
Gender and Child Nutrition: Implications of Mother's Education in Malawi

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Abstract: The objective of this study was to understand how gender gaps in child nutrition vary across different levels of mother's education. We obtained anthropometric indicators from a secondary and publicly accessible Multiple Indicator Cluster Survey (MICS-2014) data. We used height-for-age and stunting as nutrition indicators and gender as the main determinant while splitting the sample by mother's education. We apply Ordinary Least Squares on the data in Stata 16 to understand if female and male differences in under-five child nutrition differs conditional on the level of education for their mother, while controlling for diverse child, household and community characteristics. Our finding suggests that female child height for age premium increases at high levels of mother's education and differences in stunting disappear amongst uneducated and highly educated mothers while persisting amongst the middle education levels (primary and secondary educated mothers). We conclude that gendered nutrition gaps are heterogeneous across different levels of mother education. In the case of a rural economy of sub-Saharan (SSA) such as Malawi, female children get the lion's share of nutrition investment as the education of the mother increases. However, the female nutrition premium reduces with increasing education only when it threatens the male child into nutrition deficiency.

Keywords: Child Nutrition, Gender Disparities, Mother's Education, Nutrition Investment, Malawi

1. Introduction

'Gendered child nutrition disparities', here regarded as the differences between anthropometric indicators of males and females, regained its prominence amongst both researchers and policy makers as from the year 2015, countries embarked on earmarking investment in human capital to meet the first Sustainable Development Goal of zero hunger. One of the main targets of this first SDGs concerns ending malnutrition by 2025. The gendered nutrition gaps enable researchers to understand the existence of intra-household resource allocation inequalities that affect the analysis of the relationship between health investment and wellbeing outcomes [1]. Besides, policymakers use these findings to understand the potential effects of their investments on child

growth and development that has two-stage implications on the general health of the population and its associated economic productivity [2]. For instance, gender gaps in child health investments lead to disproportionate welfare future outcomes such as education attainment and the resultant earnings from the labour market [3]. Evidence on the topic show that the direction of bias for the preferred gender remains context specific with some studies [1, 3, 4] finding boy preference while others [5–8] show girl child inclination.

Sub-Saharan Africa remains the region with favourable girl child nutrition relative to boys [9, 10] that until present does not receive academic attention that investigates the heterogeneity in this nutrition disparity across different levels of its possible associated determinants. In this paper, we contribute to bridging this literature gap by exploring how the

female child nutrition premium varies across different education levels of the mother using data from Malawi. The country becomes compelling to understand nutrition disparities, as until present, registers highest malnutrition rates in the region. With the dominance of matrilineal societies in the country¹, which is also the case for the sub-Saharan region, the malnutrition burden could fall much on boys. Consequently, we hypothesise that increased female education relates to increased girl child nutrition premium. We first investigate the relationship between gender and height for age across different levels of mother education. Second, we further explore the existence of these gender gaps using stunting to understand if the deprivation pushes male children into nutrition deficiency

2. Gender Gaps in Child Nutrition

Child health investment literature unanimously agree about the existence of gendered nutrition disparities despite the remaining controversy on the direction of the nutrition investment bias. Earlier studies showed that boys possess superior nutrition outcomes relative to girls, with high-expected returns from investment in male children stemming as one of the justifications for the difference [for instance 1 and 4]. However, later evidence [3] counter argues this reasoning showing that boys have a high growth potential relative to girls resulting into the observed differences even when both genders are given the same amount of nutrition investments, as supported by findings in India and Peru [5]. Later studies show that the direction of bias is not universal such that in some areas girls possess a nutrition premium over boys. For instance, a study [5], found the pro-female bias in nutritional status in Ethiopia, Peru, India and Vietnam confirming other results [6-8], which show that boys lag behind girl nourishment, citing female resilient genetic potential as the reason [11]. However, another study [12] shows that a household headed by a female exhibits pro-girl child nutritional bias highlighting the existence of conscious-non genetic biased female child investment. Arguably, we anticipate pro-female nourishment even in male-headed households whenever the bargaining power of the woman increases.

