The Impact of Changes in Nutritional Policy on the Determinants of Child Stunting: The Case of Rural and Urban Zambia

Richard Bwalya
and
Thomson Kalinda

Working Paper AFPON-014

Bringing Rigour and Evidence to Economic Policy Making in Africa

AFRICAN ECONOMIC RESEARCH CONSORTIUM
CONSORTIUM POUR LA RECHERCHE ÉCONOMIQUE EN AFRIQUE

The Impact of Changes in Nutritional Policy on the Determinants of Child Stunting: The Case of Rural and Urban Zambia

By

Richard Bwalya
Institute of Economic and Social Research,
University of Zambia

and

Thomson Kalinda
Department of Agricultural Economics and Extension Studies,
University of Zambia

AERC Working Paper AFPON-014
African Economic Research Consortium, Nairobi
June 2023

THIS RESEARCH STUDY was supported by a grant from the African Economic Research Consortium. The findings, opinions and recommendations are those of the author, however, and do not necessarily reflect the views of the Consortium, its individual members or the AERC Secretariat.

Published by: The African Economic Research Consortium
P.O. Box 62882 - City Square
Nairobi 00200, Kenya

Contents

List of tables

Figures

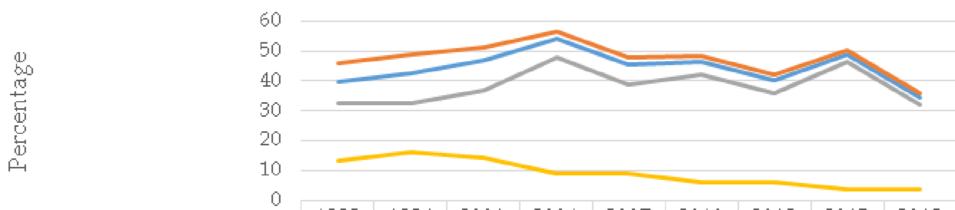
Abstract

This paper evaluates the impact of changes in nutritional policies on the underlying determinants of child stunting in Zambia using data from the 2010 and 2015 Living Conditions Monitoring Survey (LCMS). Regression results show that although there are commonalities across rural and urban areas as well as between 2010 and 2015 in terms of the determinants of child stunting, significant differences between the regions and periods exist, which may have implications for the design of interventions. Decomposition results show that differences in the levels of endowment account for the majority of the observed differences in stunting between rural and urban areas for both periods, implying that interventions aimed at overcoming rural-urban disparities in child nutrition outcomes need to focus principally on bridging gaps in socioeconomic endowments.

1. Introduction

Ensuring adequate nutrition, especially among the low income groups, mothers, children and vulnerable populations, has always been a serious challenge for Zambia. Zambia is one of 36 countries with more than 20% child stunting (Black et al., 2013). Figures from the Zambia Statistical Agency (ZSA) show that although child malnutrition, especially stunting, has been on the decline over the last decade (Figure 1), stunting rates remain stubbornly high at 34.6% (ZSA et al., 2019). As with poverty, child malnutrition is more a rural than an urban phenomenon. The Zambia Demographic Health Survey (ZDHS) for 2018 shows that the proportion of rural children that are stunted is higher (35.9%) than that for urban children (32.1%). Malnutrition also poses a serious health challenge as it is the cause of up to 52% of all deaths in under-five children (MoH, 2012). Estimates of the economic cost of malnutrition for Zambia are high, particularly for stunting, which does not only affect health (physical and cognitive development), but also negatively affects productivity in adulthood. For example, according to the Ministry of Health (MoH et al., 2017), if stunting levels remain unchanged for the period 2016 to 2027, future productivity losses related to stunting would be about US$18.315 billion.

Figure 1: Rural-urban trends in child stunting, 1992–2018



	1992	1996	2001	2006	2007	2010	2013	2015	2018
Zambia	39.6	42.4	46.8	54.2	45.5	46.7	40.1	49	34.6
Rural	46	48.7	51.3	56.6	47.9	48.3	42.1	50.3	35.9
Urban	32.5	32.7	36.8	47.8	39	42.3	36	46.5	32.1
Rural-Urban Difference	13.5	16	14.5	8.8	8.9	6	6.1	3.8	3.8

Sources: UNZA et al., 1993; CSO et al., 1997; CSO et al., 2003; CSO et al., 2009; CSO et al., 2014; ZSA et al., 2019; CSO, 2012; CSO, 2015.

Developing a viable investment and policy strategy for reducing child malnutrition in Zambia, as in most African countries, has remained elusive. The high levels of malnutrition have persisted despite various policies and programmes aimed at addressing malnutrition. Zambia's commitment towards improving nutrition dates back as far as 1967, when the National Food and Nutrition Commission (NFNC) Act was enacted by Parliament. This Act paved the way for the launch of the National Food and Nutrition Policy (NFNP) in 2008, which had its food and nutrition objectives and broad actions incorporated into the national development agenda through the Fifth National Development Plan (2005–2010), Sixth National Development Plan (2011–2015) and Zambia's long-term vision known as Vision 2030. The NFNP is implemented through five-year National Food and Nutrition Strategic Plans (NFNSP). The latest was developed in 2011 covering the period 2011–2015 and demonstrated government's commitment to providing the much needed political leadership in addressing the challenges of food and nutrition through an effective and well-coordinated multi-sectoral response.

