

Prevalence and Socioeconomic inequalities trends in child health comparing within and between group inequalities: Food insecurity and malnutrition in Zimbabwe

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Abstract

Background

Inequalities in child health remain a threat to this global efforts to achieve universal health coverage. We assessed socioeconomic inequalities in child health focusing on malnutrition and food insecurity in Zimbabwe.

Methods

We used Demographic Health Survey (DHS) data sets of 2010\11 and 2015. Food insecurity in children was determined based on the WHO dietary diversity score. Minimum dietary diversity was defined by a cut- off point of >4 therefore, in this study children with less than 3 of the 13 food groups were defined as food insecure. Malnutrition was assessed using weight for age Z-score, with children whose weight-for-age Z-score below minus two standard deviations (-2 SD) from the median considered malnourished. Concentration indices were computed to understand if malnutrition was dominant among the poor or rich. The study used the Theil index and decomposed the index by population subgroups (geographical clusters and socioeconomic status).

Results

Over the study period, malnutrition prevalence increased by 1.03 percentage points (**p.p**) [2010/11(3.73%); 2015(4.76%)], while food insecurity prevalence decreased by 4.35**p.p** [2010/11(78.29%);2015(73.94)]. Prevalence of malnutrition and food insecurity increased by; 9.6**p.p** and 2**p.p** among poor children & 10.23**p.p** and 0.5**p.p** among rural children. Children from wealthy households were more likely to be food secure and children from poor households were more likely to be nutritious. For nutrition status, socioeconomic inequality gaps appeared to be widening as the concentration indices between the two time periods increased, while for food security status socioeconomic inequality gaps appeared to be contracting as the concentration indices between the two time periods reduced. Food security status showed contracting socioeconomic inequality gaps in both geographical clusters (urban & rural), while for nutrition status there were widening socioeconomic inequality gaps among urban children and contracting socioeconomic inequality gaps among rural children.

Conclusion:

Within-group inequalities are driving most of the socioeconomic inequalities in nutritional status and food security status among children in Zimbabwe. There is need for policies that focus on addressing within-group inequalities and direct food security interventions for food insecure children through availing food aid parcels especially for children from poor households irrespective of where they reside.

Keywords: Food Insecurity; Child Health; Malnutrition; Socioeconomic Inequalities

Background

Food insecurity and malnutrition in Africa over the years have moved to be on the continent's development agenda. The latter assertion is highlighted by the 2014 Malabo commitment which called for "Ending hunger and reducing stunting to below 10% and underweight to below 5% by 2025" [1]. Food insecurity and malnutrition in children are now public health problems being tabled on political agendas globally, this has been reflected in the Sustainable Development Goal (SDG) target 2.2 "End all forms of malnutrition by 2030 and attain internationally agreed targets on stunting and wasting in children under 5 years of age by 2025..."[1]. From both aforementioned assertions argued into policy regionally and globally, the need and importance of understanding food insecurity and malnutrition trends in children can be deduced. Food insecurity is a major global concern with an estimate of 1 billion people reported to be suffering from starvation, under nutrition and malnutrition [5]. With globally forecasted statistics showing global population to be at 9.7 billion by 2050 and Africa to date accounting for majority of global population growth, it can be argued that indeed food insecurity is likely to be exacerbated in the near future [6]. The aforementioned is confirmed by the statistics of 2015 which reported sub-Saharan Africa alone, reporting an estimated 239 million people to be suffering from hunger [7].

Child malnutrition and food insecurity are widespread phenomenon's known to be dominant in rural inhabitants living in poverty [2]. As of 2010 malnutrition accounted for about 50% of under-five deaths in the developing nations [3]. To note malnutrition has been argued to be strongly correlated with poverty, as higher levels of malnutrition are dominant in poor developing countries than in wealthy developed countries [4]. As this is not enough, malnutrition has been reported to account for an estimated 45% of deaths among children younger than 5 years thus about 3.1 million deaths annually [5]. For the past 3 decades (1985-2016) the prevalence of stunting in sub-Saharan Africa significantly declined by 7.2% [6].

However, one in three children under the age of five is reported to be stunted, with eastern and western Africa accounting for the highest proportions thus 44 percent and 36 percent respectively, while the lowest prevalence (3 percent) is observed in southern Africa [6] (figure 1). Figure 1 gives an overview of child food insecurity as of 2016 it can be deduced that middle Africa recorded the highest proportion 31% whilst southern Africa recorded the lowest.

