The data used in the study were secondary data from the Nigeria Demographic and Health Surveys (DHS) for 2003 and 2008 which were designed to provide estimates of population and health indicators for Nigeria as whole, urban and rural areas, and the six geo-political zones. Representative probability samples of 7,864 and 36,000 households were selected for the 2003 and 2008 NDHS surveys, respectively. The sample was selected using a stratified two-stage cluster design consisting of 365 clusters for 2003 and 888 clusters for 2008 and enumeration areas were developed from 1991 and 2006 population census frame, respectively. In the second stage, a complete listing of households was carried out in each selected cluster. An average of 21 and 41 households was respectively selected in every cluster in 2003 and 2008 by equal probability systematic sampling. All women aged 15-49 and all men aged 15-59 who were residents of the households were interviewed. From the DHS data, we constructed the indicators of child health used in this study which are: nutritional status measured by height-for-age and weight-for-age z-scores, calculated for children less than 10 years according WHO (2006) methodology.

III. Results and Discussions

The results are presented in the appendix. Tables 1, 2 and 3 are the summary statistics, while tables 4 and 5 show the Oaxaca decompositions of determinants of health inequality. Tables 6 and 7, respectively, show the decomposition of health concentration index and variations in nutritional status by geopolitical zones.

III.1 Summary Statistics by Socioeconomic Status and Zones

Tables 1, 2 and 3 show the summary statistics of health-related variables (standard deviations in parenthesis) by wealth index, education level of mother and geopolitical zones respectively. Table 1 shows that households at the tail end of wealth distribution on the average have lower access to safe drinking water, have poor sanitary toilet, and have low level of completed education of mother. Also, the poorer the household, the worse the average health of children less than 10 years measured by stunting and underweight and the less likely would the household have access to health infrastructure measured by average intake of vitamin A up to two months after delivery. Table 2 shows that on the average, households with better educated mothers have higher access to safe-drinking water, are less exposed to unsafe toilet, and have higher average income measured by the wealth index. With better educated mothers, average child health is higher, that is the likelihood of stunting and underweight is lower and access to health infrastructure increases. Table 3 shows that the northern geopolitical zones on the average have lower average health-related inputs such as safe drinking water, sanitary toilet and access to vitamin A compared to the southern geopolitical zones. The tables also indicate that the northern zones as a group have poor socioeconomic status and have poor average child health measured by the prevalence of malnutrition in the area. This is shown clearly in table 7.

III.2 Oaxaca Decomposition Results

Tables 4 and 5 show Oaxaca decompositions of Height-for-age (HAZ) and Weigh-for-age (WAZ) z-scores, respectively, for the poor and nonpoor in the first four columns and for the north and south in the last four columns of each table. For the poor and nonpoor Oaxaca decompositions, wealth index, regional factors, and access to safe drinking water as well as child demographics have significant endowment effects on child health inequality as shown in column 3 of table 4. Education level of mother has no significant endowment effect on child nutritional gap between the poor and nonpoor but has significant coefficient effect as shown in column 4 of table 4. However, maternal education has significant effect in the prevalence of child underweight between the poor and nonpoor households as shown in column 3 of table 5. Wealth differential accounts for about 58 per cent of nutritional gap between the poor and nonpoor children measured by HAZ and also accounts for about 33 per cent of why the poor children have disproportionately higher share of underweight in the population measured by WAZ as shown in column 3 of tables 4 and 5, respectively. Hence, differences in asset ownership between the poor and nonpoor households act to widen child health inequality in favour of the nonpoor. Again, table 5 shows that differences in educational levels account for about 12.6 per cent of the observed differences in higher prevalence of underweight among children of the poor compared to nonpoor children. Table 4, column 4 shows that effective utilization of education of mother to obtain maximum health benefit explains about 23.0 per cent of child nutritional gap between the poor and nonpoor.