The persistence of rural-urban disparities in child nutrition highlights the need for an enhanced understanding of the main drivers of rural-urban differences in nutrition outcomes. An important associated public health policy question is whether fundamentally different nutritional policies and interventions are required in rural and urban areas. Against this background, the purpose of this paper is to contribute to improving our understanding of the rural-urban differentials in child undernutrition in Zambia and shed some light on the factors underlying these differences. Specifically, the study examines how the underlying determinants of stunting for children aged between 0–59 months in rural areas differ from those for similar-aged children in urban areas, and also aims to establish the magnitude of the differences. In addition, the study assesses whether the underlying determinants of child malnutrition in both rural and urban areas have responded differently to the changes in nutritional-related policies that took place between 2010 and 2015. Finally, the paper identifies the priority and high-impact underlying determinants that the government and other stakeholders need to focus on to tackle the problem of stunting in Zambia.

2. Methodology

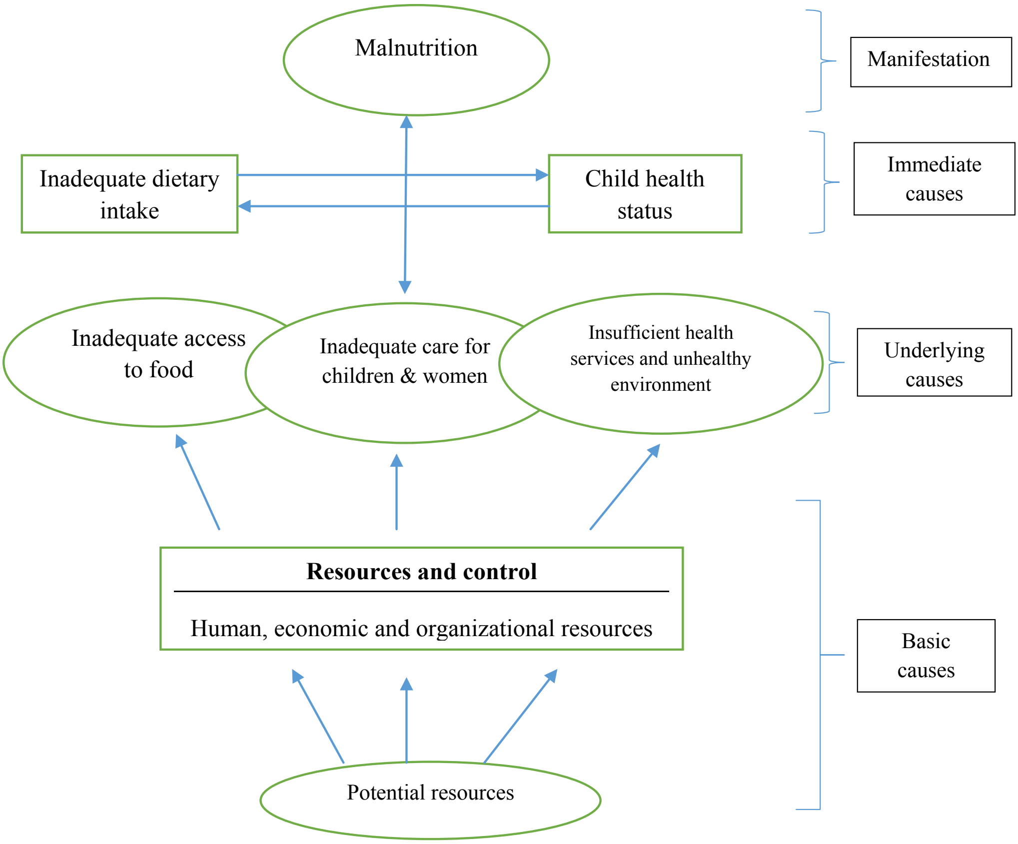
Data sources

The paper relies on Zambia Living Conditions Monitoring Survey (LCMS) data for 2010 and 2015, which is available from the Zambia Statistical Agency. Although similar studies have used Demographic Health Surveys (DHS), the LCMS is preferred as it enables researchers to examine the predictive power of a wide range of policy-relevant explanatory variables, such as household food security, women's education and women's access to productive resources, children's access to health services and utilization, as well as water supply, sanitation and housing conditions, which are measured using nationally and sub-national representative household surveys. The other motivation for using LCMS rather than DHS data is that although both data sets contain similar information on child malnutrition, the implementation of the LCMS surveys coincides more closely with the changes in nutrition policy in Zambia. In terms of sample design and coverage, the LCMS uses nationally representative cross-sectional household surveys with varied sample sizes. For example, while the 2010 survey was designed to cover a representative sample of about 19,300 non-institutionalized private households residing in both rural and urban parts of the country, the 2015 survey was much smaller and designed to cover a representative sample of only 12,260 households.

Conceptual framework

The study uses the widely-accepted framework developed by the United Nations Children's Fund (UNICEF) in the early 1990s (Figure 2), and has since been used in a number of studies on child malnutrition (UNICEF, 1990). This conceptual framework, together with the variables available in our data sets, lead us to investigating the roles that the underlying determinants of child nutrition – household food security status, quality of care for mothers and children, and healthy environment and health services – have played in the nutritional status of both rural and urban children, as well as how these determinants have evolved in response to changes in food and national nutritional policies. It illustrates the hierarchical relationship between the immediate, underlying and basic determinants of child nutrition status.