Debatably, maternal education improves women's bargaining power through increased ability to contribute resources to the family budgets [7]. Results shows that increased maternal education improves female child nutrition over that of males in instances where the mothers prefer daughters to sons even when the fathers favour the reverse [13]. Therefore, women that have enhanced bargaining power due to high education may use their enhanced position to favour female child nourishment.

SSA becomes a region dominated by the matrilineal types of marriage where female children take care of their parents and relatives at old age while men marry and settle at the

female location, farming on the land owned by their wives [14]. Therefore, investing much in girls relative to boys provides old age insurance to parents and the woman's relatives. In the region, Malawi becomes one of the countries dominated by matrilineal societies [15], where studies consistently show that female child nutrition is superior to male child nourishment. For instance, recent evidence [10] reveals that 27 percent of boys are stunted relative to girls (23 percent). The outcomes substantiate previous findings [9] that 23 percent of boys are underweight relative to girls (20 percent) in the country.

3. Nutrition in Malawi

The Malawi government through its various programmes and strategies has emphasised better health outcomes for children. Among others, these strategies include the Poverty Alleviation Program (1994), the Malawi Poverty Reduction Strategy (2002-2005), the Malawi Growth and Development Strategy (2006-2011 and 2011-2016) and more recently the MDGS IV-2016-2025 [10]. Malnutrition has declined over the years showing benefits of those efforts by the government of Malawi to improve health outcomes. Table 1 shows trends of stunting, wasting and underweight for the period 1992-2015. The most recent DHS (2015-16) reveal the upward trajectory that the Malawi government moved to tackle malnutrition. Levels of stunting had remained high and unchanged over the 22-year period (1992 – 2010), but there was a huge decline by 10-percentage point in the later years. In 2015, wasting hit the lowest point ever experienced since 1992. The developments reveal that over time malnutrition has been reducing. However, the figures remain high by international standards. As such, the country needs a holistic approach to fighting malnutrition informed by detailed empirical analysis if it has to meet the global SDG targets of ending malnutrition by 2025.

Table 1. Trend in the Nutritional Status of Under-Five Children, 1992-2015 (%).

Indicator	1992	2000	2004	2010	2015
Stunting	48.7	49.0	47.8	47.1	37.1
Wasting	5.4	5.5	5.2	4.0	2.7
Underweight	27.2	25.4	22.0	12.8	11.7

Source: Malawi DHS.

4. Methodology

The empirical application of our research question models child nutrition as a function of its gender and characteristics under which the child lives captured as:

$$HAZ_i = \alpha_0 + \alpha_1 Male_i + \alpha_2 Characteristics_{ihc} + \varepsilon_i \quad (1)$$

To understand how the relationship between child gender and nutrition varies at different levels of mothers' education we estimate four models of equation (1). Each model captures

¹ Societies value female children as an old age insurance for a woman's parents hence make biased investment in girls (14).

a different level of mother education ranging from uneducated, primary educated, secondary educated and higher educated. In the equation HAZ_i captures height for age Z score for a given child and is the outcome variable in the paper. We compute the Z score following the World Health Organisation (WHO 2006) standard that calculates height for age using the following formula:

$$HAZ_i = \frac{(Height_i - Height_r)}{SD_{Height}} \quad (2)$$

In equation 2 the z-score is a function of height for age of a child minus height for age of a child from a distribution of international reference category divided by the standard deviation of this distribution. A mean value for the Z score which is in the range between zero and minus 2 entails that the child has normal height for age while that below minus 2 entails that the child is stunted (too short for their age). The variable of interest in the height for age equation is male. Male represents 1 for a boy child and 0 for female child. If boys have less height for age relative to girls, the variable male adopts a positive sign while a negative sign entails that boys have low height for age relative to girls. The characteristics variable encompass the determinants of height for age besides gender of the child that might affect the relationship between gender and height for age if excluded from the model. These include child, household specific and community specific characteristics. We further include regional fixed effects to account for time invariant regional heterogeneities. The equation further include a white noise error term that is assumed independent and identically distributed.

To understand the severity of the differences in gendered height for age we re-estimate the models using stunting as a dependent variable. We categorise the sample into children whose height for age z-score is less than minus 2 standard deviations as the stunted and those below as well nourished. Therefore, the stunted equations measure the probability of child becoming stunted at different levels of mother's education. We describe the data and variables used in both models in the section to follow.