Regional characteristics explain about 9.4 per cent of the nutritional gap and 18.9 per cent of underweight gap as shown in column 3 of tables 4 and 5 respectively. Child demographics account for -2.0 to -3.0 per cent of outcome difference. This means that being a female child reduces inequality in child health outcome between the poor and nonpoor by between 2.0 and 3.0 per cent (see column 3 of table 4 and 5). The year dummy contributes 1.5 per cent and this is statistically significant, implying that, inequality in nutritional status (HAZ) between children born in poor households and those born in nonpoor households increased by 1.5 per cent between 2003 and 2008 while inequality in the prevalence of underweight (WAZ) among children of the poor over the same period decreased by 0.7 per cent as shown in column 3 of tables 4 and 5 repectively. Access to safe drinking water has significant endowment and coefficient effects which act to reduce child nutritional inequality (measured by HAZ) between the poor and nonpoor. Living in rural area increases nutritional inequality due to knowledge gap between the poor and nonpoor by about 59.8 per cent while the effect of rural residence on WAZ as shown in table 5 is not significant.

For the North and South, health gap difference shown in column 6 of table 4 and 5 is statistically significant and the decompositions into the various contributing factors are shown in columns 6,7,8,and 9 of tables 4 and 5,.Table 4 shows that access to safe drinking water, wealth index, availability of vitamin A at least up to two months after delivery, child and household demographics as well as place of residence have significant endowment and coefficient effects as shown in colums 7 and 8. Income gap (difference in asset index) between the northern and southern geopolitical zones increases inequality in child nutritional status by about 16.2 per cent (column 7 of table 4) and increases inequality in child underweight by about 9.30 per cent (column 7 table 5). Income has significant coefficient effect which reduces inequality due to differences in characteristics of north and south by about 39.0 per cent. Availability of vitamin A reduces child nutritional gap by 5.83 per cent between the north and south. Access to safe drinking water reduces the nutritional gap between the north and south by about 3.81 per cent and effective utilisation of safe drinking water to obtain maximum health benefits reduces child nutritional gap between the North and South by about 20.8 per cent as shown in columns 7 and 8 of table 4. Effect of education on child health inequality between the north and south is not significant.

III.3 Decomposition of Concentration Index

Table 6 shows the concentration index of height-for-age z-score for children less than 10 years for 2003 and 2008 and its decomposition into various contributing factors. Overall, the negative values of the concentration index indicate that poor health (in this case malnutrition) is disproportionately concentrated on the poor in both time periods. However, the results show that health inequality between the poor and nonpoor reduced in 2008 (the value of the index in absolute terms is smaller in 2008). For example the concentration index was -0.0726 in 2003 and became -0.0414 in 2008. We further decomposed the concentration index into various contributing factors as reported in the table.

Negative values of concentration index imply more concentration of bad health on the poor. Positive contribution of a variable to concentration index means the variable reduces the concentration of bad health on the poor whereas negative contributions imply the variable increases concentration of bad health on the poor. Elasticities measure the extent of sensitive of the concentration index on a particular variable. The results show that the concentration index was very sensitive to child demographic characteristics such as the age and gender, household characteristics such as the gender of the household head, education, access to electricity and place of residence because of their high elasticity coefficients. The results show that in 2003 there was high inequality in the asset index to the advantage of the rich. Access to safe drinking water, electricity, good toilet facilities and availability of vitamin A to a child at least two months after delivery are tilted to the advantage of the nonpoor. Inequality in education is also disproportionately concentrated on the rich. In 2008, wealth related inequality was still very high and again disproportionately concentrated on the rich. Inequality in education and sanitary toilet declined sharply in 2008, while there were slight declines in inequality in access to electricity, safe drinking water, availability of vitamin A, and residence as well as in child demographics. These declines contributed to the decline in the overall concentration index for child malnutrition in 2008.

The percentage contribution of each variable to the overall concentration index is shown in the last column for each year. We see that child age, asset index, place of residence, and access to electricity contributed more positively to the concentration index. In essence, their impacts widened the observed health inequality in 2003. On the other hand, access to safe drinking water, sanitary toilet, education level, and zonal factors contributed more negatively to concentration index. In 2008, the percentage contribution to the concentration index by the wealth variable increased to about 32.8 per cent while the percentage contribution of access to electricity became negative implying access to more electricity is very likely to reduce health inequality between the poor and nonpoor. The percentage contribution of zonal factors to concentration index was highly negative in 2003 but became highly positive in 2008. This implies that the reduction in inequality in the malnutrition we observed between 2003 and 2008 may partly be attributed to the reduction in the gaps in zonal characteristics or returns to those characteristics.

