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Inequality in Under-Five Child Malnutrition: Evidence from Nigeria Multiple Indicator Cluster Survey

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Abstract
This paper evaluates inequality in under-five child malnutrition in Nigeria; using cross-sectional data from 2011 multiple indicator cluster survey. The concentration curve was employed to ascertain whether inequality in under-five child malnutrition is pro-poor or pro-rich whereas the concentration index was used to determine the size of this inequality in Nigeria. We found that inequality in malnutrition concentrates amongst the poor under-five children and that the size of this inequality is reasonably large. This result is consistent for the three anthropometric measures of child malnutrition i.e., stunting, underweight and wasting. However, inequality in stunting and wasting were found to be fairly the same and bigger than that of wasting. Put differently, inequality in stunting and that of underweight were found to be the strongest in Nigeria, while that of wasting was discovered to be the weakest. We recommend increase in food production and distribution, investment in nutrition education and increase in access to nutritious food, mainly for children left behind (i.e., the poor children) in the country.
Keywords: Under-Five Child Malnutrition, Inequality, Concentration Curve, Concentration Index

1. Introduction

Child malnutrition has been widely identified by researchers and health policy makers as a crucial public health issue in the developing world. Malnutrition (under-nutrition), brought about by inadequate food intake, micronutrient deficiencies and poor health conditions is associated with poor physical, mental development, and reduced intellectual achievement of the child. In the later life of the child, it leads to reduced work capacity and decreased economic productivity. More worrisome is that it causes childhood morbidity and mortality (World Health Organization (WHO), 2013).

In Nigeria, malnutrition remains a great challenge, particularly for children under the age of five. It contributes to death of about half a million children each year. This makes Nigeria one of the highest contributors to under five mortality in the world (Ogundipe, 2015). According to Nigeria Federal Ministry of Health (2016), 37% of children in Nigeria are stunted, 29% are underweight while 18% are wasted. A situation mainly attributable to poverty i.e., that the very poor household cannot afford to purchase the necessary food (nutritious diet) (National Population Commission (NPC) & ICF International, 2014). In developing countries such as Nigeria with high level of poverty, economic growth tends to favour only a class of wealthy people. This leads to rising inequality in health and nutrition that mainly affects the helpless group of the population, such as children under the age of five (Fatukasi & Ayeomoni, 2015).

However, a survey of literature in this area reveal little (not large) amount of empirical studies in general on the economic position in which malnutrition inequality concentrates and on the magnitude of this inequality. Utilising the Living Standards Measurement Study (LSMS) survey for 11 developing countries and multi-topic surveys for 9 countries, Wagstaff & Watanabe (2000) analysed socioeconomic inequalities in child malnutrition in 20 selected developing countries, excluding Nigeria. They revealed that inequalities in underweight tend to be larger than inequalities in stunting, which tend to be larger than inequalities in wasting. In summary, they found that inequalities in malnutrition always disfavour the poor. Using the living standard and development survey collected in 1993, Zere & McIntyre (2003) discovered considerable pro-rich inequalities in the distribution of stunting and underweight in South Africa but found stunting to be the most prevalent form of malnutrition in the country. In the same South Africa, May & Timeus (2014), repeated what Zere & McIntyre (2003) did with similar but more up to date data (i.e., 2008 National income dynamics survey data), to know if any change has occurred.