5. Data and Descriptive Statistics

The study uses data from the Malawi Millennium Development Goals Endline Survey (MES) conducted by the National statistical office for the country in 2014. The MES forms part of the country series of Multiple Indicator Cluster Surveys (MICS) conducted to monitor the situation of children and women. A nationally representative two-stage sampling survey had 1140 enumeration areas containing 25 randomly selected households each. The survey collected data on 19,285 children. After dropping all children with missing information on any of the variables of interest, we remained with an estimable sample of 18335. The MES also collects information on the education of the mother of every sampled child in 4 categories; uneducated, primary, secondary and higher education. Figure 1 (see Appendix) provides the distribution of height for age by gender of the

child across the mothers' education levels. The figure reveals that boys are generally of low height for age relative to girls. The gender difference is 0.19 standard deviations amongst uneducated and primary educated mothers while that of secondary educated mothers is 0.16 as shown in Figure 2 (see Appendix). The last second column of figure two reveals that amongst highly educated mothers, male children lag behind female children by 0.32 standard deviations. The distributions provide preliminary evidence that high levels of mother's education relate pro-female nourishment. Besides, they also show that very low levels of education relate to fewer gaps in gendered nutrition. These results however, are univariate that could change once we control for other determinants of height for age in the analysis. Table 2 provides summary statistics of all the variables used in the analysis of the paper. We disaggregate the data by gender of the child.

Table 2. Summary Statistics of variables used.

Variable	Male child	SD	Female child	SD	Difference
Age of child	1.999	1.391	2.023	1.392	0.023
Height 4 age	-1.814	1.445	-1.629	1.409	0.185***
Stunting	0.420	0.494	0.364	0.481	-0.057***
Male child	0.500	0.500	0.500	0.500	0.500
1-17yr olds	3.117	1.756	3.167	1.774	0.050*
Male head	0.797	0.402	0.805	0.396	0.008
Uneducated	0.135	0.342	0.132	0.338	-0.003
Primary	0.696	0.460	0.708	0.455	0.011
Secondary	0.158	0.365	0.151	0.358	-0.007
Higher	0.011	0.102	0.010	0.097	-0.001
Catholic	0.175	0.380	0.164	0.370	-0.011
CCAP	0.650	0.477	0.652	0.476	0.002
Muslim	0.137	0.344	0.147	0.354	0.010*
No religion	0.038	0.192	0.037	0.188	-0.002
North	0.178	0.383	0.175	0.380	-0.003
Centre	0.344	0.475	0.334	0.472	-0.010
South	0.478	0.500	0.491	0.500	0.013
Poorest	0.229	0.420	0.216	0.411	-0.014*
Poor	0.214	0.410	0.220	0.415	0.006
Middle	0.206	0.405	0.217	0.412	0.011
Richer	0.183	0.387	0.184	0.387	0.001
Richest	0.152	0.359	0.147	0.354	-0.004
Piped water	0.175	0.380	0.168	0.374	-0.007
Borehole	0.643	0.479	0.641	0.480	-0.001
Well	0.133	0.340	0.141	0.348	0.008
Spring	0.010	0.100	0.010	0.102	0.000
Tanker-truck	0.001	0.031	0.001	0.032	0.000
Surface water	0.038	0.191	0.038	0.191	0.000
Flush	0.016	0.125	0.014	0.119	-0.001
Pit-latrine	0.919	0.272	0.923	0.266	0.004
No toilet	0.065	0.246	0.063	0.242	-0.002
Observations	9641		9644		19285

[Insert Figures 1 and 2 here, see appendix].

6. Results

Table 3. The relationship between height for age and gender.

