ECRONICON OPEN ACCESS

EC NUTRITION
Research Article

Varying Relationship of Wealth of Households and Stunting of Under Five Children in Sub-Saharan Africa: A Meta-Analysis of Demographic Health Surveys

Kalkidan Hassen Abate[1]*, Waseyehun Assen[2] and Rahma Ali[3]

[1]*Department of Population and Family Health, Jimma University, Ethiopia*

[2]*College of Agriculture, Jimma University, Ethiopia*

[3]*Lecturer, Department of Population and Family Health, Jimma University, Ethiopia*

***Corresponding Author**: Kalkidan Hassen Abate, Department of Population and Family Health, Jimma University, Ethiopia.

Received: June 30, 2018; **Published:** July 29, 2019

Abstract

Background: The sustainable development goal of countries presented unprecedented set of opportunities to expand nutrition interventions. In guiding such interventions, locating the most vulnerable segment of the population is critical undertaking. The present review was designed to investigate the association of households' economic position and stunting of under five children in sub-Saharan African countries. In the process, we also set out to appraise the DHS wealth index capability in identifying households' at risk of having stunted under 5 child.

Method: The analysis used demographic health survey data of 35 sub-Saharan African countries dated back from the millennium to 2016. Only reports which had data on child chronic malnutrition alongside household's wealth quantile were included. Data were entered and cleaned in excel and transported to Stata version 13 for Meta-analysis and Meta proportions. Pooled odds ratio and proportion and their confidence interval were computed and their heterogeneity assessed through I square.

Results: The height for age Z score values of 215,164 of children and their households wealth index were analyzed. The proportion of stunted children in the poorest, poor, medium, rich and richest were 44, 40, 35, 29 and 18 % respectively. The pooled odds of stunting OR (CI) in the; poorest versus households in the upper four wealth quantiles, poor and poorest combined versus households in the upper three wealth quantile, the lower three wealth quantiles versus the upper two wealth quantiles combined and the lower four wealth quantile combined versus the richest alone were 1.34 (1.27, 1.42), 1.43(1.34, 1.52), 1.57 (1.46, 1.69) and 1.9 (1.79, 2.09), respectively.

Conclusion: The findings showed varying relationships between wealth and child stunting, thus, wealth index may not be an optimal proxy to assess economic vulnerability. The result may also put forward the need for multi-sector approaches in minimizing chronic malnutrition in sub-Sahara Africa.

Keywords: *Stunting; Africa; Children; Wealth*

Abbreviations

OR: Odds Ratio; DHS: Demographic Health Survey; SDG: Sustainable Development Goal; CI: Confidence Interval

Introduction

Globally, the human costs of undernutrition is disproportionately hardest on lower income countries [1]. Approximately, one in every thirteen children (7.5%) of the globe is wasted, nearly a quarter (23.8%) stunted, while Africa and Asia bear 93% of the stunted and 94% of the wasted children [2]. Identifying the vulnerable households within these countries is the top priority for focused nutritional interventions [1,2]. In doing so, economically disadvantaged groups were mostly identified through three approaches; through the house hold income, consumption expenditures or the wealth index [3]. Developed by the demographic health survey Program (DHS) with partial

funding from the World Bank, the wealth index was designed to identify and locate the poorest families. More specifically, the wealth index was developed to complement the lack of reliable data on income or expenditures in low income countries [3].

DHS report is one of the most widely used data set in health care system of developing world. For instance the Ethiopian national nutrition programs were formulated based on DHS series [4]. Trends in funding for a particular issue based on specific data gives a clue as to how much the data is accepted by the funders. For example, 96% of Sub-Saharan African countries relied on DHS data for setting priorities in health care financing [5]. In their review, Fabic., *et al*. reported high correlation between the annual United States Government funding for specific international health domains and the number of publications based on DHS data [6]. They further reported bidirectional positive relationship between numbers of DHS based publications and funding for specific public health domain. The likelihood of researches based on DHS data in driving policy towards relevant health related programs remained high compared to other similar endeavors [3-6].

