Inequalities in Stunting Prevalence Among Children Under Age 5 in Ghana Between 1998 and 2014

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Abstract

Background

Over the years, Ghana has made significant improvements in the nutritional status of children, particularly concerning stunting. Though these improvements are commendable, there are concerns of inequalities in the prevalence of stunting among children under five. To this end, we examined the trends and inequalities in the determinants of stunting prevalence in children under five in Ghana, throughout 1998-2014.

Methods

Using the World Health Organization's (WHO) Health Equity Assessment Toolkit (HEAT) software, we analysed data from the 1998-2014 Ghana Demographic and Health Surveys (GDHS). We approached the inequality analysis in two steps. First, we disaggregated stunting prevalence among children < 5 years by five equity stratifiers: wealth index, education, sex, residence, and region. Second, we measured the inequality through summary measures, namely Difference, Population Attributable Risk, Ratio, and Population Attributable Fraction. A 95% confidence interval was constructed for point estimates to measure statistical significance.

Results

Concerning economic status, only the simple summary measures (Difference [D], Ratio [R]) showed significant inequality in stunting. For instance, both D (23.40; 17.55-29.25) and R (2.43; 1.78-3.09) revealed substantial economic variation in stunting in 1998 and the same trend was noted across all the survey years. The complex summary measures, however, showed a significant but negative association. Both D (16.36; 12.13-20.60) and R (1.90; 1.51-2.28) revealed a positive significant disparity in favour of urban residents in 1998. The simple measures further indicated a significant disparity in stunting at the detriment of male children throughout the period studied. Finally, a significant disparity at the expense of children in the Northern Region was evident in 1998 (D=31.00; R=3.22), 2003 (D=37.21; R=3.17) and 2014 (D=22.73; R=3.19).

Conclusion

Inequalities in stunting prevalence in Ghana is to the disadvantaged children of poorest wealth quintile, mothers with no formal education, male children, rural residents and the Northern Region of Ghana. We recommend the introduction and strengthening of equitable interventions focusing on nutrition on sub-populations in the country who suffer from a higher burden of stunting.

Background

The nutritional status of children under five years is an important element that affects their overall health and wellbeing. Children under five sometimes suffer from undernutrition which manifests in three ways: wasting, underweight, and stunting [1]. Stunting has become a significant anthropometric measure for children's socio-economic deprivation [2]. The term "stunting" is also referred to as linear growth retardation [3], suggesting that a stunted child is one who is too short for his/her age [4]. Globally, there are more than 165 million stunted children, with low- and middle-income countries hosting the biggest burden of stunting [5]. In Ghana, there was a decline in stunting from 28% in 2008 to 19% in 2014. Despite this, stunting remains high in children under five years in Ghana [6], with significant regional variations [7].

Extant literature has associated stunting among children to several factors, including insufficient nutritional intake or malnutrition, infectious diseases, and poor socioeconomic status [4, 8]. Other studies have also identified low birth weight, recurrent infection, nutritional deficiencies/inadequacies, and insufficient care to be contributory factors to stunting among children. There is also evidence to show that one-fifth of all stunting originated at conception [9, 10, 11]. Furthermore, the existing body of knowledge shows that stunting perpetuates inequalities and has the tendency to exacerbate poverty and result in poor academic performance and high fertility [12]. Therefore, it is critical to invest in interventions to ameliorate stunting among children [13].

The United Nations, in its attempt to improve children's health, placed premium on issues related to stunting in the then Millennium Development Goals and the current Sustainable Development Goals (SDGs) as a matter of policy to propel countries, particularly

LMICs, to combat stunting. In relation to this, Ghana has implemented policies such as capitation grant and school feeding programme to help reduce the levels of food insecurity, malnutrition, and stunting among children [14]. While the implementation of such policies is a step in the right direction, there is still a need for evidence-based stunting inequalities studies, as such studies are an exemplary step in identifying priority areas necessary for interventions design and effective implementation. To this end, we examined the trends in stunting prevalence in children under five in Ghana, throughout 1998–2014.