Figure 2: Conceptual framework guiding the empirical analysis



Source: UNICEF, 1990

Measurement of variables

Dependent variable

Existing child nutrition studies have found different growth-nutrition elasticities, depending on whether underweight prevalence (weight for age), wasting prevalence (weight for height), or stunting prevalence (height for age) is used as the dependent variable (Headey, 2013). Linking back to the general objective of the study, which is to assess how the determinants of rural and urban malnutrition have evolved between the two periods in response to changes in the nutrition policy, height-for-age z-scores (HAZ), also referred to as stunting, were used as an indicator of child nutritional status for both rural and urban households. Stunting is a good indicator of child nutrition and health as it reflects the effects of chronic nutritional deficiency.

Measurement of other key variables

Household Food Security Variables. With regards to household food security-related variables, we focus on those indicators that can be measured using Household Expenditure Surveys (HES) data. According to Smith and Subandoro (2007), each of these indicators addresses some aspect of the following definition of food security, adopted at the 1996 World Food Summit: "Food security … [is achieved] when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FAO, 1996). The three categories of food security indicators are: diet quantity, diet quality and economic vulnerability. For diet quality, we use the household dietary diversity score (HDDS), which is a continuous variable defined as the number of food groups consumed from a list of 12 food categories as defined by the FAO (Kennedy et al., 2011). For diet quantity, we use total calories per adult equivalent per day, which is also a continuous variable. For economic vulnerability, which relates to people's ability to acquire food, we use the percentage of total household expenditure on food, also known as food expenditure share.

Care for Women and Children. The second category of underlying determinants, according to the conceptual framework, is care for women and children. This category includes mother-specific and child-specific variables. For the mother-specific variables we use maternal education, which has long been associated with improved child nutrition outcomes (Alderman and Headey, 2014; Behrman and Wolfe, 1984; Desai and Alva, 1998; Webb and Block, 2004). We also use mother's age, which is not only associated with low birthweight and pre-term birth (Du Plessis et al., 1997), but also with an increased risk of intrauterine restriction (Conde-Agudelo et al., 2005). The variable "number of children under the age of five" is used as a proxy for birth spacing, which plays a key role in nutrition status among children under the age of five, with shorter birth intervals being associated with an increased risk of both stunting and underweight (Gribble et al., 2009). For child-specific variables we include the child's immunization status, child's age in months, whether the child is a boy and the child's health status.

Healthy Environment and Health Services. The third category of underlying determinants is a healthy environment and health services. We use a number of indicators in this category, namely, access to improved water sources for drinking water, access to improved sanitation facilities, distance to health facilities and a crowding index. There is a significant body of literature that finds associations between access to piped water and reductions in the incidence of diarrhoea diseases as well as chronic undernutrition. For example, contaminated drinking water may jeopardize children's nutrition status as waterborne illnesses are the second most common causes of death for children under the age of five (UNICEF, 2008). The World Health Organization estimates that 50% of malnutrition is associated with repeated diarrhoea or intestinal worm infections from unsafe water or poor sanitation or hygiene (Ngure et al., 2014). The variable distance to health facilities is used as a proxy for access to health facilities. Access to healthcare can be an important means of improving overall maternal and child health and also as a potential means for accessing nutrition-specific services (Headey et al., 2017; Aoun et al., 2015). Household density (measured by the crowding index) has long been viewed as both an indicator of low socioeconomic status and also as a stressful situation associated with high morbidity and mortality risks. Indeed, research shows that the crowding index (denoted by number of residents per room) is correlated with a wide range of pathological health outcomes (Freedman, 1975; Baker et al., 1998).

Analytical approach

With regard to the choice of methods, this paper is motivated by the finding that observed rural-urban differences in indicators of child nutrition outcomes, such as height for age, may arise because of either rural-urban differences in the levels of determinants of nutrition outcomes, which is termed as covariate effects in a regression context; or rural-urban differences in the strength of association between particular determinants and nutrition outcomes, which is also termed as coefficient effects in a regression context. As such, we propose using the Blinder–Oaxaca decomposition analysis, which is useful in explaining the gap in outcomes between the two population groups (Blinder, 1973; Oaxaca, 1973).