Though debatable, a single data set should not be used in generating a given public policy [7]. Instead, the summary of different pieces of evidence scattered across different platforms aggregated by gregarious systematic reviews should be preferable [7,8]. Inevitably, the findings of a single effort might be used when supplementary studies are lacking. In such condition, the given study should be subjected to critical appraisal process before evidence utilization [8]. Notably, monitoring the validity of tools and methods used in identifying or estimating population at risk is critical undertaking while ascertaining the validity of an evidence for policy. Such process can detect misclassification of cases and prevent inefficient utilization of resources [9]. Accordingly, the present review was designed to investigate the association of households' economic position and stunting of under five children. In the process, we also set out to appraise the DHS wealth index capability in identifying the vulnerable households for under 5 children stunting. In line with the premise which was given for wealth index by the developers, we hypothesized an inverse relationship in odds and proportions between households' wealth quantiles and stunting of under-five children.

Method

The Data source for the present analysis was DHS, a survey conducted every 5 years with the aim of providing reliable and up-to-date information on health and population issues of low-income country. DHS collects data on maternal and child health, reproductive health and fertility, immunization and child survival, HIV and AIDS; maternal mortality, child mortality, malaria, and nutrition amongst women and children. The present analysis used only published data of DHS of sub-Saharan African countries from the millennium to the 2016 [10]. Data were considered for extraction only if child chronic malnutrition alongside household's wealth quantile were presented.

DHS presented data on household wealth index computed by principal components analysis (PCA) via SPSS factor analysis procedure [4]. The procedure reported in DHS, first, standardizes the indicator variables (calculating z- scores); then the factor coefficient scores (factor loadings) were calculated; and finally, for each household, the indicator values are multiplied by the loadings and summed to produce the household's index value. In the process, only the first of the factors produced were used to represent the wealth index [3]. The anthropometric indicator for chronic malnutrition used in DHS was the Z-score value of height for age, expressed as standard deviation units from the median for the reference group [10].

In the tabular analysis, DHS wealth index quintiles were used as generated and reported by DHS. These quintiles were based on the distribution of the household population rather than on the distribution of households. Thus, the distribution represents the national household population, where each member was given the wealth index score of his or her household. Data were cleaned and entered in excel and transported to Stata version 13 for statistical analysis. The five categories of wealth index quantiles used in DHS (poorest, poor, middle, rich and richest) were taken as analyzed and presented in DHS report. Data were pooled in statistical meta-analysis using Stata Version 13 (StataCorp LLC, Texas, USA) [11]. Effect sizes were expressed as either odds ratios (for dichotomous data) or proportion and their 95% confidence intervals were calculated. Metaprop, a statistical procedures in Stata for pooling of binomial data was used to compute exact binomial based confidence intervals [12]. Metaprop provides appropriate methods for dealing with proportions close to or at the margins where the normal approximation procedures often break down. Metan, the main Stata meta-analysis command which employ meta-analysis calculations using standard methods of Deeks., *et al*. (2001) was used to calculate the odds ratios [12,13]. Heterogeneity was assessed statistically using the standard chi-square and I square tests [14].

Accordingly, Odds of having stunting were computed for each wealth quintiles compared against the remaining group. The odds of stunting of under five children living in the poorest households was computed compared to the remaining households in the upper four

wealth quantiles combined. In the same fashion, further odds were computed by adding one more upper wealth index quantile at a time against the remaining quantiles combined. Specifically, we computed the odds of stunting in the; 1) Poorest versus the upper four wealth quantiles combined, 2) Poor and poorest combined versus the upper three wealth quintiles combined 3) the lower three wealth quantiles combined versus the rich and richest combined and 4) The lower four wealth quantile versus the richest households. For each analysis the odds ratio of each country were computed separately. In addition, the pooled effect size was calculated to have an average weighted odds ratio and pooled proportions for sub-Saharan African countries. We also computed the pooled period prevalence of stunting for the region.

Results

Of the total of 44 DHS covered countries, data of nine countries; Botswana, Cape-Verde, Central republic of Africa, Mauritania, Senegal, Ondo state of Nigeria, Madagascar and Sudan were excluded as their data did not meet the review inclusion criteria. Data on chronic malnutrition among under five children and their household wealth of the remaining 35 countries were extracted. A total of 215,164 of under 5 children anthropometrics and their household wealth quantiles were analyzed. The pooled proportion of households which were categorized in the poorest, poor, medium, rich and richest wealth quintiles were 22.7%, 22%, 22%, 17.3%, and 16%, respectively. The pooled proportion of stunted children in the poorest, poor, medium, rich and richest were 44, 40, 35, 29 and 18 %, respectively (Table 1).