Methods

Data source

Data used for this study emerged from the 1998, 2003, 2008, and 2014 Ghana Demographic and Health Surveys (DHS) which were executed by the Measure DHS Program. The DHS Program conducts these surveys for several low- and middle-income countries. The DHS generally collates information on child and maternal health, including issues on stunting. Surveys of the DHS Program such as the ones included in this study utilize a twofold sampling procedure. In Ghana, the initial stage constituted the systematic selection of clusters/enumeration areas within rural and urban settings of Ghana. The second stage was characterized by household selection within the enumeration areas that were selected in stage one. Eligible women (permanent residents and those who joined the households the night before the survey) were subsequently interviewed [7]. A total of 10,826 (2,529 in 1998; 2,874 in 2003; 2,529 in 2008; 2,894 in 2014) women were included in this present study.

Variables

Dependent variable

Stunting among children below five years was our dependent variable. The dependent variable, stunting, was measured by the DHS by using the WHO Child Growth Standards [15]. As such, the DHS collected data on each child's height/length, sex, and age to compute the number of standard deviations (i.e. z-score) to determine whether the child's height is above or below the median of the 2006 WHO growth reference population. Stunting, therefore, was defined as a z-score less than -2 and not stunted if otherwise [15].

Independent variables

A total of four inequality stratifiers served as the independent variables for this study. The first is economic status, which was computed using the Principal Component Analysis (PCA). It was derived by segregating households into five levels based on ownership of some cardinal assets (e.g. television and bicycle) and dwelling characteristics (e.g. floor and roofing material). The second is education, measured as no education, primary education, and secondary education or higher. The third is the place of residence (rural or urban) whilst the sex of the child was either male or female. Finally, the region of residence comprised all the then ten administrative regions of Ghana.

Analysis

We analysed the data with the assistance of the 2019 updated version of WHO's HEAT software via the WHO Health Equity Monitor database [16]. Four principal summary measures were employed in our analysis. These four measures are Ratio (R), Difference (D), Population Attributable Fraction (PAF), and Population Attributable Risk (PAR). These four distinct summary measures were employed due to the recommendation by WHO that the usage of different summary measures helps to generate outcomes that are sensitive to policy formulation [17].

In deriving our summary measures, the following procedures were followed. Concerning economic status, D was computed by subtracting stunting prevalence among children of poorest women (quintile 1) from the stunting prevalence among children of richest women (quintile 5). On education, stunting prevalence among the children of women without education was subtracted from the prevalence among children of women who had secondary/higher education. Similarly, prevalence among children of rural residents was subtracted from the prevalence among children of urban residents. The D for the region variable was calculated as the region with the maximum prevalence of stunting minus the region with the minimum prevalence across the respective surveys.

In computing R, it was calculated as the ratio of two different populations, i.e. $R = Y_{\text{high}}/Y_{\text{low}}$. In the case of a residence, R denoted a place of residence where Y_{high} stood for urban and Y_{low} stood for the rural population. With education, Y_{high} implied children of women with secondary or higher education where Y_{low} represented children of women with no education. For wealth quintile, Y_{high} was the richest quintile whilst Y_{low} was the poorest quintile. In the same manner, Y_{high} represented males or females, depending on the category with the highest prevalence in a particular survey. The PAR was derived by ascertaining the difference between estimates of the reference sub-populations (known as yref) of the national mean of stunting among children under 5. With this, (μ): $\text{PAR} = \text{yref} - \mu$, with μ being the national mean of stunting. Likewise, PAF denoted the relative inequality dimension of PAR and it was derived as $\text{PAF} = (\text{PAR} / \mu) * 100$.

Ethical issues

Data used for this study is a publicly available de-identified data. Ethical approval for Ghana DHS was granted by the Ghana Health Service and the Ethical Review Board of the Measure DHS. All participants consented either in writing or verbally before participating in the surveys.