They found that pro-rich inequalities in stunting and underweight have significantly declined since the end of apartheid; they attributed these findings to child support grant program introduced in 1998. Van de Poel *et al.* (2007) used 2003 demographic and health survey data and revealed that poorer children were more likely to be malnourished than richer children in Ghana. Employing data similar to that of Van de Poel *et al.* (2007), Konings *et al.* (2010) found that the level of malnutrition accumulates faster amongst the poor than amongst the better-off in Ghana. Again, Van de Poel *et al.* (2008) did a cross country study with demographic and health survey data covering 26 countries from sub-Saharan Africa,7 from Eastern Mediterranean, 5 from South and South-East Asia, and 9 in Latin America and the Caribbean; they found that stunting and wasting disproportionately affect the poor in almost all these countries investigated. Pathak (2009) also found higher concentration of malnutrition among the poor over the years analysed (i.e., 1992-2005) in India using data from three rounds of National Family and Health Survey (NFHS) conducted during 1992-2005. In Bangladesh, Ahmed *et al.* (2013), found similar result i.e., that child malnutrition was more common in poor quintiles compared to rich quintiles using the concentration index method. Novignon *et al.* (2015) in their own study, discovered that there exist pro-rich inequalities in child malnutrition measured by stunting and wasting using 2011 Ghana Multiple indicator cluster survey. Finally, Salvucci (2016) also found pro-rich inequalities in the distribution of malnutrition for all years in Mozambique by employing data from the Household Budget Survey 1996–1997 and 2008–2009, and data from the Development and Health Statistics 2003 and 2011.

To the best of our knowledge, there have been very limited effort(s) in Nigeria that determine the economic ladder in which inequality in malnutrition concentrates and the size of this inequality. The work of Uthman (2009) quantified the magnitude of inequality in childhood malnutrition in Nigeria, but focused only on one malnutrition measure (i.e., stunting) with 2003 demographic and health survey. Results from this study may limit policy coverage for other malnutrition indicators such as underweight and wasting. Therefore, in the light of this gap, we add to literature by utilizing three anthropometric measures that offer a comprehensive profile of malnutrition (i.e., stunting, underweight and wasting) and we also use a different and more recent survey data (i.e., 2011 Multiple indicator cluster survey) to reveal the socioeconomic (measured with wealth) position in which inequality in malnutrition concentrates and the size of this inequality in Nigeria. Put differently, we address two specific questions in this paper. First, is inequality in under- five child malnutrition in Nigeria pro-poor or pro-rich? Second, what is the size of this inequality? The answers to these questions are important since they will enable more effective policies and programs aimed at reducing existing inequalities in child malnourishment and policies that will help enhance resources to raise the health of vulnerable groups in Nigeria.

The rest of the paper is sub-divided as follows. In section two, the analytical methods used for the empirical estimations are presented followed by data and variables description in section three. Section four reports the empirical findings while section five, concludes the paper with the policy implications of the study findings.

2. Methodology

The study is driven by two specific research objectives namely: (i) to determine whether inequality in under-five child malnutrition in Nigeria is pro-poor or pro-rich; (ii) to estimate the size of inequality in under-five child malnutrition in Nigeria. To address these specific research objectives, we used; the concentration curve and the concentration index approach

2.1 Measuring pro-poor/pro-rich inequality

To determine whether inequality in under-five child malnutrition in Nigeria is concentrated among the poor or rich children, we used the concentration curve. The concentration curve provides a complete graphical representation of health inequality. It can be used to assess whether or not a health variable (say, child malnutrition) is more unequally distributed to the disadvantage of the poor children. The concentration curve plots the cumulative percentage of the health variable (y-axis) against the cumulative percentage of the population, ranked by living standards, starting with the poorest, and ending with the richest (x-axis) (O' Donnel *et al.,* 2008). Put in different terms, it plots shares of the malnutrition variable against quintiles of the wealth variable. If every child, irrespective of his or her wealth, has exactly the same value of malnutrition, the concentration curve will be a 45-degree line (i.e., the line of equality), running from the bottom left-hand corner to the top right-hand corner. If, by contrast, the malnutrition variable takes higher (lower) values among poorer children, the concentration curve will lie above (below) the line of equality. The farther the curve is above the line of equality, the more concentrated the malnutrition variable is among the poor children. The reverse is the case, the farther the curve is below the line of equality (O' Donnel *et al.,* 2008).