The food security framework is a multifaceted concept explaining interactions of food and poverty [7, 8]. Food insecurity is defined as a state in which people do not possess physical and economic access to; sufficient, safe and nutritious food, which is suffice for their dietary needs [9]. Figure 2 gives a time dimension of food insecurity and illustrates both chronic and transitory food insecurity. Chronic food insecurity is defined as a long-term or persistent inability to meet minimum food consumption requirements while a short-term or temporary inability to meet minimum food consumption requirements that indicates a capacity to recover is known as transitory food insecurity [10, 11]

Zimbabwe is part of Sub-Saharan Africa, situated to the south of Africa and she is a land locked country hence heavily relies on agriculture and mining [12]. Agriculture is considered the back bone of Zimbabwe's economy providing more than 70% of employment [13], with 2013-14 estimates reflecting a 13% contribution of agriculture to Gross Domestic Product [14]. Suprisingly, Zimbabwe ranked 46 out of 78 listed developing countries on the Hunger Index as of 2013 [15]. On the hunger index ranking, Zimbabwe fell under the "Serious" category with undernourishment cited to be the major driving force for the latter stated position [13]. Several factors have been alluded to be factors fuelling food insecurity and malnutrition in Zimbabwe

however; poverty, inadequate maternal and child care have been cited as the main driving factors [16].

The prevalence of stunting in Zimbabwe has been erratic since the mid-1980s' however, post mid-1980 figure 2 reports a marginal decline in stunting, however, the number of stunted children was on the rise [17]. Stunted children rate accelerated from -0.63% in 2012 to 0.20% in 2016 (Figure 2), if this rate is maintained then projections for 2025 would imply that 0.76 million children would be expected to be stunted [17]. Globally food insecurity and malnutrition are causes for concern, hence their dominance on the global health agenda. The Sustainable Development Goal (SDG) 2.1 targets to, "End hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round by 2030," [18]. Inequality decompositions of nutritional status and food security status of children can be a starting point of providing highly relevant evidence to inform policies that ensure nutritional and food security well-being of children. Therefore, the study assessed the prevalence and measured within and between groups socioeconomic inequalities in children mainly focusing on food insecurity and malnutrition in Zimbabwe for 2010\11 and 2015.

Methods

Sources of Data

Zimbabwe Demographic and Health Surveys (ZDHS) of 2010\11 and 2015 were used for analyses. Both data sets had population samples of 2,666 and 2,708 children respectively, aged 0-59 months. For both 2010/11 and 2015 the ZDHS samples were nationally representative, with a sample of more than 11,000 households thus yielding representative information for most indicators of Zimbabwe for urban and rural areas, for each of Zimbabwe's ten provinces: Manicaland, Mashonaland Central, Mashonaland East, Mashonaland West, Matabeleland North, Matabeleland South, Midlands, Masvingo, Harare, and Bulawayo. For both ZDHS studies (2010/11 & 2015) 2002 and 2012 population censuses sampling frames were used.

Outcome variables

Two indicators of food access across children age groups were assessed. The indicators were endorsed by countries represented at the UN Statistical Commission to monitor target 2.1 namely; prevalence of undernourishment (malnourished) and prevalence of severe food insecurity in the population [1]. Food insecurity among the children age groups was determined using the WHO dietary diversity score based on the Infant And Young Child Feeding (IYCF) practices. Dietary diversity is the number of different foods or food groups consumed over a given reference period [19]. For this study 13 food groups were considered thus; food from grains, food from tubers, eggs, meat, pumpkin & carrots, green leafy vegetables, vitamin A fruits, other fruits, liver & heart, fish, {beans, peas, lentils, nuts}, other milk products and yogurt. The IYCF tool defines minimum dietary diversity as indicator for food security by a cut- off point of >4 [19], hence in this study children with less than 3 of the 13 food groups were defined as food insecure. Malnutrition was assessed using the child anthropometric

measure of weight-for-age. Weight-for-age is a composite index of height-for-age and weight-for-height hence taking account both acute and chronic under-nutrition. Children whose weight-for-age z-score was below minus two standard deviations (-2 SD) from the median were considered malnourished and those above minus two standard deviations (-2 SD) from the median nourished.

Socioeconomic status

Socioeconomic status was adapted from the wealth index for households in the original surveys (ZDHS). In both ZDHS's wealth index was reported as scores based on the number and kinds of consumer goods owned; ranging from a television to a bicycle or a car, plus housing characteristics such as source of drinking water, toilet facilities, and flooring materials. The latter scores were derived using principal component analysis and national wealth quintiles were compiled by assigning household scores, then each person was ranked in the household population by their score, and lastly the distribution was divided into five equal categories, each with 20 percent of the population in the original studies. For this study socioeconomic status was then re-categorised from 5 (poorer, poor, middle, richer, richest) groups into 3 groups thus poor, middle and rich (Table 1).