Country (Year of DHS)	DHS wealth Quantiles					Total
	Poorest	Poor	Medium	Rich	Richest	
Angola (2016)	0.47	0.45	0.39	0.27	0.20	0.38
Burkina Faso (2010)	0.42	0.37	0.38	0.33	0.19	0.35
Burundi (2015/16)	0.69	0.64	0.6	0.5	0.31	0.56
Cameroon (2011)	0.49	0.42	0.31	0.23	0.12	0.33
Chad (2014-15)	0.41	0.40	0.40	0.45	0.32	0.40
Comoros	0.38	0.32	0.26	0.27	0.22	0.30
Congo DRC (Zaire) (2013-14)	0.50	0.48	0.46	0.41	0.23	0.43
Congo (Brazzaville) (2011-12	0.34	0.28	0.27	0.17	0.09	0.24
Cote d'Ivoire (2011/12)	0.38	0.35	0.28	0.24	0.15	0.30
Equatorial Guinea (2011)	0.28	0.28	0.35	0.26	0.19	0.26
Eritrea (2002)	0.45	0.45	0.41	0.34	0.18	0.38
Ethiopia	0.45	0.43	0.38	0.35	0.26	0.38
Gabon (2012	0.30	0.19	0.12	0.12	0.06	0.16
Gambia (2013)	0.30	0.27	0.25	0.22	0.15	0.24
Ghana (2014)	0.25	0.26	0.18	0.14	0.08	0.19
Guinea (2012)	0.34	0.41	0.34	0.25	0.15	0.31
Kenya (2014)	0.36	0.3	0.25	0.21	0.14	0.26
Lesotho (2014)	0.46	0.38	0.35	0.28	0.14	0.33
Liberia (2013)	0.35	0.35	0.35	0.28	0.20	0.32
Malawi (2015/16)	0.46	0.40	0.37	0.33	0.24	0.37
Mali (2012/13)	0.46	0.44	0.42	0.34	0.21	0.38
Mozambique (2011)	0.51	0.48	0.46	0.37	0.24	0.43
Namibia (2013)	0.31	0.29	0.24	0.17	0.09	0.24
Niger (2013)	0.47	0.48	0.42	0.47	0.34	0.44
Nigeria (2013)	0.54	0.46	0.35	0.26	0.18	0.37
Rwanda (2014/15)	0.49	0.45	0.38	0.30	0.21	0.38
Sao Tome and Principe (2008/09)	0.38	0.35	0.32	0.21	0.18	0.29
Sierra Leone (2013)	0.43	0.40	0.38	0.35	0.28	0.38

South Africa (2016)	0.36	0.29	0.24	0.24	0.13	0.27
Swaziland (2006/07	0.38	0.32	0.27	0.25	0.17	0.29
Tanzania (2015)	0.40	0.39	0.39	0.30	0.19	0.34
Togo (2013/14)	0.33	0.38	0.32	0.19	0.11	0.27
Uganda (2011)	0.37	0.31	0.45	0.31	0.21	0.33
Zambia (2013/14	0.47	0.42	0.40	0.38	0.28	0.40
Zimbabwe (2010/11)	0.37	0.32	0.35	0.29	0.24	0.32
Meta Prop (Fixed pooled ES)	0.44	0.40	0.35	0.29	0.18	0.35

Table 1: *Proportion of stunting among under 5 children in sub Saharan African countries, 2000-2016.*

The polled period prevalence of stunting in the region for the year 2000-2016 was 35.2 %. Of these stunted children 28.5%, 25%, 21%, 16.5%, and 9.2% were living in poorest, poor, medium, rich and richest households, respectively. The highest prevalence of stunting was observed in Burundi (56%) and the lowest was in Gabon (16%). The pooled odds of having stunting of under five children in the; poorest versus households in the upper four wealth quantiles, poor and poorest combined versus households in the upper three wealth quantile, the lower three wealth quantiles versus the upper two wealth quantiles combined and the lower four wealth quantile combined versus the richest alone were 1.34 (1.27, 1.42), 1.43(1.34, 1.52)1.57 (1.46, 1.69) and 1.9 (1.79, 2.09), respectively (Figure 1-4).