Mothers education	(1)	(2)	(3)	(4)
	Uneducated	Primary	Secondary	Higher
Variables	Height for age	Height for age	Height for age	Height for age
Male child	-0.124 (0.085)	-0.195*** (0.037)	-0.217*** (0.056)	-0.248** (0.114)
Female head	-0.199** (0.085)	-0.116** (0.052)	0.025 (0.069)	0.156 (0.175)
Child's age	-0.096*** (0.016)	-0.128*** (0.012)	-0.068*** (0.020)	0.148* (0.072)
under 17s	-0.016 (0.027)	-0.032** (0.013)	-0.015 (0.021)	-0.007 (0.079)
Poor	0.176 (0.136)	0.063 (0.051)	0.133 (0.157)	0.000 (0.000)
Middle	0.022 (0.108)	0.116** (0.055)	0.010 (0.097)	0.000 (0.000)
Richer	0.248* (0.131)	0.262*** (0.058)	-0.037 (0.096)	0.372 (0.520)
Richest	0.259 (0.185)	0.312*** (0.066)	0.122 (0.118)	0.429** (0.191)
Protestant	-0.095 (0.102)	0.054 (0.047)	0.104 (0.099)	0.051 (0.218)
Muslim	0.157 (0.113)	0.155*** (0.052)	0.049 (0.064)	-0.891*** (0.312)
No religion	-0.418* (0.213)	-0.215** (0.090)	-0.336* (0.183)	0.000 (0.000)
Central region	-0.092 (0.213)	-0.153** (0.062)	-0.092 (0.100)	0.670** (0.317)
Southern region	0.017 (0.207)	-0.058 (0.068)	-0.092 (0.092)	0.499 (0.323)
Borehole water	0.062 (0.099)	0.057 (0.054)	-0.065 (0.095)	-0.332 (0.234)
Protected well	-0.270** (0.100)	0.010 (0.063)	-0.082 (0.111)	0.372 (0.257)
Protected spring	-0.441 (0.435)	-0.013 (0.157)	-0.187 (0.387)	0.000 (0.000)
Tanker-truck	0.070 (0.171)	-0.348** (0.134)	-0.537 (0.548)	0.000 (0.000)
Surface water	0.278 (0.262)	0.083 (0.130)	-0.052 (0.370)	-0.422 (0.802)
Pit-latrine	-0.482 (0.401)	-0.371 (0.226)	-0.177 (0.328)	-0.231 (0.159)
No toilet	-0.651 (0.389)	-0.588*** (0.214)	-0.201 (0.347)	0.325 (0.328)
Constant	-1.028** (0.503)	-1.039*** (0.211)	-1.152*** (0.419)	-2.075*** (0.384)
Observations	2,428	12,876	2,848	183
R-squared	0.042	0.037	0.022	0.088

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 3 presents results on the relationship between child gender and height for age. The first column reveals that uneducated mothers' male and female children's nutrition

status does not significantly differ. The second column shows that primary educated mothers have male children who are relatively undernourished compared to female children. Increasing education levels further-as shown in column 3 and 4 associates with larger gender differences.

Table 4. The relationship between stunting and gender mediated by mother's education.

Mothers education	(1)	(2)	(3)	(4)
	Uneducated	Primary	Secondary	Higher
Variables	stunting	stunting	stunting	stunting
Male child	0.038 (0.024)	0.067*** (0.011)	0.065** (0.030)	0.042 (0.047)
Female head	0.000 (0.030)	0.024 (0.017)	-0.023 (0.021)	-0.161** (0.073)
Child age	0.037*** (0.007)	0.034*** (0.004)	0.005 (0.008)	-0.037* (0.019)
under 17s	0.003 (0.008)	0.008** (0.004)	0.004 (0.007)	0.023 (0.026)
Poor	-0.061 (0.037)	-0.031* (0.016)	0.020 (0.048)	0.000 (0.000)
Middle	-0.033 (0.031)	-0.037** (0.016)	0.056 (0.049)	0.000 (0.000)
Richer	-0.109** (0.045)	-0.071*** (0.016)	0.030 (0.055)	-0.266 (0.377)
Richest	-0.116** (0.056)	-0.096*** (0.019)	-0.012 (0.055)	-0.257 (0.323)
Protestant	-0.014 (0.037)	-0.018 (0.019)	-0.062** (0.028)	-0.064 (0.080)
Muslim	-0.020 (0.029)	-0.004 (0.016)	-0.015 (0.040)	-0.151* (0.080)
No religion	0.125 (0.090)	0.079** (0.038)	0.062 (0.079)	0.000 (0.000)
Central region	0.118** (0.056)	0.046** (0.020)	0.003 (0.038)	-0.256* (0.128)
Southern region	0.082 (0.056)	0.013 (0.020)	0.017 (0.030)	-0.176 (0.127)
Borehole water	-0.005 (0.041)	-0.019 (0.016)	0.007 (0.041)	-0.064 (0.115)
Protected well	0.038 (0.041)	-0.022 (0.020)	-0.053 (0.040)	-0.360*** (0.082)
Protected spring	0.008 (0.118)	-0.040 (0.039)	0.038 (0.140)	0.000 (0.000)
Tanker-truck	-0.361*** (0.063)	-0.012 (0.121)	0.261 (0.385)	0.000 (0.000)
Surface water	-0.026 (0.088)	-0.006 (0.032)	0.057 (0.093)	0.387 (0.232)
Pit-latrine	0.305** (0.129)	0.237*** (0.055)	0.079 (0.071)	0.113* (0.061)
No toilet	0.361*** (0.123)	0.308*** (0.054)	0.137 (0.109)	-0.243** (0.116)
Constant	0.000 (0.151)	0.083 (0.064)	0.233* (0.117)	0.717* (0.401)
Observations	2,543	13,409	2,961	193
R-squared	0.035	0.025	0.017	0.101