We examine determinants of children's nutrition status by adopting the household production framework of Becker (1965) and Strauss and Thomas (1995). Starting with a simple household utility maximizing model, we assume that a household has preferences that can be characterized by the utility function *U*, which depends on the consumption of a vector of commodities, *X*, leisure, *L*, and the quality of children represented by their nutritional status, *N*:

$$U = u(X, L, N) \tag{1}$$

where *N* can be measured using standardized anthropometric measures of height for age (HAZ), weight for age (WAZ) and weight for height (WHZ). The assumption in such a model is that good nutrition, as represented by the vector of nutritional status of children, is desirable in its own right, and it is likewise assumed that households make consumption decisions on the basis of reasons other than nutrition (Pitt and Rozenzweig, 1990). Conversely, household utility is maximized subject to several constraints, including a time-specific nutrition production function and income constraints. Guided by the underlying determinants, the reduced form nutritional function for each child can be derived as:

$$N_i = n\ (C, W, H, Z\ , \varepsilon) \tag{2}$$

where C is consumption, W is a vector of child-specific characteristics; H is a vector of household-specific characteristics; Z is a vector of community-level characteristics and ε is the error term. The reduced form model enables us to capture the total impact of child, household and community characteristics rather than their impact conditional on a set of choice variables through a structural model (Strauss and Thomas, 1995; Thomas et al., 1996). The specified nutritional production function allows us to estimate the following equation for stunting, which is our area of interest:

$$haz_i = f(W, H, Z, \varepsilon) \tag{3}$$

where *i* denotes the i^{th} group (defined by year or region) and ε is a random error term assumed to be uncorrelated with the covariates included in the reduced form nutritional outcome model.

For estimation purposes, we propose using decomposition methods as used by Amare et al. (2018), Sharaf and Rashad (2016) and Srinivasan et al. (2013). To explain the rural-urban disparities in stunting among children before and after the nutrition policy change, we use the Blinder– Oaxaca decomposition.. This technique decomposes the gap in HAZ between urban and rural regions into one part that is due to the difference in the distribution of the determinants of HAZ (endowment or covariates effect) between the two regions, and another part that is due to the difference in the effect of these determinants (coefficient effect) between the two regions. For example, if y_i, our outcome variable, is affected by a single variable, *x*, and we have two groups, urban and rural, then HAZ for rural and urban children are given by Equations 4 and 5, respectively.

$$y_i^{rural} = \beta^{rural} x_i + \varepsilon_i^{rural} \tag{4}$$

$$y_i^{urban} = \beta^{urban} x_i + \varepsilon_i^{urban} \tag{5}$$

Therefore, the urban-rural gap in the mean HAZ $(y^{urban} - y^{rural})$, is given by Equation 6:

$$y^{urban} - y^{rural} = \beta^{urban} x^{urban} - \beta^{rural} x^{rural} \tag{6}$$

where x^{urban} and x^{rural} are the explanatory variables at their means for the urban and rural regions. The overall urban-rural gap could be decomposed into a gap that is attributable to the difference in the level of the covariates, x'_s, and a gap that is attributable to differences in coefficients, β'_s, as in Equations 7 and 8:

$$y^{urban} - y^{rural} = \Delta x \beta^{rural} - \Delta \beta x^{urban} \tag{7}$$

$$y^{urban} - y^{rural} = \Delta x \beta^{urban} - \Delta \beta x^{rural} \tag{8}$$

where $\Delta x = x^{urban} - x^{rural}$ and $\Delta\beta = \beta^{urban} - \beta^{rural}$.

The decomposition equation could be re-written as in Equation 9:

$$y^{urban} - y^{rural} = \Delta x \beta^{rural} + \Delta \beta x^{rural} + \Delta \beta \Delta x = E + C + CE \quad (9)$$

where the overall urban-rural gap in child malnutrition comprises the gap in endowment (E) and the gap between the coefficients (C) and the interactions (CE). Additionally, $y^{urban} - y^{rural} = \Delta x \beta^{rural} - \Delta \beta x^{urban}$ can be equal to (*E*+(*C*+*CE*)) and $y^{urban} - y^{rural} = \Delta x \beta^{urban} - \Delta \beta x^{rural}$ is equal to ((*E*+*CE*)+*C*). In short, this entails that the gap in mean outcomes can be thought of as derived from the gap in endowments (E), a gap in coefficients (C) and a gap arising from interactions in endowments and coefficients (CE).

3. Results

Descriptive statistics

For the dependent variable, we use the HAZ which is a continuous variable. Figure 3 compares mean HAZ for rural and urban areas for the two periods (before the policy change, 2010, and after the policy change, 2015) in Zambia. The results show marginal increases in the mean HAZ z-scores for both rural and urban areas. The results also show that the mean increase in the HAZ for urban areas was larger (0.3974) than that for rural areas (0.2485) over the same period.