The concentration index

The concentration indices were used to determine socio-economic inequalities in child nutrition and child food security. The latter index is expressed as a value of a health variable which would have been assigned to an individual as a function of a socioeconomic category to which the individual belongs [20]. The concentration index is a mathematical derivative of the concentration curve. On the concentration curve; the x axis represents cumulative proportion of individuals by socioeconomic class starting with the lowest socioeconomic class (*poorest*) and ending with highest socioeconomic class (*richest*), while the y axis is the cumulative total

proportion of health in these individuals [20]. The Concentration curve identifies the existence of socioeconomic inequalities in health sector/outcome variables, and is only sensitive to relative inequality [21]. The bounds of this measure are -1 and 1 with a negative (positive) value representing inequality favouring the worse-off (better-off).

As the CI is expressed in a number of ways algebraically in this study the most common in literature will be adapted for convenience;

$$CI = \frac{2}{\mu} cov(c_i; R_i) \dots \dots \dots (1)$$

Equation (1) denotes that the value of the concentration index is equal to the covariance between individual child health (c_i) and child's relative rank (R_i), scaled by the mean of health in the population (μ) and then multiplied by 2 so as to ensure that the concentration index ranges between -1 and +1 [22–24].

Theil index

To date a wide range of measures can be applied in assessing income inequalities however, this study used the Theil index which is a generalized entropy measure. Selection of this measure was informed by principles concerning the conceptual, methodological and technical qualities of the generalized entropy measures. Generalised Entropy (GE) measures are cited to be based on the idea of divergence between probability distributions derived from information theory [25–28]. The study adopted the Theil index, as unlike other measures of inequalities, only the generalised entropy class of inequality measures satisfies the five standard criteria for measuring inequalities including the attractive property of being easily decomposable by subgroups.

Inequality decomposition was done by population subgroup so as to separate total inequality in the distribution into components of inequalities between the selected groups and the

remaining within-group inequality. For this study we used the syntax *ineqdec0* which is a stripped-down version the syntax *ineqdeco* as we intended to include zero and negative incomes in calculations hence, only estimates availed are of the GE(2) index only. The aforementioned approach is functional in explaining the relationship between inequalities in the whole population and inequalities within and between subgroups (*residence, socio-economic status and child age groups*). Theoretically, Theil index ranges from 0 to infinity, with 0 being a state of equal distribution and values greater than 0 representing increasing levels of inequality [29, 30]. Data analysis was done using Stata version 13.1 (Stata Corp, Texas, United States).

Results

Over the period under review malnutrition prevalence increased by 1.03 percentage points (**p.p**) [2010/11(3.73%);2015(4.76%)] while food insecurity prevalence decreased by 4.34**p.p**. In 2010/11 of the 3.73% children that were malnourished majority were poor male neonates residing in the rural areas and the mothers had at least attained secondary education while for 2015 of the 4.76% majority were poor females residing in the rural areas and the mothers had also at least attained secondary education. For both time periods of the 78% [2010/11] and 74% [2015] food insecure children majority were poor neonates residing in the rural areas and the mothers had at least attained secondary education (table 2).

Concentration indices of nutrition status were negative (pro-poor) for both time periods which means that poor children were more likely to be nutritious, while concentration indices for food security status were positive (pro-rich) for both time periods which means children from wealthy households were more likely to be food secure (table 3).

The concentration curves in both time periods concur with concentration indices as they show food security status to be pro rich (children from wealthy households more likely to be food secure) and nutrition status to be pro poor (children from poor households more likely to be nourished) (figure 4a, 4b).

Decomposition by residence

The study focused on two household characteristics in assessing income inequalities thus; location of the household and socioeconomic status. Economic inequalities among regions and socioeconomic classes within a country may can be attributed as the driving force of income inequalities as uneven progress in development across regions can result in the diversification of income and worsening income of inequalities [31].

As reflected in table 4 and 5 it can be deduced that for both time periods majority of the children resided in the rural areas and accounted also for the greatest proportion of income. To note there is small variances between income share and population share which makes the two geographical clusters comparable.

Table 6 shows contracting socioeconomic inequality gaps for food security for both time periods in both geographical clusters. However, socioeconomic inequalities were more dominant in the rural areas as it recorded their indices higher than in the urban for food security. For nutritional status socioeconomic inequalities appear to have widened in the urban areas while in the rural areas the gaps contracted. As the theil indices in the urban increased while in the rural areas the indices decreased (Table 6).

Decomposed results of food security by residence show that; for 2010/11 about 1.6% of the income inequality can be explained by where the child resides with more than 98% of socioeconomic inequalities as a result of within group income fluctuations while for 2015;

2.5% of income inequalities are explained by where the child resides and more than 97% are explained by within group income fluctuations (table 7). For nutrition; for 2010/11 over 96% of income inequalities can be explained by within group income variability and about 4% can be explained by where the child resides. While for 2015; within group income variations can explain over 92% of income inequalities with about 7% explained by where the child resides (table 7). Thus for food security within group income variations can explain 97.5%-98.4% of income inequalities while where the child resides can explain 1.6%-2.5% income inequalities.