Results

Trends in stunting prevalence in children under age 5, disaggregated across five inequality dimensions, 1998–2014

Table 1 shows the trends in disaggregated stunting prevalence among children below age 5 in Ghana spanning from 1998 to 2014. Generally, stunting peaked in 2003 with 35.26%, with the least prevalence occurring in 2014 (18.77%). Analysis of stunting by economic status demonstrated an inverse relationship across the data points. Thus, in 1998, stunting among poorest under-fives (39.72%; uncertainty intervals [UI] = 35.53–44.08) was more than twice the proportion of richest children who were stunted (16.32%; UI = 12.67–20.77) and this trend continued until 2014, where a marginal variation occurred between children of first (poorest) and second quintiles. In 2014, the least proportion of stunted children were within the richest quintile (8.47%; UI = 5.36–13.15); however, the prevalence of stunting among children in quintile two (25.51%; UI = 21.60–29.86) slightly exceeded the stunted prevalence in quintile 1 (24.81%; UI = 21.52–28.41). Throughout the period, children of women with secondary education or higher recorded the lowest prevalence of stunting. In the case of 1998, 24.06% (UI = 21.19–27.17) stunting occurred among children of women with secondary or higher education whilst 37.48% (UI = 34.20–42.91) stunting was observed among children of women without education. In 2014, 26.05% (UI = 22.62–29.80) and 12.76% (UI = 10.74–15.10) stunting occurred among children of women with no formal education and secondary/higher education respectively. The analysis revealed that stunting dominates among rural residents with the widest variation occurring in 1998 and 2003. Males persistently had the greatest share of stunting with the highest prevalence occurring in 2003 (38.22%; UI = 35.68–40.82). The northern part of Ghana (consisting of Northern, Upper East and Upper West regions) consistently accounted for the greatest proportion of stunting. In 1998 and 2003, for instance, Northern region was leading with 44.99% (UI = 36.91–53.34) and 54.34% (UI = 49.43–59.17) respectively.

Table 1

Trends in stunting prevalence in children under-age 5, disaggregated across five inequality dimensions between 1998 and 2014

	1998 (30.59)		2003 (35.26%)		2008 (27.95%)		2014 (18.77%)	
	N = 2529		N = 2874		N = 2529		N = 2894	
Dimension	n	% (UI)	n	% (UI)	n	% (UI)	n	% (UI)
Economic status								
Quintile 1 (poorest)	665	39.72 (35.53–44.08)	741	46.96 (43.42–50.54)	622	35.08 (31.13–39.24)	665	24.81 (21.52–28.41)
Quintile 2	540	34.72 (30.41–39.30)	651	37.17 (33.61–40.88)	573	34.13 (29.65–38.92)	590	25.51 (21.60–29.86)
Quintile 3	523	33.15 (28.83–37.77)	581	37.49 (33.06–42.15)	468	28.26 (23.35–33.74)	603	17.93 (14.46–22.02)
Quintile 4	426	20.47 (16.14–25.61)	479	27.52 (23.22–32.29)	504	21.42 (17.63–25.77)	540	14.34 (10.69–19.01)
Quintile 5 (richest)	373	16.32 (12.67–20.77)	421	17.42 (13.57–22.09)	356	14.40 (10.40–19.60)	495	8.47 (5.36–13.15)
Education								
No education	942	37.48 (34.20–42.91)	1145	43.36 (40.64–46.12)	737	29.65 (26.02–33.55)	750	26.05 (22.62–29.80)
Primary	504	31.73 (27.60–36.17)	653	31.38 (27.82–35.17)	543	31.48 (27.03–36.29)	509	19.78 (16.25–23.85)
Secondary +	1082	24.06 (21.19–27.17)	1076	28.99 (25.83–32.37)	984	23.59 (20.36–27.16)	1333	12.76 (10.74–15.10)
Place of residence								
Rural	1910	34.60 (32.18–37.10)	1944	40.38 (38.44–42.35)	1549	32.30 (29.46–35.27)	1574	22.09 (19.71–24.66)
Urban	619	18.23 (15.00–21.98)	930	24.55 (21.16–28.29)	975	21.05 (17.91–24.58)	1320	14.82 (12.49–17.49)
Sex								
Female	1292	27.67 (25.18–30.31)	1428	32.26 (29.83–34.79)	1243	26.21 (23.31–29.33)	1381	16.98 (14.91–19.28)
Male	1237	33.64 (30.66–36.75)	1446	38.22 (35.68–40.82)	1281	29.65 (26.74–32.93)	1513	20.40 (18.04–22.99)
Region								