Figure 3: Comparison of HAZ between 2010 and 2015

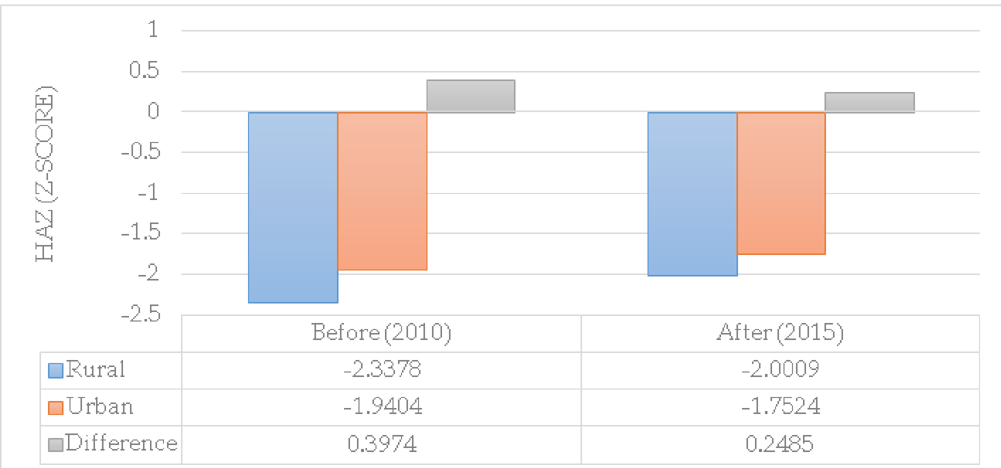


Table 1 shows the differences in mean values for some key indicators across children (0–59 months) belonging to rural and urban households in Zambia for the periods before and after the policy change. In general, children in rural areas tend to be disadvantaged with regards to access to the underlying determinants of child nutrition status compared to their urban counterparts, both before and after the policy changes. However, a comparison between the two periods shows that whereas the rural urban differences narrowed for some determinants between the two periods, this was not the case for some determinants, which showed an increase in rural-urban differences.

Table 1: Differences in mean values of underlying determinants of HAZ before and after policy change for rural and urban areas

Category	Variable	Before policy change (2010)			After policy change (2015)		
		Rural	Urban	Difference	Rural	Urban	Difference
Household food security	Percentage of expenditure on food (mean) Total calories per day per AE (mean)	64.2 2396	60.1 2098	4.1 298	68.7 4127	61.0 3442	7.7 685
	Dietary diversity score (mean)	6.6	8.7	-2.1	7.6	9.5	-1.9
Care for mothers and children	Mother’s highest grade (mean)	6.5	8.9	-2.4	5.6	8.3	-2.7
	Mother’s age in years (mean)	28.8	28.7	0.1	28.6	28.5	0.1
	Number of under-five children (mean)	1.8	1.6	0.2	1.6	1.5	0.1
	Whether child was sick or not (%)	25.2	20.6	4.6	28.9	18.0	10.9
	Age of child in months (mean)	27.0	28.1	-1.1	27.9	27.3	0.6
	Whether child is a boy (%)	49.0	58.9	-1.1	47.8	48.5	-0.7
	Whether child is fully vaccinated or not (%)	52.0	50.1	-6.9	52.0	56.6	-4.6
Healthy environment and health services	Improved source of drinking water (%)	51.5	85.9	-34.4	54.3	87.3	-33.1
	Improved sanitation (%)	8.5	41.3	-32.8	12.1	56.5	-44.4
	Distance to health facility (km)	9.6	5.0	4.6	7.8	2.6	5.2
	Crowding index (mean)	2.3	2.0	0.3	2.8	2.0	0.8

Decomposition analysis results

To quantify the contribution of selected predictors in explaining the rural-urban gap in the mean HAZ for the periods before and after the policy change (i.e., 2010 and 2015), we use the Blinder–Oaxaca decomposition analysis. First, we check for evidence of differences in the effects of the determinants using separate regression models for 2010 and 2015 on the determinants, interacting with the dummy variable separating the urban from the rural population. The joint test on the interaction effects was significant indicating that a Blinder–Oaxaca decomposition is applicable in this context. The estimated models for the period before and after the policy change (2010 and 2015) are used to decompose the HAZ gap into explained and unexplained components (Table 2).

The upper part of Table 2 (Differential) shows that children belonging to rural households had lower HAZ compared to children belonging to urban households, both before (2010) and after (2015) the policy change. For instance, the mean HAZ for urban children was larger (-1.9404) than that for rural children (-2.3378) before the policy change (2010). Similarly, the mean HAZ for urban children was larger (-1.7524) than that for rural children (-2.0001) after the policy change. It is also worth noting that the raw differences in the mean HAZ between rural and urban areas for the periods before the policy change (0.3974) and after the policy change (0.2485) are statistically significant (p-value < 0.001), implying that stunting outcomes are more prevalent among rural children compared to urban children. The results also show that the rural-urban difference (gap) in the mean HAZ reduced between the periods (i.e., from 0.3974 before the policy change in 2010, to 0.2485 after the policy change in 2015).

Table 2: Oaxaca decomposition analysis showing mean differences in HAZ between rural and urban children (2010 and 2015)

	2010		2015	
	z-score	Std. error	z-score	Std. error
Differential				
Mean prediction (urban)	-1.9404***	(0.0629)	-1.7524***	(0.0379)
Mean prediction (rural)	-2.3378***	(0.0543)	-2.0001***	(0.0366)
Raw difference (urban- rural)	0.3974***	(0.0830)	0.2485***	(0.0527)
Decomposition				
Explained (endowments)	0.3272***	(0.0630)	0.2787***	(0.0351)
Unexplained (effects/coefficients)	0.0702***	(0.0986)	-0.0302***	(0.0607)

Note: * denotes significance at 10%, ** significance at 5%, *** significance at 1%.

The lower section of Table 2 presents the decomposition results, which provide information on the relative contribution of individual covariates to the HAZ in rural and urban Zambia before and after the changes in nutritional policies. The rural-urban gap is decomposed into two parts. The first part of the gap is known as the endowment effect and represents the component of the gap that is due to the group differences in the magnitude of the determinants of the outcome between the rural and urban populations. The second part is known as the coefficient effect and represents that part of the gap that is due to group differences in the effects of these determinants between the rural and urban populations.