Decomposition by socio-economics status

For food security in both time periods the poor had the biggest population share, however accounting for the least proportion of income share (table 8 & 9). Table 10 shows contracting socioeconomic inequality gaps among the poor for food security and nutrition for the period under review. However, for the wealthy class socioeconomic inequality gaps appeared to have contracted for food security and widening for nutrition (table 10).

Table 11 results show that when decomposed by socioeconomic status for food security 95.7%-97.2% of income inequalities can be explained by within group income variations and 2.8%-4.3% of income inequalities can be explained by the socioeconomic group to which the child belongs. For nutrition 94.3%-96.4% income inequalities can be explained by within income group income variations and 3.6%-5.7% income inequalities can be explained by which socioeconomic class the child belongs.

Discussion

Indeed, child malnutrition is a widespread phenomenon, particularly in rural areas, where most of the inhabitants live in poverty often characterised with food insecurity [2]. Dietary diversity scores were cited to remarkably be well-related to socio-economic factors [32, 33]. A study done Mali found a strong significant relationship between socio-economic status and dietary

diversity [34]. Dietary diversity was cited as a significant interaction effect determinant in three countries; Malawi, Haiti, and Peru [35]. The latter assertions concur with findings of this study as children from the lowest socioeconomic class recorded highest food insecure and malnourishment prevalence's.

A number of factors can be alluded to food insecurity and malnutrition among households. Food insecurity and malnutrition in children is mainly driven by; chronic poverty, failed policies, physical & natural constraints [36]. Widespread poverty, poor infant and young child care practices, and low dietary diversity were cited to be among key structural drivers of hunger and malnutrition in Zimbabwe [13]. The latter arguments concurred to our findings as; majority of malnourished and food insecure children resided in the rural areas and aged 0-24 months (neonates & infants) recording high prevalence's of food insecurity indicating low dietary diversity.

More recently, [37] analysed the patterns of inequalities in health relative to nutrition outcomes among children under five in Tunisia. Their study used using Shapley decomposition to estimate the relative contributions of circumstances and found out that parents' education, parental wealth, and place of residence were the key factors influencing inequalities in child health [38]. Literature argued geographic location to be an important determinant of malnutrition, citing stunting to be worse among rural than urban children [16], this was consistent with our findings for both time periods as they show that rural children were the most malnourished. [39] investigated the correlation between socioeconomic status and malnutrition among children under five in South Africa. The study found malnutrition to be highly concentrated in the poorest regions of South Africa [40]. This was also true in our study, as malnutrition and food insecurity was also more prevalent among rural children belonging to

the lowest socioeconomic class. Decomposed results of this study showed within group income variations to be a strong indicators of explaining socioeconomic inequalities, the latter findings also concur with results of the Poland study [31].

Limitations of the study

There is need for further investigation of figure 3a as it shows the concentration curve for nutrition status crossing the 45° line, hence a dominance test would need to be carried out. Also demographic health survey responses on children feeding solemnly rely on the 24-hour recall method, hence the results might not reflect children's past feeding dietary pattern thus results on food security are prone to recall bias.

Conclusion

In order to avail efficient and effective policy recommendations and interventions that advocate for health equity as well as enhance nutritional and food security well-being of children, it is necessary to first understand the levels of malnutrition & food security. With existence of socioeconomic disparities in nutritional status and food security status among children by socioeconomic status (poor, middle & rich) and geographical locations (rural or urban) evident in Zimbabwe. Increasing access of healthy food among children thus targeting food insecurity and malnutrition is of utmost importance. The latter policies should be tailor made to specifically target within and between group inequalities.

Abbreviations

DHS- Demographic Health Survey

GE- Generalised entropy (GE)

IYCF- Infant and Young Child Feeding

SD- Standard Deviation

SDG- Sustainable Development Goals

UN-United Nations

WFP- World Food Programme

WHO- World Health Organisation

ZimVac- Zimbabwe Vulnerability Assessment Committee

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Availability of data and materials

All data sets are publicly available on the Demographic Health Survey website and can be accessed upon request from the Demographic Health Survey team.

Authors' contributions

ATL designed the study, wrote the paper, analysed results, reviewed the paper and submitted it for publication; SA reviewed the paper in preparation for publication, KZN reviewed the paper in preparation for publication, JA reviewed the paper in preparation for publication and OA designed the study and reviewed the paper in preparation for publication.

Ethics approval and consent to participate

No ethical approval was sought as the parent studies DHS were cleared on ethics also this is a secondary data analysis hence data sets are publicly available.

Competing interests

No competing interests between the authors

Consent for publication

Consent from all co-authors was obtained.

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