	1998 (30.59)		2003 (35.26%)		2008 (27.95%)		2014 (18.77%)	
	N = 2529		N = 2874		N = 2529		N = 2894	
Western	336	32.68 (26.29–39.78)	301	31.84 (27.17–36.90)	236	26.96 (18.16–38.03)	306	17.71 (12.91–23.81)
Central	371	32.45 (26.40–39.15)	258	37.42 (32.45–42.67)	245	33.70 (26.64–41.57)	340	20.03 (17.29–27.62)
Greater Accra	267	13.98 (9.72–19.70)	295	17.13 (12.36–23.26)	277	14.17 (10.07–19.56)	424	10.39 (6.71–15.74)
Volta	291	28.57 (23.01–34.87)	230	27.94 (32.11–33.34)	227	26.76 (19.91–34.94)	214	19.30 (14.55–25.16)
Eastern	352	28.27 (23.07–34.13)	299	31.96 (27.23–37.09)	216	37.87 (28.48–48.26)	273	17.02 (12.22–23.22)
Ashanti	413	33.61 (28.58–39.05)	549	36.74 (32.74–40.94)	507	26.45 (22.43–30.91)	496	16.08 (11.64–21.80)
Brong Ahafo	198	22.37 (16.06–30.26)	322	34.98 (28.25–42.37)	273	25.17 (19.80–31.43)	284	17.23 (13.57–21.64)
Northern	163	44.99 (36.91–53.34)	387	54.34 (49.43–59.17)	359	32.38 (26.92–38.36)	359	33.11 (28.41–38.18)
Upper West	62	39.81 (33.05–46.98)	88	38.67 (32.11–45.67)	115	35.97 (29.59–42.89)	117	14.39 (11.38–18.04)
Upper East	171	42.88 (37.51–48.41)	141	35.86 (29.49–42.76)	65	24.58 (19.75–30.15)	78	22.21 (16.82–28.73)
UI: Uncertainty Interval								

Inequality indices estimates of the factors associated with stunting prevalence in children under age 5 between 1998-2014

We presented the indices of the inequality estimates of factors associated with stunting in Table 2. For economic status, only the simple summary measures (D, R) showed significant inequality in stunting. For instance, both D (23.40; 17.55–29.25) and R (2.43; 1.78–3.09) revealed substantial economic variation in stunting and the same trend was noted across all the survey years. The complex summary measures, however, showed a significant but negative association. Similarly, simple summary measures revealed positive variation in stunting whilst all the complex measures indicated negative variation from 1998 to 2014. Also, both D (16.36; 12.13–20.60) and R (1.90; 1.51–2.28) revealed a positive significant disparity in favour of urban residents. The simple measures further indicated a significant disparity in stunting at the detriment of male children throughout the period studied. Finally, a significant disparity at the expense of children in the Northern region was evident in 1998 (D=31.00; R=3.22), 2003 (D=37.21; R=3.17) and 2014 (D=22.73; R=3.19).