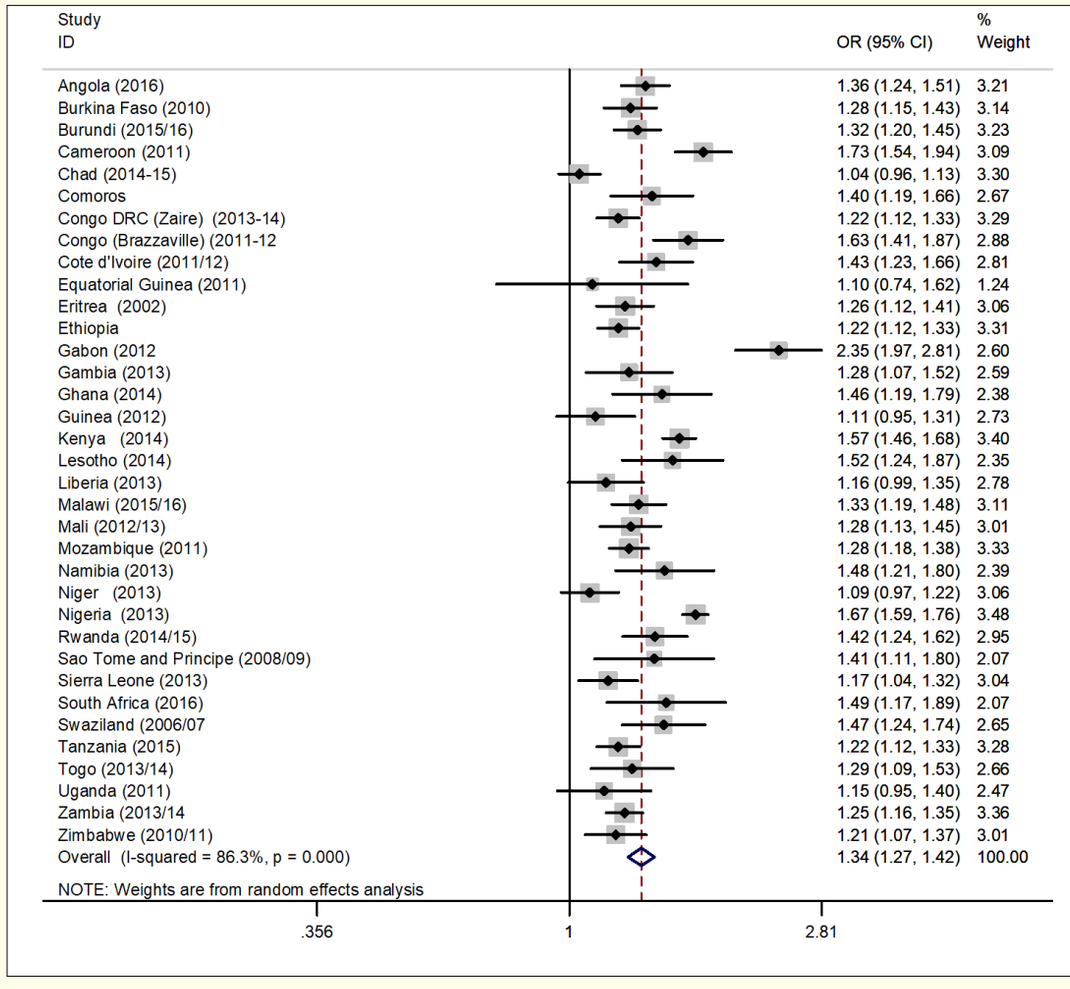

Figure 1: *Stunting likelihood among under 5 children living in the poorest households compared to households in the upper four wealth quantiles combined in sub Saharan Africa. A meta-analysis.*