The concentration curves as depicted in figure 3 and figure 4 in the appendix show the pattern of distribution of the prevalence of malnutrition over time and within each geopolitical zone. Looking at the curves we could not see dominance of one curve over another but the concentration indices in figure 5 indicate that in 2003 the degree of health inequality was higher than in 2008 but this was largest in the South East. This means that malnutrition was more disproportionately concentrated on the poor in 2003 than in 2008 and that this disproportionate degree of concentration was more in the south east in 2003 and 2008 compared to any other zone. However, the south east does appear to have on the average better population nourishment compared to other zones but the distribution of health in the zone was highly unequal. However in 2008 we saw an overall improvement in the distribution of health across all zones. However, the South East still has more disproportionate concentration of health on the poor compared to the other zones. This again has important implication for policies that target both improvement in mean health and its distribution in the population.

Table 7 shows the distribution of the prevalence of malnutrition across the six geopolitical zones and across socioeconomic groups. Based on the World Health Organisation (WHO) classification of population degree of malnutrition we are able to rank the degree of malnutrition across all groups. As the table shows there is strong evidence of high to very high degree of malnutrition among the population and very limited degree of medium degree of malnutrition and this varies across the zones. For example, the percentage of children under 10 years that were malnourished 2003 in the North East and North West was respectively 47.0 per cent and 61.0 per cent; and 26.8 per cent and 43.3 per cent of those children being severely exposed to malnutrition, respectively, in the same year. In the North Central, 34.3 per cent of children less than 10 years were moderately malnourished, while the 15.6 per cent were severely malnourished. Thus, there were very high cases of both moderate and severe malnutrition in all the zones but the figures show it was worst in the North than in the South in both 2003 and

2008. However, in 2008, we observed that the degree of malnutrition of less than 10 year olds began to worsen in both the North and South.

IV. Recommendations and Conclusion

One policy recommendation from our findings is that specific interventions are needed to improve the welfare level of individuals especially the poorest groups most of whom are found in the north-east and north-west. One of such interventions is the provision of basic education for women and making it affordable. Women education is vital for effective utilization of health information and healthcare to raise a healthy family. Hence, giving women greater opportunities to be formally educated would improve health outcome and also reduce health inequality across all groups. Another key recommendation from our findings is that income generating activities in the private and public sectors should be created. The government could achieve this by supporting the private sector with soft loans and providing the basic infrastructure such as electricity so that small scale enterprises could be run at sustainable costs. This is important because policies that improve income or welfare conditions of the population especially the poorest group will be effective in improving the mean health of this group. In other words, more inclusive growth is needed to ensure that income plays dual role in household and individual health namely, improving mean health and reducing health inequality across all groups. Interventions are needed to improve health and other basic infrastructure and educating people on the utilization. Providing basic amenities such as safe drinking water and sewage systems by the government will be very effective in reducing health inequality between the rich and the poor in all the six zones of the country. However, it is also important that extensive education of the people on the utilization of these amenities for better health should be carried out through mass literacy campaigns and public enlightenment not by using the mass media alone but by sending community health workers to educate the people from time to time. This is necessary because it is not uncommon to see people that have access to good drinking water but drink rain water or from well.

Socioeconomic variables are important determinants of both the mean health and the distribution of health in the population. Furthermore, to the socioeconomic factors, child demographics and regional endowments also play significant roles in explaining health discrepancies observed in the population. These findings are consistent with some empirical works done in many countries but one key finding of the study that is different from other studies is that much of the zonal gap in child mean health outcome in Nigeria are accounted for not by socioeconomic endowments but by knowledge gap in the utilisation of those endowments to produce better health. For Nigeria to move closer to the health related MDG targets, specific actions, as we have recommended, should be taken to influence child health outcome positively.

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Appendix

Table 1: Summary Statistics of the Health Variables by Wealth Index

Variable	poorest	poorer	middle	richer	richest	Total
safe dri_water	0.128	0.236	0.303	0.500	0.724	0.339
	(0.334)	(0.425)	(0.460)	(0.500)	(0.447)	(0.473)
safe toilet	0.217	0.357	0.359	0.444	0.786	0.400
	(0.412)	(0.479)	(0.480)	(0.497)	(0.410)	(0.490)
educlevel Mother	0.300	0.477	0.809	1.280	1.955	0.854
	(0.583)	(0.698)	(0.850)	(0.898)	(0.830)	(0.950)
stunting	0.536	0.515	0.472	0.390	0.313	0.461
	(0.499)	(0.500)	(0.499)	(0.488)	(0.464)	(0.498)
underweight	0.397	0.338	0.263	0.202	0.131	0.285
	(0.489)	(0.473)	(0.440)	(0.402)	(0.337)	(0.451)
received vitamin A	0.0847	0.132	0.234	0.346	0.545	0.238
	(0.278)	(0.339)	(0.423)	(0.476)	(0.498)	(0.426)