Table 2

Inequality indices estimates of the factors associated with stunting prevalence in children aged < 5 years, 1998-2014

Dimension	1998			2003			2008			2014		
Economic status	Est	LB	UB	Est	LB	UB	Est	LB	UB	Est	LB	UB
D	23.40	17.55	29.25	29.54	24.03	35.06	20.68	14.58	26.78	16.33	11.22	21.46
PAF	-46.66	-58.42	-34.89	-50.58	-60.45	-40.72	-48.49	-61.09	-35.89	-54.85	+67.50	-42.20
PAR	-14.27	-17.87	-10.67	-17.83	-21.31	-14.35	-13.55	-17.08	-10.03	-10.30	-12.67	-7.92
R	2.43	1.78	3.09	2.70	2.01	3.38	2.44	1.61	3.26	2.93	1.55	4.30
Education												
D	13.43	8.96	17.91	14.37	10.12	18.62	6.05	0.99	11.11	13.29	9.10	17.47
PAF	-21.37	-28.00	-14.73	-17.78	-24.05	-11.50	-14.06	-21.60	-6.52	-29.04	-36.85	-21.22
PAR	-6.54	-8.57	-4.51	-6.27	-8.48	-4.05	-3.89	-5.93	1.79	-5.22	-6.63	-3.82
R	1.56	1.32	1.80	1.50	1.30	1.69	1.26	1.02	1.50	2.04	1.59	2.49
Place of residence												
D	16.36	12.13	20.60	15.83	11.79	19.88	11.24	6.84	15.65	7.27	3.78	10.78
PAF	-40.40	-49.50	-31.29	-30.37	-37.15	-23.60	-24.69	-32.27	-17.11	-21.07	-29.14	-12.99
PAR	-12.36	-15.14	-9.57	-10.71	-13.10	-8.32	-6.90	-9.02	-4.78	-3.95	-5.47	-2.44
R	1.90	1.51	2.28	1.64	1.39	1.90	1.53	1.26	1.81	1.49	1.19	1.79
Sex												
D	5.96	2.01	9.92	5.96	2.40	9.51	3.44	-0.80	7.68	3.42	0.12	6.71
PAF	-9.54	-15.29	-3.79	-8.50	-13.48	-3.52	-6.25	-12.60	0.11	-9.52	-17.42	-1.62
PAR	-2.92	-4.68	-1.16	-3.00	-4.75	-1.24	-1.75	-3.52	0.03	-1.79	-3.27	-0.030
R	1.22	1.06	1.37	1.18	1.06	1.31	1.13	0.96	1.30	1.20	0.99	1.41
Region												
D	31.00	21.41	40.60	37.21	29.95	44.47	23.70	12.67	34.73	22.73	16.13	29.32
PAF	-54.29	-67.66	-40.93	-51.40	-63.32	-39.48	-49.33	-63.71	-34.94	-44.64	-59.61	-29.73
PAR	-16.61	-20.70	-12.52	-18.12	-22.32	-13.92	-13.79	-17.81	-9.77	-8.39	-11.19	-5.58
R	3.22	1.94	4.49	3.17	2.13	4.21	2.67	1.54	3.81	3.19	1.75	4.63
Est: Estimate; LB: Lower bound; UB: Upper bound												

Discussion

This study examined the inequalities in stunting prevalence among children under five years in Ghana between 1998 and 2014. The educational dimension of stunting among children under five years has shown improvements over the studied period. Maternal educational level emerged as a key variable that contributes to the inequalities in stunting among children under five years. Our finding that stunting is more common among children of women with no/low educational attainment is in line with previous studies conducted in South Asia [18], some sub-Saharan African countries [19], Nigeria [20], and Sierra Leone [21]. The possible reason for this findings could be that more educated women are likely to utilize healthcare services which in turn, may affect health-related decisions that improve child nutritional outcomes, such as stunting [22]. This suggests that addressing disparities in

stunting among children under five years in Ghana will need among other things a strong commitment in increasing mothers' education by paying critical attention to the inequalities in educational attainment between socio-economic groups in the country. Also, designing educational interventions to equip mothers with the necessary knowledge of the nutritional needs of their children may help prevent stunting among children of mother with no/low formal education.