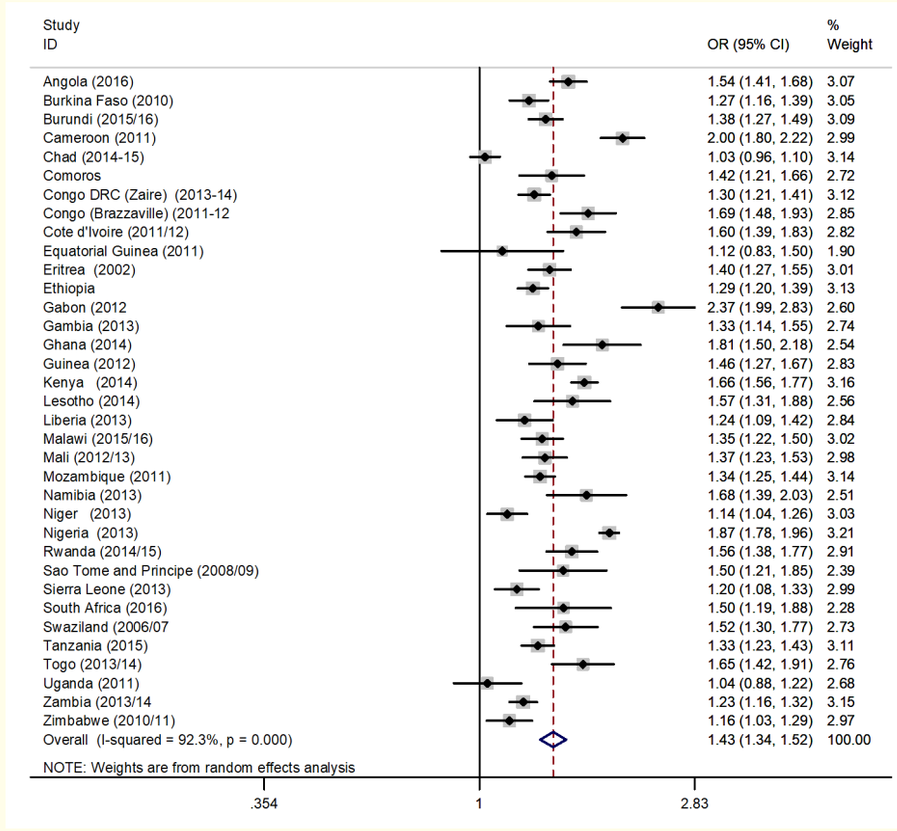

Figure 2: *Stunting likelihood among under 5 children living in the poor and poorest households combined versus those living in the upper three wealth quantile households in sub Saharan Africa. A meta-analysis.*

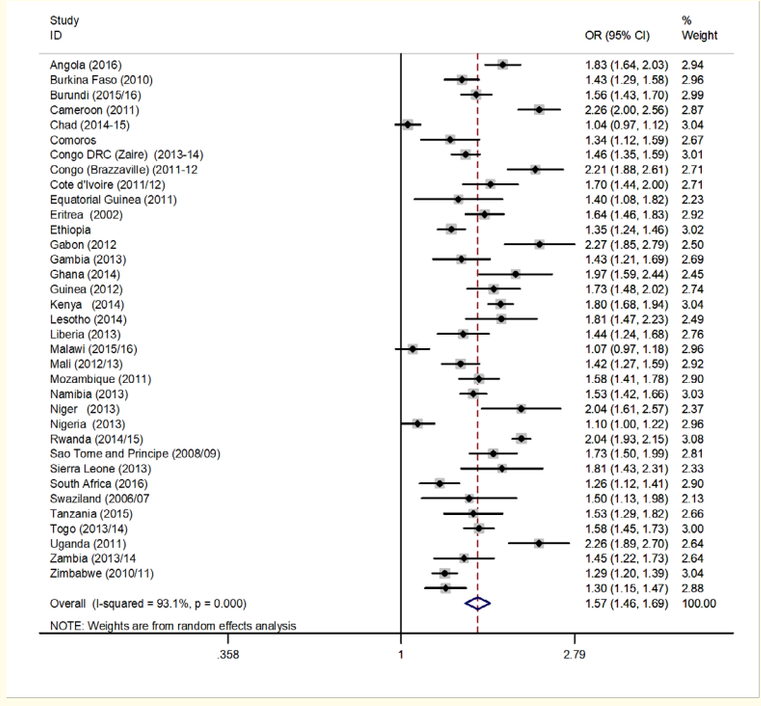

Figure 3: *Stunting likelihood among under 5 children living in the lower three wealth quantile households combined versus those living in the upper two wealth quantile households in sub Saharan Africa. A meta-analysis.*