2.2 Measuring the size of inequality

To estimate the size of inequality in under-five child malnutrition, the concentration index was computed. Concentration curve can be used to identify whether socioeconomic inequality in a health variable exists, but it does not give a measure of the size of inequality which can be used for convenient comparison (O' Donnel *et al.,*

2008). The concentration index which is directly related to the concentration curve enables the estimation of the size of socioeconomic related inequality in a health variable (Kakwani, Wagstaff & Van Doorslaer, 1997 as cited in O' Donnel *et al.,* 2008). It has been used, for instance, to measure the degree of socioeconomic-related inequality in child malnutrition (Wagstaff, van Doorslaer & Watanabe, 2003). The concentration index is defined as twice the area between the concentration curve and the line of equality (i.e., the 45-degree line). If there is no socioeconomic-related inequality, the concentration index is zero. Conventionally, the index takes a negative value when the curve lies above the line of equality, indicating disproportionate concentration of the health variable among the poor, and a positive value when it lies below the line of equality. The concentration index can be obtained by using the following formula;

$$C = \frac{2}{N\mu}\sum_{i=1}^{n} h_i r_i - 1 - \frac{1}{N} C = \frac{2}{N\mu}\sum_{i=1}^{n} h_i r_i - 1 - \frac{1}{N} \quad (1)$$

Where CC is the concentration index, $h_i h_i$ represents the health sector variable (say, child malnutrition), $\mu\mu$ is it mean, $r_i r_i$ is the fractional rank of the individual in the socioeconomic distribution with $i\,i$ = 1 for the poorest and $i\,i$ = N for the richest. A more convenient formula can be computed as the covariance between the health variable (child malnutrition) and the fractional rank in the wealth score distribution as follows;

$$C = \frac{2}{\mu} cov\,(y_i, r_i) C = \frac{2}{\mu} cov\,(y_i, r_i) \quad (2)$$

Where CC is the concentration index, $y_i y_i$ represents child malnutrition and $r_i r_i$ is the fractional rank of the individual $i\,i$ in the distribution of wealth score. $\mu\mu$ is the mean of the child malnutrition variable and $covcov$ is covariance. The value of the concentration index (CI) is bounded between -1 and +1 and the magnitude of the CI provides information about the strength of the relationship and the degree of variability in child malnutrition. The closer the absolute value of CI to one, the stronger the level of inequality.

3. Data and Variables

Data used in the study were gotten from the 2011 Nigeria Multiple Indicator Cluster Survey (MICS). The dataset is the fourth in a series of nationally representative sample survey of households, children aged 0–5 years and women aged 15–59 years. The survey was conducted in 2011 by the National Bureau of Statistics (NBS) with financial and technical support from United Nations children's fund (UNICEF), United Nations populations fund (UNFPA), and the Government of Nigeria through the National Bureau of Statistics. MICS provides up-to-date/valuable 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 upon commitments (e.g., the world fit for children goals) (NBS Final Report, 2011). The sample for the 2011 Nigeria MICS4 was designed to provide estimates for a large number of indicators on the situation of children and women at the national level, for urban and rural areas, and for the 36 states of the Federation and the Federal Capital Territory as well as the 6 geo-political zones of Nigeria. The states within each zone were identified as the main reporting domain while the Enumeration Areas (EAs) within each state were identified as the main sampling units. Sample size was 29,600 households and 29,077 were successfully interviewed (NBS Final Report, 2011).

3.1 Measurement of Nutritional Status

Three anthropometric measures of child nutrition were used for the analysis. They include; height-for-age (HAZ), weight-for-age (WAZ) and weight-for-height (WHZ) z-scores, based on the 2006 World Health Organization (WHO) standard. The z-scores were categorised into stunting, underweight and wasting respectively, indicating growth retardation defined as HAZ, WAZ, and WHZ below -2 z-scores from the WHO Multicentre Growth Reference Study Median. These are standard cut-off points proposed by the WHO to measure malnutrition. This limit also gives a good indication of increased risk of morbidity and mortality among under-five children (WHO, 2006). Intuitively, height-for-age (stunting) is hindrance in growth of the child i.e., little height given the child's age. Underweight (weight-for-age) refers to low body weight of the child given age i.e., weighing less than the normal/ required amount while wasting is small weight given the height of the child.