Table 2: Summary Statistics of the Health Variables by Education Level of Mother

	no education	primary	secondary	higher	Total
safe drinking water	0.259	0.311	0.467	0.637	0.339
	(0.438)	(0.463)	(0.499)	(0.481)	(0.473)
safe toilet	0.381	0.318	0.442	0.757	0.400
	(0.486)	(0.466)	(0.497)	(0.429)	(0.490)
wealth index	2.013	2.795	3.716	4.620	2.726
	(1.063)	(1.264)	(1.222)	(0.703)	(1.397)
stunting	0.538	0.440	0.362	0.271	0.461
	(0.499)	(0.496)	(0.480)	(0.445)	(0.498)
underweight	0.394	0.224	0.159	0.105	0.285
	(0.489)	(0.417)	(0.365)	(0.307)	(0.451)
received vitamin A	0.101	0.264	0.422	0.565	0.238
	(0.302)	(0.441)	(0.494)	(0.496)	(0.426)

Table 3: Summary Statistics of the Health Variables by Geopolitical Zones

	north central	north east	north west	south east	south west	south south
safe dri_water	0.248	0.260	0.338	0.491	0.379	0.484
	(0.432)	(0.439)	(0.473)	(0.500)	(0.485)	(0.500)
safe toilet	0.353	0.327	0.521	0.416	0.314	0.413
	(0.478)	(0.469)	(0.500)	(0.493)	(0.464)	(0.492)
Educlevel Mother	0.928	0.447	0.326	1.502	1.552	1.531
	(0.940)	(0.761)	(0.691)	(0.830)	(0.750)	(0.889)
wealth index	2.783	2.039	2.280	3.325	3.365	3.829
	(1.353)	(1.165)	(1.225)	(1.265)	(1.247)	(1.273)
stunting	0.481	0.483	0.567	0.292	0.378	0.348
	(0.500)	(0.500)	(0.496)	(0.455)	(0.485)	(0.477)
underweight	0.229	0.359	0.432	0.138	0.149	0.144
	(0.420)	(0.480)	(0.495)	(0.345)	(0.356)	(0.351)
received vitamin a	0.266	0.133	0.0856	0.359	0.381	0.492
	(0.442)	(0.339)	(0.280)	(0.480)	(0.486)	(0.500)

Table 4: Blinder-Oaxaca Decompositions of Child Nutritional Status (Malnutrition) using Height-for-Age Z-score for Children<10

	Poor and Nonpoor				North and South			
	Differential	Endowments	Coefficients	Interaction	Differential	Endowments	Coefficients	Interaction
Prediction_1	2.283***				2.113***			
	(0.000)				(0.000)			
Prediction_2	1.753***				1.279***			
	(0.000)				(0.000)			
Difference	0.530***				0.834***			
	(0.000)				(0.000)			
vitamin A		0.0144	-0.0497	0.0350		-0.0583**	-0.253***	0.162***
		(0.530)	(0.411)	(0.411)		(0.049)	(0.000)	(0.000)
safe dr_water		-0.0453*	-0.236***	0.150***		-0.0381**	-0.208***	0.0752***
		(0.100)	(0.001)	(0.001)		(0.046)	(0.001)	(0.002)
good_sanitation		0.00370	0.0899	-0.0401		-0.00312	0.0851	0.00674
		(0.862)	(0.201)	(0.201)		(0.434)	(0.139)	(0.170)
has electricity		-0.0950	0.115	-0.104		-0.0135	0.133	-0.0635
		(0.191)	(0.435)	(0.435)		(0.761)	(0.246)	(0.246)
child_demo		-0.0267**	0.547**	-0.020***		-0.00378	0.726***	-0.0033
		(0.012)	(0.012)	(0.008)		(0.664)	(0.002)	(0.722)
hhold_demo		0.00649	-0.361	0.000508		-0.0209	-1.227***	0.0936***
		(0.172)	(0.257)	(0.947)		(0.216)	(0.000)	(0.000)
region		0.0940**	-0.269**	0.0752				
		(0.016)	(0.028)	(0.221)				
education		0.0528	0.230**	-0.164**		0.0957	-0.0779	0.0518
		(0.234)	(0.029)	(0.046)		(0.301)	(0.136)	(0.622)
Rural Resid		0.00553	0.598**	0.171**		-0.0142	0.754***	0.0786***
		(0.892)	(0.041)	(0.041)		(0.489)	(0.004)	(0.004)