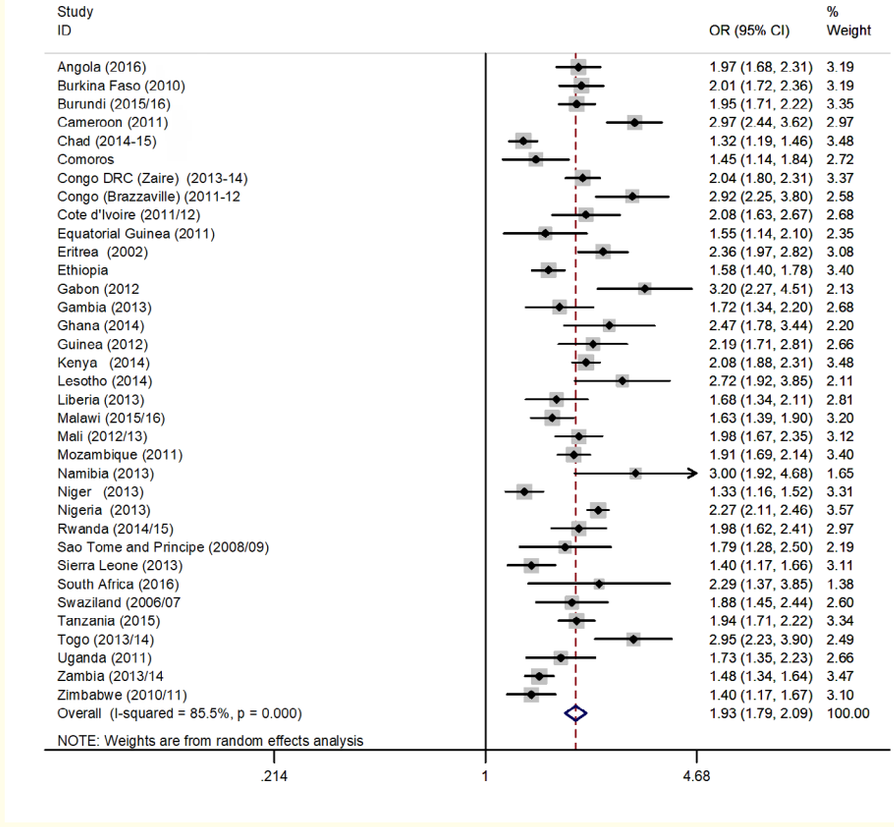

Figure 4: *Stunting likelihood among under 5 children living in the lower four wealth quantile combined versus those living in the richest wealth quantile households in sub Saharan Africa. A meta-analysis.*

Discussion

Globally, there is optimal policy and commitment to end childhood undernutrition by 2030 [16]. The sustainable development goals (SDGs) of countries also presented unprecedented set of opportunities to expand nutrition interventions [14]. In guiding such interventions, locating vulnerable populations is critical undertaking. In the present analysis, more than one third (35.2%) of children of the Sub-Saharan African countries were found to have stunting. Remarkably, more than a quarter of the stunted children (25.7%) were residing in the rich and richest families. The analysis also showed implausible or varying relationship between household's wealth quantiles and child stunting. In the extremes of wealth conditions (poorest versus richest), notable difference in the proportion of stunting (44% versus 18 %) was observed. On the other hand, comparable proportions of stunting (35 to 44%) were observed in the lower three wealth quantile of households. In the upper fourth wealth quantile (the rich), there also existed unacceptably high (29%) level of stunting as compared to the lower three wealth quantile (35 to 44%) (Table 1).

In the meta-analysis, the odds of stunting were varying with wealth strata. The likelihood of child stunting in the lower two wealth quantiles households (OR = 1.43) was higher than the lowest wealth quantile alone (OR = 1.34) when both compared with the remaining upper wealth quantiles (Figure 1 and 2). Similarly, children living in the lower two and lower three wealth quantile households were 1.57 and more 1.43 more likely to have stunting compared to the upper quantiles (Figure 2 and 3). The addition of richer households in the lower wealth groups did not change the odds of stunting dramatically as expected (Figure 1-4). In other words there was comparable likely hood of stunting of children in all lower four wealth quantiles. The findings of the meta-analysis as well as Meta proportion suggested comparable vulnerability in child stunting in more than 90% of the households.

The present findings was in line with a study published in The Lancet Global Health, which looked at DHS data from 1990 to 2011 of 36 low- and middle-income countries, which suggested increases in per-head gross domestic product in the last two decades have generally not been associated with improvements in childhood nutritional status [15]. Other studies also reported variable findings with regard to the association of wealth and intimate sexual violence [17,18]. Ideally, it became more convincing economic advantage had been resulted in linear relationship with optimal nutritional outcomes and an inverse with health risks.