Both the explained and the unexplained components of the height-for-age gap are statistically significant for both the 2010 and 2015 height-for-age decomposition models. The decomposition results also show that almost all the differences in the HAZ between urban and rural children arise due to differences in the distribution of the determinants (endowments), while the contribution of the differences in the coefficients is minimal. For example, almost all the difference in the HAZ (0.3272) between the rural and urban children in 2010 can be attributed to differences in the distribution of the determinants, while the contribution of the differences in the coefficients is minor (0.0702). In percentage terms, the differences in the distribution of the determinants (endowments) accounts for over 82% of the rural-urban HAZ gap, while the coefficient effects accounted for only 18%. Similarly, the majority of the HAZ gap (0.2787) between rural and urban children in 2015 can be attributed to differences in the distribution of the determinants, while the contribution of the differences in the coefficients is negative and minor (-0.0302). In percentage terms, differences in the distribution of determinants account for over 112% of the rural-urban HAZ gap, while the coefficient effects worked to off-set the effects of endowments although they accounted for only –12%. The detailed decomposition results (Table 3) provide information on the relative contribution of individual covariates to the child nutrition outcomes gap before the policy change (2010). Negative figures imply a contribution to increasing the rural-urban disparity in HAZ, while positive figures show a contribution to reducing it. The explained and unexplained effects have been grouped according to the respective categories of household food security status, care for mothers and children, and a healthy environment and health services. The results for the period before the policy change (2010) show that the covariates under the healthy environment and health services category accounted for the majority (55.23%) of the endowment gap. Specifically, determinants such as access to improved water sources and access to improved sanitation facilities significantly contributed towards explaining the overall endowment gap, individually contributing 19.19% and 21.76% towards the total endowment gap, respectively. The results also show that covariates under the household food security category accounted for 33.16% of the total endowment gap, with the household dietary diversity score accounting for 31.72% of the total endowment gap. The covariates under care for mothers and children category accounted for 11.63% of the total explained gap. With regard to the effects of the determinants (coefficient effect), detailed decomposition results show that except for factors related to healthy environment and health services and child-related factors under the care for mothers and children category, which contributed towards increasing the rural-urban gap, the remaining factors had offsetting effects.

Table 3: Blinder– Oaxaca decomposition: Contribution to overall gap between rural and urban children's HAZ, 2010

Category	Variable	Endowment effect		Coefficient effect	
		z-score gap	% contribution	z-score gap	% contribution
Household food security	Percentage of expenditure on food	0.0060	1.83	-0.4779	-680.77
	Calories (per adult equivalent)	-0.0013	-0.40	0.0595**	84.76
	Household dietary diversity score	0.1038**	31.72	-0.0829	-118.09
	Category contribution to total gap	0.1085	33.16	-0.5013	-714.10
Care for mothers and children	Highest education for mother (years)	0.0275	8.40	-0.0181	-25.78
	Mother's age (years)	-0.0009	-0.28	-0.9438**	-1,344.44
	Number of under-five children	-0.0141*	-4.31	-0.3208*	-456.98
	Whether child was sick in past 2 weeks	0.0166	5.07	-0.0408	-58.12
	Child's age in months	0.0036	1.10	0.4274**	608.83
	Child is a boy	-0.0056	-1.71	0.2591	369.09
	Child is fully vaccinated	0.0110*	3.36	0.1080	153.85
	Category contribution to total gap	0.0381	11.63	-0.529	-753.56
Healthy environment and health services	Access to improved drinking water	0.0628**	19.19	0.1809	257.69
	Access to improved sanitation services	0.0712	21.76	0.0291	41.45
	Crowding index	0.0258	7.89	0.0477	67.95
	Distance to nearest health facility (km)	0.0209	6.39	-0.0281	-40.03
	Category contribution to total gap	0.1807	55.23	0.2296	327.06
	Constant	0	0.00	0.8709	1,240.60
	Total gap	0.3272	100.00	0.0702	100.00

Note: * denotes significance at 10%, ** denotes significance at 5%, *** denotes significance at 1%.

Table 4 presents the detailed decomposition results for the period after the policy change (2015). The covariates under the healthy environment and health services category accounted for the majority of the explained gap. Together, the covariates under this category accounted for 57.15% of the total rural-urban endowment gap in 2015. Specifically, access to improved water sources and access to improved sanitation facilities remained the most significant contributors towards explaining the overall endowment gap under the healthy environment and health services category of variables, with access to improved drinking water sources accounting for 39.45% of the total endowment gap, while access to improved sanitation facilities accounted for 13.46%. The results also show that the covariates under the household food security category accounted 12.10% of the total rural-urban endowment gap in 2015. Narrowing down to the specific variables, the household dietary diversity score remained the most significant contributor (contributing 8.83%) towards the total endowment gap under this category of variables. The variable for food expenditure as a percentage of total expenditure had a minor but positive contribution (3.70%) towards the total endowment. Finally, although almost negligible, the contribution of calories per adult equivalent to the total endowment gap is negative, implying that it contributed towards narrowing the gap as rural households were better endowed in terms of calorie availability compared to their urban counterparts.