3.2 Measurement of Socioeconomic Status

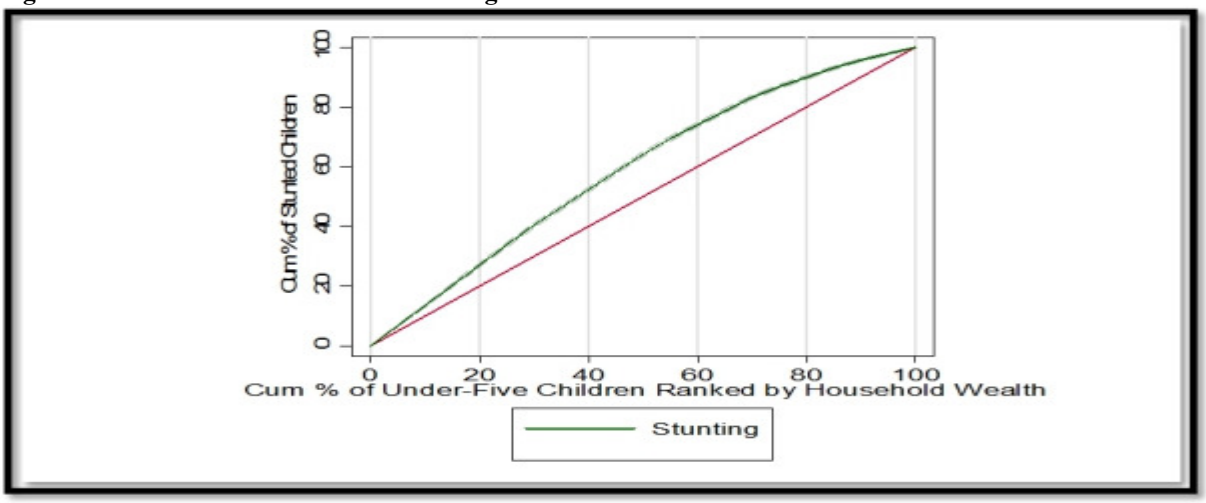
In literature, there are different measures of living standard, we have direct measures such as income and expenditure, and indirect measure (i.e., proxy) such as wealth index computed using household assets such as ownership of car, fridge, television, telephone and motorcycle. The use of income and expenditure data are prone to various bias such as the recall bias, variation of income from season to season and reluctance to disclose

information. In order words, income and expenditure data are difficult to collect (Sahn & Stifel, 2003 as cited in Alaba & Chola, 2014). However, in this paper, the wealth index which is a good proxy for household income or expenditure was used as the living standard measure. According to O' Donnel *et al.* (2008), asset data are easier to collect and potentially less susceptible to measurement error. Another reason for the adoption of wealth index as a measure of welfare is because the Multiple Indicator cluster survey (MICS) does not contain income and expenditure data.

4. Results and Discussion

4.1 Results for Pro-poor /or Pro-rich Socio-economic (measured with wealth) Inequality in Under-Five Child Malnutrition in Nigeria