The threshold of wealth index in the present study to prevent child stunting seemed very high. Only the richest households (the fifth wealth quantile) showed exceptional advantage of their wealth. Based on these findings, one can give triple explanation for the variability of the relationship. First, wealth index may not be a good instrument to measure economic position of households in sub-Saharan Africa; as it was claimed to be a non-reliable alternative proxy of expenditure which lead to miss-classification of households' economic position [19]. Second, wealth also may not play a strong role in the causation of chronic malnutrition compared to child care, education and other factors common in the region [20]. Third, such implausible association can be explained by the concepts of Amrita Sen's capability approach [21]. Sen has shown households inherent disparity in their abilities to translate the same resources into valuable functioning's. Thus, the present implausible relationship of wealth index and chronic malnutrition might make sense and justified in a context of household's heterogeneity in utilizing their wealth for nutritional benefit.

Conclusion

In conclusion, our results showed that measurements of household economic wellbeing through wealth index showed varying relationships with respect to having stunted under five children in sub-Saharan Africa. In other words, wealth index may not provide enough optimism in locating households' economic vulnerability. Finally, the results may also justify the need for multisector approach in minimizing chronic malnutrition in sub-Sahara Africa.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Bibliography

1. Peng W and Berry EM. "Global nutrition 1990-2015: A shrinking hungry, and expanding fat world". *PloS one* 13.3 (2018): e0194821.
2. UNICEF. "UNICEF Data Monitoring the Situation of Children and Women" (2017).
3. Rutstein Shea O and Kiersten Johnson. "The DHS wealth index. DHS Comparative Reports No. 6". Calverton, Maryland, USA: ORC Macro (2004).
4. FDRE: Government of the Federal Democratic Republic of Ethiopia. National Nutrition Programme, June 2013 - June 2015. Addis Ababa Ethiopia (2017).
5. Hjalte F and Glenngard A. "What Factors Determine the Demand for Health Expenditure Data in Sub-Saharan Africa?" (2007).
6. Fabic MS., *et al*. "A systematic review of Demographic and Health Surveys: data availability and utilization for research". *Bulletin of the World Health Organization* 90.8 (2012): 604-612.
7. Oliver S. "Systematic reviews: making them policy relevant. A briefing for policy makers and systematic reviewers".
8. Lavis J., *et al*. "Towards systematic reviews that inform health care management and policy-making". *Journal of Health Services Research and Policy* 10.1 (2005): 35-48.
9. Mhaskar R., *et al*. "Critical appraisal skills are essential to informed decision-making". *Indian Journal of Sexually Transmitted Diseases* 30.2 (2009): 112-119.
10. DHS report, Publication by country (2018).

11. StataCorp. Stata Statistical Software, Release 13.0 [computer program].

12. Nyaga VN., *et al*. "Metaprop: a Stata command to perform meta-analysis of binomial data". *Archives of Public Health* 72.1 (2014): 39.

13. Harris R., *et al*. "Metan: fixed-and random-effects meta-analysis". *Stata Journal* 8.1 (2008): 3.

14. DerSimonian R and Laird N. "Meta-analysis in clinical trials". *Controlled Clinical Trials* 7 (1986): 177-188.

15. Griggs D., *et al*. "Policy: Sustainable development goals for people and planet". *Nature* 495.7441 (2013): 305-307.

16. Wüstefeld M., *et al*. "Nutrition targets and indicators for the post-2015 Sustainable Development Goals". About SCN News (2015).

17. Vollmer S., *et al*. "Association between economic growth and early childhood undernutrition: evidence from 121 Demographic and Health Surveys from 36 low-income and middle-income countries". *The Lancet Global Health* 2.4 (2014): e225-e234.

18. Dalal K. "Does economic empowerment protect women from intimate partner violence?" *Journal of Injury and Violence Research* 3.1 (2011): 35-44.

19. Kishor S and Johnson K. "Reproductive health and domestic violence: Are the poorest women uniquely disadvantaged?" *Demography* 43.2 (2006): 293-307.

20. Howe LD., *et al*. "Is the wealth index a proxy for consumption expenditure? A systematic review". *Journal of Epidemiology and Community Health* 63.11 (2009): 871-877.

21. Sen Amartya. "Capability and Well-Being73". The quality of life. Oxford University Press (1993): 30.

Volume 14 Issue 8 August 2019