The covariates under the care for mothers and children category contributed a total of 30.76% towards the total endowment gap in 2015. It is also worth noting that just as for 2010, the mother's education level continues to be the greatest contributor towards the endowment gap, accounting for 27.85% of the total endowment gap in 2015. The results also show that mother's age, number of children under five years of age as well as the child being a boy had negative, though marginal, contributions towards the total endowment gap, showing that they contributed towards narrowing the rural-urban gap for both periods as rural populations were better endowed with regard to those variables compared to their urban counterparts. Regarding the effects of the determinants (coefficient effect), the detailed decomposition results show mixed results. For example, the coefficient effects have a negative sign overall, implying that despite having lower levels of endowment compared to their urban counterparts, rural households performed better than their urban counterparts in terms of obtaining nutritional benefits from the available level of endowments. It is also worth noting that while the food security category variables and the healthy environment and health services variables had positive signs on their coefficients, which implies that they contributed towards increasing the total rural-urban coefficient effect gap, these are offset by the care for mothers and children category of variables, which have negative coefficients implying that they contribute towards narrowing the rural-urban coefficient effects gap.

Table 4: Blinder–Oaxaca decomposition: Contribution to overall gap between rural and urban children's HAZ, 2015

Category	Variable	Endowment effect		Coefficient effect	
		z-score gap	% contribution	z-score gap	% contribution
Household food security	Percentage of expenditure on food	0.0103*	3.70	-0.4138**	1,361.18
	Calories (per adult equivalent)	-0.0012	-0.43	0.0051	-16.78
	Household dietary diversity score	0.0246	8.83	-0.0737	242.43
	Category contribution to total gap	0.0337	12.10	-0.4824	1,586.84
Care for mothers and children	Highest education for mother (years)	0.0776**	27.85	-0.1837	604.28
	Mother's age (years)	-0.0012	-0.43	0.1675	-550.99
	Number of under-five children	0.0091	3.27	-0.0976	321.05
	Whether child was sick in past 2 weeks	0.0040	1.44	0.0235	-77.30
	Child's age in months	-0.0047*	-1.69	0.2817**	-926.64
	Child is a boy	-0.0023	-0.83	0.0709	-233.22
	Child is fully vaccinated	0.0032	1.15	-0.0138	45.39
	Category contribution to total gap	0.0857	30.76	0.2485	-817.43
Healthy environment and health services	Access to improved drinking water	0.1099**	39.45	0.0081	-26.64
	Access to improved sanitation services	0.0375	13.46	0.0348	-114.47
	Crowding index	0.0056	2.01	-0.0687	255.99
	Distance to nearest health facility (km)	0.0062	2.23	0.0086	-28.29
	Category contribution to total gap	0.1592	57.15	-0.0172	56.58
	Constant	0	0.00	0.2207	-725.99
	Total gap	0.2786	100.00	-0.0304	100.00

Note: * denotes significance at 10%, ** denotes significance at 5%, *** denotes significance at 1%.

4. Discussion

In this study, we systematically investigate the underlying factors that accounted for the rural-urban inequalities in child stunting in Zambia and how these differed across rural and urban areas before and after the changes in the food and nutrition policy strategy in 2011. We find marked rural-urban disparities in the levels of socioeconomic determinants of child nutritional status. In general, rural households tend to have lower access to improved water sources, sanitation and healthcare services. Rural mothers are also less educated and tend to be younger compared to their urban counterparts. We also find that although rural households tend to have more calories per adult equivalent compared to urban households, urban households tend to have more diversified diets compared to rural households. These rural-urban differentials in the levels of socioeconomic determinants of HAZ tend to persist even after the changes in nutritional policies. The Blinder–Oaxaca decomposition shows that the observed gap (difference) in child stunting between rural and urban areas for the periods before and after the changes in policies is mostly explained by the differences in the levels of endowments between rural and urban areas as opposed to differences in the effects of the coefficients between rural and urban areas. As such, bridging the rural-urban inequalities gap in child undernutrition is largely a matter of equalizing endowments of the determinants of child malnutrition between rural and urban areas and not necessarily improving the efficiency with which rural households can obtain nutritional benefits from the available endowments. These findings are similar to those reported in other studies (Sharaf et al., 2016; Srinivasan et al., 2013; and Garret and Ruel, 1999).

The results also highlight the potential role that access to improved water and sanitation services plays in improving nutritional outcomes among children. The Zambian Government has been implementing interventions aimed at providing safe water supply and sanitation in both rural and urban areas. However, despite these efforts, our findings show that rural-urban disparities have continued to exist. For example, only 51.5% of rural households had access to improved water sources compared to 85.9% in urban areas, resulting in a 34.4% rural-urban gap in 2010. Similarly, whereas 41.3% of households had access to improved sanitation services in urban areas, only 8.5% of rural households had access to improved sanitation services in 2010, resulting in a 32.5% rural-urban gap. The situation did not improve much in 2015, despite the fact that the NFNSP had the provision of sustainable water supply and sanitation services in both rural and urban areas as one of its strategic objectives. An estimated 54.3% of rural households had access to improved sources of drinking water compared to 87.3% of urban households in 2015, resulting in a 33.1% rural-urban gap. With regard to improved sanitation, the proportions of households having access to improved sanitation services increased for both rural and urban areas. However, the increase in urban areas is disproportionately larger than that for rural households resulting in a widening of the rural-urban gap.