wealth index		0.582***	0.618	-0.386		0.162*	0.0195	-0.00663
		(0.001)	(0.173)	(0.173)		(0.054)	(0.948)	(0.948)
Y=2008		0.0154***	10.02	0.000948		-0.00285	27.04	- 0.000501
		(0.004)	(0.903)	(0.903)		(0.222)	(0.756)	(0.761)
Total		0.607***	0.203	-0.280		0.103	0.337***	0.394***
		(0.000)	(0.397)	(0.292)		(0.297)	(0.000)	(0.000)
Constant			-11.10				-26.66	
			(0.892)				(0.760)	
Observations	16660				16660			

p-values in parentheses *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$

Table 5: Blinder-Oaxaca Decompositions of Child Nutritional Status (Malnutrition) using Weight-for-Age Z-score for Children<10

	Poor and Nonpoor				North and South			
	Differential	Endowments	Coefficients	Interaction	Differential	Endowments	Coefficients	Interaction
Prediction_1	1.420***				1.309***			
	(0.000)				(0.000)			
Prediction_2	0.729***				0.400***			
	(0.000)				(0.000)			
Difference	0.691***				0.909***			
	(0.000)				(0.000)			
vitamin A		0.0369***	0.0586	-0.0412		0.0393**	0.0173	-0.0111
		(0.007)	(0.117)	(0.117)		(0.039)	(0.663)	(0.663)
safe dri_water		-0.0143	0.0368	-0.0234		0.00314	0.0907**	-0.033**
		(0.379)	(0.392)	(0.393)		(0.797)	(0.026)	(0.027)
good_sanitation		-0.000567	-0.0333	0.0149		-0.00202	0.0525	0.00416
		(0.964)	(0.439)	(0.439)		(0.430)	(0.148)	(0.178)
has electricity		-0.0110	-0.0126	0.0114		-0.0150	0.0445	-0.0212
		(0.798)	(0.890)	(0.890)		(0.600)	(0.538)	(0.538)
child_demo		-0.0201***	0.591***	-0.00548		-0.00392	0.183	0.00384
		(0.003)	(0.000)	(0.264)		(0.521)	(0.213)	(0.481)
hhold_demo		-0.000404	-0.211	0.00135		0.00211	-0.269	0.00916
		(0.885)	(0.279)	(0.770)		(0.845)	(0.191)	(0.550)
region		0.189***	0.0406	0.0561				
		(0.000)	(0.595)	(0.137)				
education		0.126***	-0.0618	0.0547		0.0737	-0.0439	0.244***
		(0.000)	(0.338)	(0.281)		(0.215)	(0.175)	(0.000)
Rural resid		0.0324	0.0137	0.00391		0.0124	0.0593	0.00618
		(0.180)	(0.940)	(0.940)		(0.349)	(0.713)	(0.713)
wealth index		0.328***	-0.130	0.0809		0.0930*	-0.390**	0.132**
		(0.002)	(0.643)	(0.643)		(0.085)	(0.037)	(0.037)
Year=2008		-0.00659**	78.40	0.00742		0.00138	58.02	-0.00107
		(0.032)	(0.119)	(0.126)		(0.275)	(0.289)	(0.387)
Total		0.659***	-0.129	0.160		0.204***	0.371***	0.333***
		(0.000)	(0.389)	(0.330)		(0.001)	(0.000)	(0.000)
Constant			-78.82				-57.39	
			(0.117)				(0.295)	
Observations	16660				16660			

p-values in parentheses *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$

Table 6: Table Decomposition of Concentration Index for Height-for-Age Z-scores of Children<10 Years, Nigeria, 2003 and 2008