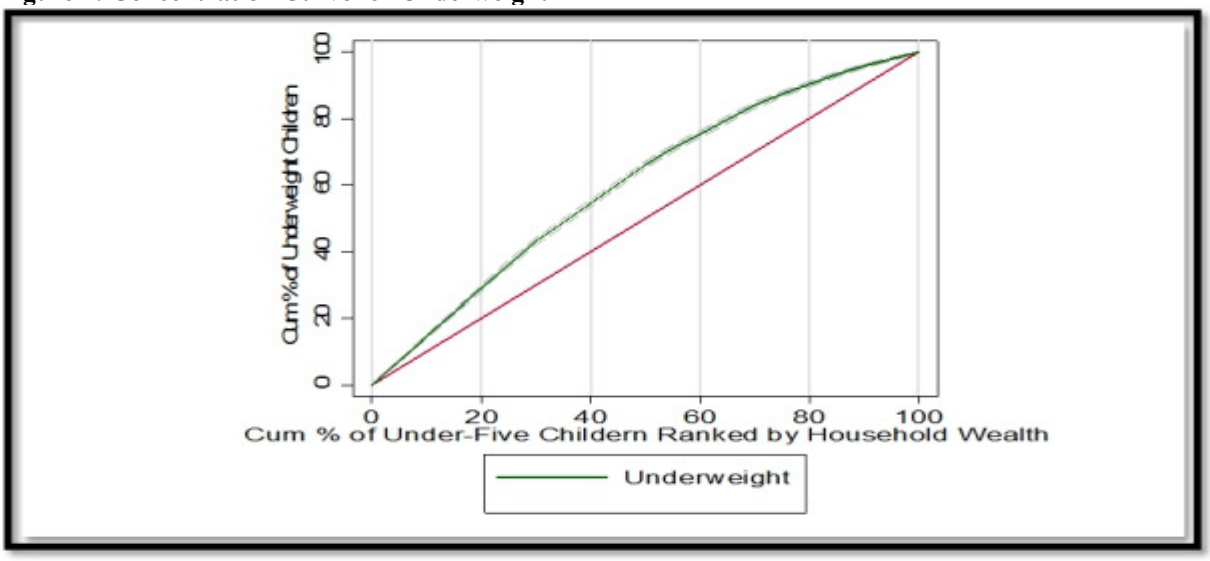
Figure 1: Concentration Curve for Stunting



Source: Computed with data from Nigeria MICS4 and Stata 13.0

The figure above plots shares of the malnutrition (stunting) variable against the quintiles of the wealth variable. It can be seen from this figure that the concentration curve of stunting lies above the equal distribution line (i.e., the red line/ 45 degree line/ straight line). This means that stunting is concentrated among the poor under-five children or that there is pro-rich inequality in stunting in Nigeria. For instance, the bottom 70% of under-five children in the wealth distribution suffer up to 80% share of stunting while the top 30% in the distribution suffer only 20% share of stunting.

Figure 2: Concentration Curve for Underweight



Source: Computed with data from Nigeria MICS4 and Stata 13.0

The figure above plots shares of the malnutrition (underweight) variable against the quintiles of wealth variable. As can be seen from this figure, the concentration curve of underweight lies above the equal distribution line (i.e., the red line/ 45 degree line). This implies that underweight is concentrated among the poor under-five children. Put differently, there is pro-rich inequality in underweight in Nigeria. For example, the bottom 60% of

under-five children in the wealth distribution suffer up to 70% share of underweight while the top 40% in the distribution suffer only 30% share of underweight. Of importance to note here is that the concentration of stunting is just the same with that of underweight in Nigeria. This is because under-five children from poor household suffer extra 10% share of stunting and this is the same for underweight as can be seen from the above analyses of the two malnutrition variables.

Figure 3: Concentration Curve for Wasting

Source: Computed with data from Nigeria MICS4 and Stata 13.0

From the graph above, it is quite easy to see that there is pro-rich inequality in child wasting. In other words, inequality in wasting is concentrated among the poor under-five children in Nigeria. Also this graph reveals that the concentration curve of wasting has a lesser distance from the line of equality (i.e., the red line/ 45 degree line) when compared with the concentration curves for stunting and underweight above. This means that wealth-related inequality in wasting is less prevalent in Nigeria. For instance, the bottom 60% of under-five children in the wealth distribution suffer only 65% share of malnutrition (i.e., wasting) while the top 40% in the distribution suffer 35% of wasting. Unlike the case of underweight where 60% of under-five children suffer up to 70% of malnutrition and 40% suffer only 30% of underweight.