Consistent with previous studies conducted in Nepal [23], Nigeria [20], and Sierra Leone [21], our findings showed that inequalities in childhood stunting were prevalent among children from the poorest wealth categories. The plausible reason could be that people in the poorest wealth quantile may encounter financial challenges in their attempt to access nutritious foods for their children, and this may increase the likelihood of stunting in their children. The socio-economic status continues to be an important policy lever that policymakers can use to address a wide range of issues.

Place of residence was found to be a significant contributor to the inequalities in stunting prevalence among children under five years in Ghana. Comparable with previous studies in sub-Saharan Africa as a whole [24] and in specific countries like Nigeria [20] and Sierra- Leone [21], stunting prevalence among children under five years dominates among rural residents compared to urban residents. The widest variation of stunting occurred between 1998 and 2003, and that could be due to the inequitable distribution of socio-economic conditions in the country [7]. The study highlighted not only the widest variation of stunting in the rural areas but the fluctuating rate of stunting prevalence among children under five years in the country over the studied years. This finding calls for a collective effort by policymakers to focus on closing the urban-rural gap in terms of stunting burden among children under five years.

The present study revealed disparities in stunting prevalence across the geopolitical regions in Ghana. Data from Ghana DHS show that stunting prevalence among children under five varies by geographical regions in the country [7], and the Northern region consistently accounted for the greatest proportion of stunting prevalence than any other region in the country. The regional inequality has shown fluctuation over the studied time by the different measures of inequality. The regional disparities found in Ghana present an interesting picture that needs further investigation to identify the drivers for this disparity to pave way for the implementation of context-specific interventions that would help eliminate the sub-national region-related stunting disparity.

Finally, our finding showed sex-related stunting inequality favouring female children. This finding is congruent with previous studies conducted in Nigeria [20], Senegal [25], and Sierra Leone [21] that demonstrated that female children have lower odds of experiencing stunting than their male counterparts. The simple measures indicated a significant disparity in stunting at the detriment of male children throughout the period studied. The simple measure of inequality (D) remained unchanged between 1998 and 2003 and declined afterwards.

Strengths And Limitations

The main strength of this study lies in the use of four large nationally representative data with a large sample size, which warrant a high precision of the findings. Also, Ghana DHS used the standardized tools, which are reliable. Additionally, we investigated the stunting disparity using the HEAT software which allows us to do the inequality analysis with high standard of quality. Despite these strengths, there is a limitation inherent in the study that needs to be acknowledged. We did not explore the root causes of stunting disparity in the country. However, programmes and interventions intended to reduce stunting in Ghana may need information on the root causes of such disparities. This highlights the need for further qualitative studies to explore the reasons for the existence of stunting disparity in the country across different population groups.

Conclusion

We examined inequalities in the determinants of stunting prevalence among children under five years in Ghana between 1998 and 2014. Inequalities in stunting prevalence in Ghana is to the disadvantage children of poorest wealth quintile, uneducated mothers, male children, rural residents, and those of the Northern region of Ghana. We recommend the introduction and strengthening of equitable interventions focusing on nutrition on sub-populations in the country who suffer from a higher burden of stunting.

Abbreviations

WHO: World Health Organization's

HEAT: Health Equity Assessment Toolkit

D: Difference

R: Ratio

SDG: Sustainable Development Goals

Declarations

Acknowledgement

We acknowledge the WHO for making the HEAT software available to the public domain for free.

Authors' contributions

CA,EKA,PA,EA,JKT and JJN conceived the study. PA analysed the data. CA,EKA,PA,EA,JKT and JJN drafted the manuscript and revised the manuscript critically for important intellectual content. All the authors have read and approved the final version for submission.

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Availability of data and materials

The datasets generated and/or analyzed during the current study are available in the WHO's HEAT version 3.1 [https://www.who.int/gho/health_equity/assessment_toolkit/en/]

Ethics approval and consent to participate

Ethics approval was not required since the data is available to the public domain.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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