Variable	2003				2008			
	Elasticities	Concindex	Contrib	%Contrib	Elasticities	Concindex	Contrib	%Contrib
Child age	0.858	-.0315	-.0271	0.373	.3857	.025	.01	-.231
Agesq	-.3291	-.0562	.0185	-.255	-.223	.043	-.01	.231
Male Child	-.1366	.0013	-.0002	.0024	-0.275	.002	-.001	.012
Asset Index	-.0305	.6108	-.0186	.257	-.0228	.594	-.0136	.328
Vitamin A	-.0133	.1783	-.0024	.0326	-.0086	.197	-.0017	.0413
male HH Head	-.1256	-.0060	.0008	-.0104	.0274	-.023	-.0006	.0153
Age HHH	.0460	-.0227	-.001	.0144	-.005	-.013	.0001	-0.002
Urban Residence	.262	-.094	-.0247	.3400	.0189	-.087	-.0016	.0395
Electricity	-.1833	.2785	-.0511	.704	.0294	.273	.0080	-.1941
Safe water	.0053	.2620	.0014	-.019	-.0062	.227	-.0014	.0342
toilet	.0029	.1108	.0003	-.005	-.0238	.284	-.0068	.1631
Education	.1999	.0125	.0025	-.035	.0175	.005	.0001	-.002
Zones			.0445	-.6133			-.0129	.3113
Residual			-.0155	.2135			-.0105	.2536
Total			-.0726				-.0414	

Table 7: Prevalence of Malnutrition (Stunting and Underweight) by Zones and Year

Groups	Year and Heath Indicator							
	2003				2008			
	Mean	SD	% below -2SD	% below -3SD	Mean	SD	% below -2SD	% below -3SD
Zones								
North Central	-1.238	2.3158	34.33	15.61	-2.2156	3.7319	48.58	32.7
North East	-1.739	2.3937	47.01	26.77	-2.0499	3.2829	50.76	35.07
North West	-2.4814	3.2529	61.16	43.32	-2.4019	3.8233	56.83	40.7
South East	-1.0741	2.771	26.98	16.55	-1.0518	3.6867	29.02	16.63
South West	-0.8694	2.7342	26.76	11.34	-1.8085	3.8572	38.18	23.83
South South	-1.0045	2.7447	31.03	12.9	-1.3051	3.1289	35.17	18.74

Figure 3: Concentration Curves of Negative of WAZ Z-scores for Children < 10 Years by Zones

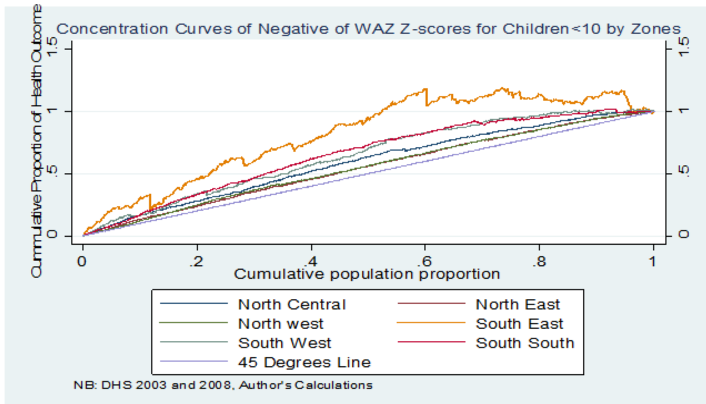

Figure 4: Concentration Curves for HAZ for Children < 10 Years by Zones

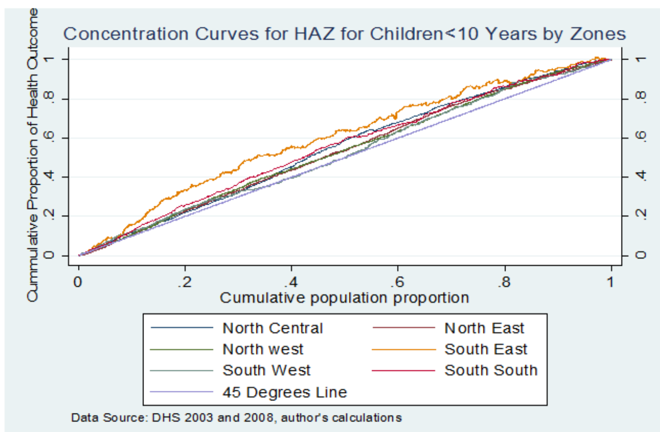

Figure 5