4.2 Results for Magnitude (Size) of Socio-economic Inequality in Under-Five Child Malnutrition in Nigeria

Table 1: Concentration Indices for Under-five Child Malnutrition in Nigeria

Concentration Index for Stunting		
Index Value	**Std. Error**	**P-Value**
-0.2315899	0.00473237	0.0000
Concentration Index for Underweight		
Index Value	**Std. Error**	**P-Value**
-0.23411151	0.00630247	0.0000
Concentration Index for Wasting		
Index Value	**Std. Error**	**P-Value**
-0.088226	0.01076938	0.0000

Source: Computed with data from Nigeria MICS4 and Stata 13.0

The table above reveals that there is statistically significant wealth inequality in Stunting, Under-weight and Wasting in Nigeria with a probability value of 0.0000 for the three indicators. Socio-economic inequality in stunting is relatively huge against the poor under-five children with a concentration index of -0.232. This is a

confirmation of the concentration curve in figure 1 above. Also socio-economic inequality in underweight and wasting is reasonably large against the poor under-five children with concentration indices of -0.234 and -0.088 respectively. In terms of differences between these indices; pro-rich inequality in stunting is just the same (in approximate terms) with that of under-weight, whereas pro-rich inequality in wasting is relatively lesser than that of stunting and underweight. Put in different terms, inequality in stunting and underweight are more dominant (i.e., more negative), whereas inequality in wasting is less prevalent in Nigeria. This result is closely in line with that of Zere & Mclntyre, (2003) who found that inequality in stunting is the strongest in South Africa (i.e., that the stunting concentration curve is the farthest from the line of equality). In summary, those children in the lowest socio-economic strata in Nigeria bear the greatest burden of malnutrition.

5. Conclusion and Recommendations

Our findings have important implication in the formulation of health policies which will not only help to reduce the concentration of malnutrition inequality among the poor under-five children but will also help to reduce the size of this inequality in Nigeria. First, the income of the poor should be increased, so that they can be able to afford nutritious food. For instance, the government should ensure regular cash transfers which will help to enhance access to basic needs (such as health, clothing, housing and education). This should be combined with livelihood promotion activities such as community-based savings and credit groups in Nigeria.

Second, the government should increase funding for nutrition services, including the establishment of nutrition corners in the primary healthcare centres in Nigeria. Also, government budgets should prioritise agricultural and rural development in order to enhance food production, distribution, availability and accessibility in the country. More so, there is the need to improve access to a healthy environment i.e., access to healthcare, safe drinking water and sanitation in communities and institutions and enhanced vaccination coverage.

Third, the civil society and media should work jointly to ensure public accountability on funds disbursement for nutrition interventions as well as increased sensitization of healthy eating habits. Also, the civil society should advocate for development and implementation of policies that increase access to food and income for the most vulnerable households in Nigeria.

Fourth, to improve nutritional status of the most vulnerable children, government should prioritize investments in girls' education, social protection and women's empowerment in Nigeria. This will not only help to reduce early marriage and pregnancy for the young girls but will also help to boost the capacity, the knowledge of mothers and their decision making powers so that they can make informed choices to improve their nutrition and that of their children. More so, greater care for women before and during pregnancy will help to reduce the rate of low birth weight, it will also result to heavier and healthier babies and children.

Finally, policies relating to nutrition and food security must be updated and translated into practice, backed by strong political and public support in order to boost their effect. For this to happen, adequate and efficient human and financial resources, policy coordination and delivery mechanisms should be put in place.

References

Alaba, O., & Chola, L., (2014), "Socioeconomic Inequalities in Adult Obesity Prevalence in South Africa: A Decomposition Analysis", *International Journal of Environmental Research and Public Health* **11**, 3388-3406.

Ahmed, S., Hasan, M., Ahmed, W., & Chowdhury, A. H. (2013), "Socio-economic Inequity of Malnutrition among Under-Five Children and Women at Reproductive Age in Bangladesh", *World Journal of Nutrition and Health* **1**(1), 13-17.

Fatukasi, A. A., & Ayeomoni, I. O. (2015), "Effect of Income Inequality on Health Indicators in Nigeria", *International Journal of Academic Research in Business and Social Sciences* **5**(8), 274-285.