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Amongst the controls, female-headed households have children with poor nutrition relative to male-headed households, particularly amongst the uneducated and primary educated mothers. Increased child age relates to reduced height for age in all categories except amongst the postsecondary educated mothers who register an increase. Increased number of younger siblings reduces height for age only amongst the primary educated mothers while increased household wealth relates to improved nutrition amongst the same mothers education. Being a Muslim relates to improved height for age amongst the primary educated mothers while the religion positively relates to the indicator amongst the highly educated mothers. Overall, non-religious households have children with poor nutrition relative to Christian households. Children with uneducated mothers and of the primary educated mothers living in the central region have poor height for age relative to those in the northern region while highly educated mothers in the central region have well-nourished children. Water drawn from the well relates to reduced height for age relative to piped water amongst the uneducated while water obtained from tankers relates to low height for age amongst primary educated mothers. Furthermore, the use of pit-latrines as opposed to flush toilets relates to low height for age amongst primary educated mothers.

Table 4 presents results on the relationship between stunting and mothers education. The first column shows that uneducated mother have children with nutrition that is not different by gender. The second column shows that primary educated mothers are more likely to have stunted male relative to female children. The third column shows that increased education to secondary level relates to nutrition premium that favours females while the fourth column shows that mothers that are educated beyond secondary have increased probability of having a stunted boy in comparison to a girl.

7. Discussion

In this paper, we have shown that under-five boys living with educated mothers have poor nutrition relative to girls using data from the Malawi Millennium Development Goals Endline Survey. We particularly find that uneducated mothers have no children with gender differences in height for age while educated mothers have well-nourished females. The differences widen with further increase in mothers education. Using stunting we find that the uneducated and the highly educated mothers have children whose probability of stunting does not differ by gender while primary and secondary educated mothers have gendered nutrition disparities amongst their children.

In a rural matrilineal society like Malawi, females hold the primary role of caring for their parents and relatives at old age [14]. This makes investing much in female children relative to males worthwhile. Nevertheless, this parental preference for girls could be disproportionate amongst the child caregivers because in the matrilineal systems, a man leaves their original home to settle at the woman's place at marriage [15]. By implication, the parents of the woman not the man benefit much from the investment in the girl child.

The cultural set up justifies the observed female nutrition premium as the women have more autonomy-through control of resources at their backyard to invest in their preferred child gender. Nevertheless, intra-household bargaining power caused by other factors besides culture can reinforce or erode this female autonomy. Education is one of these factors. Educated females have high bargaining power that also allows them to influence resource allocation [13]. Therefore, our results arguably capture the revealed female child preference by women due to increased autonomy through high education. Besides, uneducated women have low bargaining power, which arguably limits their autonomy leading to equality of nutrition investment between child genders. This equality applies to both the normal nutrition-height for age and the nutrition deficiency stunting.