Konings, P., Harper, S., Lynch, J., Hosseinpoor, A. R., Berkvens, D., Lorant, V., Geckova, A., Speybroeck, N. (2010), "Analysis of socioeconomic health inequalities using the concentration index", *Internal Journal Public Health* **55**, 71–74.

May, J., & Timeus, I. M. (2014), "Inequities in under-five child nutritional status in South Africa: what progress has been made?" *Development Southern Africa* **31**(6), 761-774.

National Population Commission (NPC) [Nigeria] & ICF International (2014), "Nigeria Demographic and Health Survey 2013. Abuja, Nigeria, and Rockville, Maryland, USA: NPC and ICF International", Retrieved from dhsprogram.com/Data/

NBS Final Report (2011), "National Bureau of Statistics (NBS) Multiple Indicator Cluster Survey Final Report. Abuja: National bureau of statistics", Retrieved from mics.unicef.org

Nigeria Federal Ministry of Health (2016, June 14), "2300 under-five children die of malnutrition annually in Nigeria", *Premium Times*. Retrieved from premiumtimesng.com/news/top-news/205266-2300-five-childr en-die-malnutrition-annually-nigeria-official.html

Novignon, J., Aboagye, E., Agyemang, O. S., & Aryeetey, G. (2015), "Socioeconomic-related inequalities in child

malnutrition: evidence from the Ghana multiple indicator cluster survey", *Health Economics Review* **5**(34), 1-11.**ccess**

O'Donnell, O., Van Doorslaer, E., Wagstaff, A., & Lindelow, M. (2008), "Analysis of health equity using household survey data: A guide to techniques and their implementation", WBI learning resource. World Bank, Washignton D. C doi: 101.1596/978-0-8213-6933-3

Ogundipe, S. (2015, August 12), "Malnutrition: Nigeria's silent crisis", *Vanguard*. Retrieved from vanguardngr.com/2015/08/malnutrition-nigerias-silent-crisis

Pathak, P. K. (2009), "Socioeconomic Inequality in Malnutrition in India, 1992-2005", Paper presented at the annual meeting of Population Association of America (PAA) at Detroit, Michigan, USA, April 29-May 2, 2009.

Salvucci, V. (2016), "Determinants and trends of socioeconomic inequality in child malnutrition: the case of Mozambique, 1996–2011", *Journal of international development* **28**, 857-875.

Uthman, O. A. (2009), "Using extended concentration and achievement indices to study socioeconomic inequality in chronic childhood malnutrition: the case of Nigeria", *International Journal for Equity in Health*, 1-8.ccess

Van de Poel, E., Hosseinpoor, A. R., Jehu-Appiah, C., Vega, J., & Speybroeck, N. (2007), "Malnutrition and the disproportional burden on the poor: the case of Ghana", *International Journal for Equity in Health*, **6**(21), 1-12.ccess

Van de Poel, E., Hosseinpoor, A. R., Speybroeck, N., Ourti, T. V., & Vega, J. (2008), "Socioeconomic inequality in malnutrition in developing countries", **86**(4), 282-291.

Wagstaff, A., & Watanabe, N. (2000), "Socioeconomic Inequalities in Child Malnutrition in the Developing World", Policy research working paper, 2434

Wagstaff, A., van Doorslaer, E., & Watanabe. N. (2003), "On Decomposing the Causes of Health Sector Inequalities, with an Application to Malnutrition Inequalities in Vietnam", *Journal of Econometrics* **112**(1), 219–27.

World Health Organization (2013), "Guidelines: Updates on the management of severe Acute Malnutrition in infants and children, WHO, Geneva", Retreived from htt://www.who.int/nutrition/publications/guidelines/updates_management_SAM_infantandchildren/en/

World Health Organization (2006), "WHO child growth standards: Length/height-for-age, weight- for-age and weight-for-height and body mass index for age: Methods and development", WHO Geneva.

Zere, E., & McIntyre, D. (2003), "Inequities in under-five child malnutrition in South Africa", *International Journal for Equity in Health* **2**(7), 1-10.