Unlike height for age, which shows that, increased education exacerbates nutrition gaps, stunting differences between male and female children disappear amongst the highly educated mothers but remains persistent amongst the primary and secondary educated mothers. Arguably, the highly educated mothers could be more aware and conscious about both contemporary and intertemporal costs of undernourished children that include frequent child illness and poor cognitive development [16]. Therefore, these mothers favour their preferred gender only when they perceive that the inequality does not lead to stunting. Alternatively, the result could be reflecting that increased resources-through better jobs due to high education of the mother reduces the incentive to deprive the male child.

The persistence of stunting differences between male and female children for primary and secondary educated mothers could be emerging from two reasons. Firstly, these groups have a relatively high bargaining power in comparison to the uneducated that allows them to influence resource allocation decisions. Secondly, they do not have as much resources as the highly educated to cushion their sons from stunting.

8. Conclusion

The study aimed at investigating if different levels of mother's education reveal variations in the extent of gendered nutrition gaps. We have shown that, on average, highly educated mothers associate with nutrition-deprived boys relative to girls. The paper call for revisiting the old wisdom that enhanced female autonomy through improved education improves overall, child nutrition by qualifying that-mothers education disproportionately relates to gendered child nutrition. Furthermore, policy aiming at eliminating gendered nutrition gaps should aim at providing equal and direct support at individual level through gender sensitive programs such as the school feeding initiatives. This is because relying only on generic programmes such as those aiming at improving women's household bargaining power can lead to disproportionate investment due to preferences shaped by other external factors such as culture.

Appendix

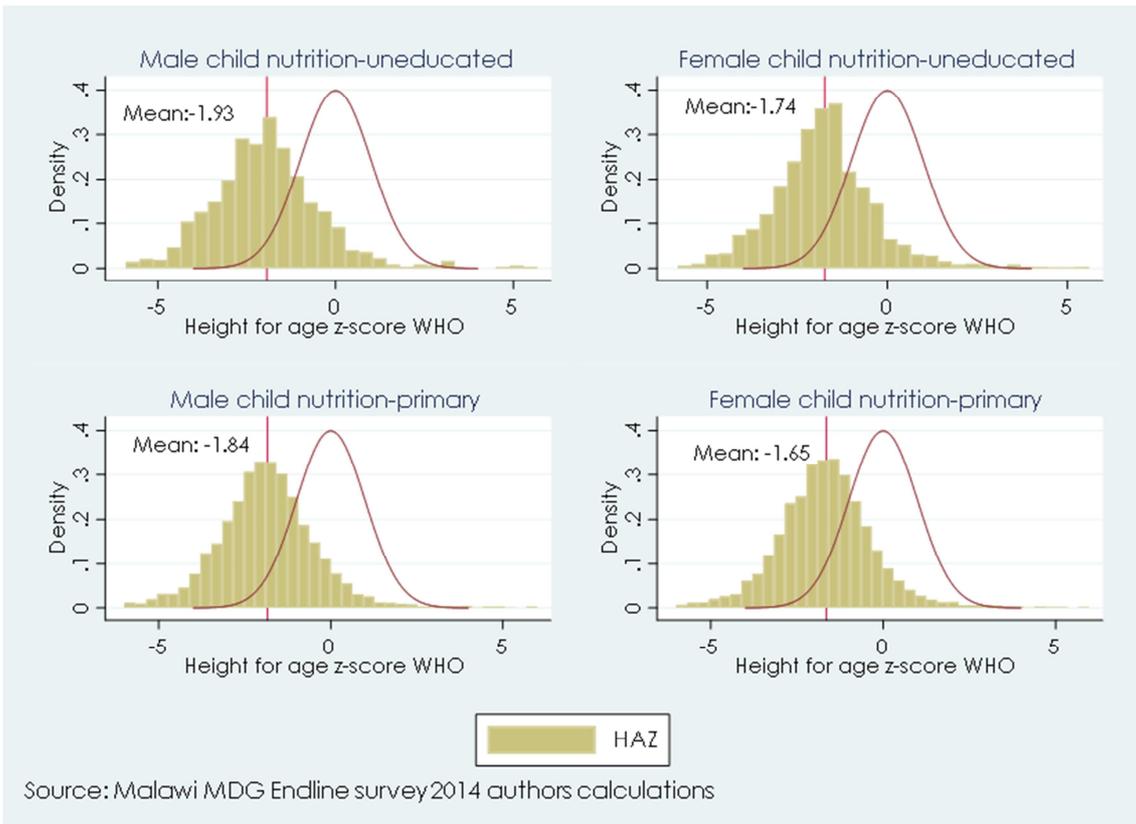


Figure 1. The distribution of height for age by child gender and mothers education.

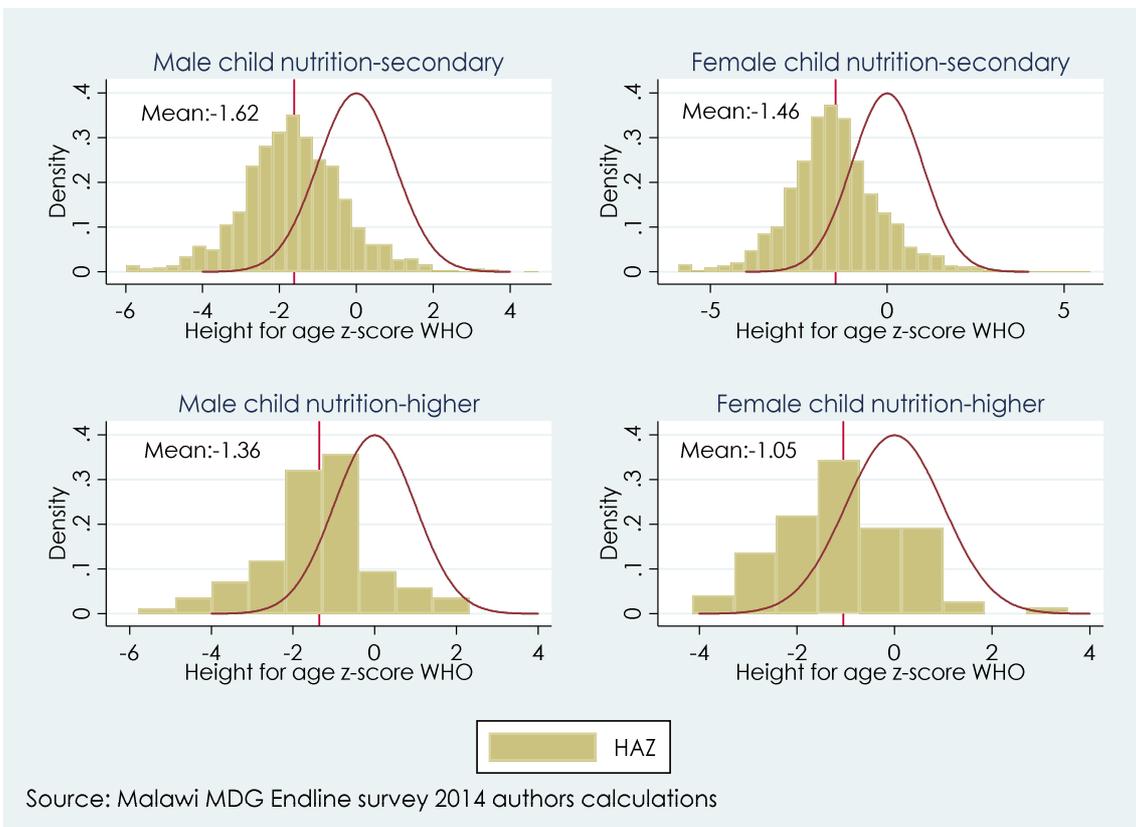


Figure 2. The distribution of height for age by child gender and mothers education.

Compliance with Ethical Standards

The study uses open access secondary data obtained from the Malawi National Statistics office (NSO). The NSO data collection process and usage follows standard ethical standards that are cleared by the Malawi Commission for Science and Technology.

Conflict of Interest

All the authors do not have any possible conflicts of interest.

Role of Funding Source

Authors declare that No funding was obtained from any institution or organisation in writing this paper.

Ethical Approval

Ethical approval was not obtained because the paper uses data from a publicly accessible domain that does not identify human subjects.

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