The results also highlight the prominent role that maternal education has had in child nutrition both before and after the policy changes. Although the contribution of the covariates under the care for mothers and children category towards the total endowment gap increased from 11.63% before the policy change to 30.76% after the policy change, maternal education accounted for the largest proportion in both periods. This implies that plugging the maternal education gap between rural and urban areas is particularly important if the rural-urban disparity in HAZ is to be addressed. Indeed, the NFNSP acknowledges the significant contributions that sectors such as education, agriculture and community development can make in addressing the problem of undernutrition in Zambia. Similarly, the Zambian Government acknowledges the fact that keeping girls in school for long (i.e., preventing them from dropping out of school early) has multiple nutritional benefits as educated women are more likely to access health care services, including family planning, and work in formal employment than their less educated counterparts (MoH, 2017). Also, being older and educated confer greater capabilities to produce optimal care for young children. However, despite the above, our findings show widening disparities in the mean years of formal schooling between urban and rural mothers.

Finally, comparisons between the period before and after the policy changes show that the rural-urban gap narrowed slightly between the two periods, with the reduction being mostly attributed to the coefficient effects. In other words, although there is an increase in the endowment gap between rural and urban areas, the coefficient effects worked towards narrowing this gap by offsetting the impact of the endowment gap, with the overall effect being that the overall rural-urban gap reduced after the policy change. In other words, the decomposition results suggest that the observed reduction in the mean HAZ between rural and urban children is mostly a result of improvements in the manner in which rural households are able to obtain nutritional benefits from the available levels of endowments as opposed to changes in the levels of endowments.

5. Conclusion

We examined rural-urban differences in child nutrition outcomes using HAZ for 2010, which is the period before the NFNSP was implemented, and 2015, which is the period after the implementation of the NFNSP. The similarity in the pattern of rural-urban differentials between these two periods suggests that these differentials persist despite changes in the national food and nutrition policy strategy. The methodology employed in this paper allows us to decompose rural-urban differences in child nutrition outcomes into covariate and co-efficient effects, and further enables us to quantify the contribution of individual explanatory variables (socioeconomic characteristics) to rural-urban differences via these effects. The decomposition of rural-urban differences into covariate and co-efficient effects shows that the covariate effect is dominant. Furthermore, the decomposition results show that a core set of determinants, namely access to improved drinking water sources, access to improved sanitation services, maternal education and household dietary diversity, accounts for a very large proportion of the covariate effects for both the periods. Our analysis suggests that public health interventions aimed at overcoming rural-urban disparities in child nutrition outcomes need to focus principally on bridging gaps in socioeconomic endowments in the areas of water and sanitation, maternal education and household dietary diversity.

6. Policy implications

These findings have significant implications for policy and programming aimed at addressing the issue of child stunting. The fact that there are differences in the influence that underlying determinants may have on child stunting, depending on the initial level of endowments between rural and urban areas, implies that there is a need to change in the approaches used to designing programmes for rural and urban areas to take into consideration the prevailing differences. As opposed to the prevailing practice where uniform programmes are implemented across rural and urban areas to address stunting, there is a need to design site-specific interventions in order to achieve the best results. The results also show that different determinants of child nutritional status responded differently to changes in strategic policy direction. For example, some determinants that significantly influenced child stunting before the policy change, such as the household dietary diversity score, became insignificant after the policy changes, highlighting the importance for policy makers to have a clear understanding which factors are sensitive to policy changes. The results also suggest that for both periods, i.e., before and after the changes in policies, differences in access to improved water sources, improved sanitation services, levels of education attained by the mothers and differences in household dietary diversity scores are important in explaining the rural-urban differences in child HAZ. These deserve more attention from policy makers if they have to design policies that are highly effective in addressing child stunting in Zambia, as all the remaining variables make a relatively small contribution towards explaining the observed rural-urban disparities.

References

Alderman, H., and D.D. Headey. 2014. *The Nutritional Returns to Parental Education*. IFPRI Discussion Paper No. 01379. International Food Policy Research Institute (IFPRI) Washington, D.C.

Amare, M., T. Benson, O. Fadare and M. Oyeyemi. 2018. “Study of the determinants of chronic malnutrition in Northern Nigeria: Quantitative evidence from the Nigeria demographic and health surveys international food policy research institute (IFPRI) Working Paper No. 45 (September 2017)”. *Food and Nutrition Bulletin*, 39(2): 296–314.

Aoun, N., H. Matsuda, and M. Sekiyama. 2015. “Geographical accessibility to healthcare and malnutrition in Rwanda”. *Social science & medicine*, 130, 135-145.

Baker, D., H. Taylor, and J. Henderson 1998. “Inequality in infant morbidity: causes and consequences in England in the 1990s. ALSPAC Study Team. Avon Longitudinal Study of Pregnancy and Childhood". *Journal of Epidemiology & Community Health*, 52(7), 451-458.

Black, R.E., C.G. Victora, S.P. Walker, Z.A. Bhutta, P. Christian, M. de Onis, ... and R. Uauy. 2013. “Maternal and child undernutrition and overweight in low-income and middle-income countries”. *The Lancet*, 382(9890): 427–51.

Becker, G.S. 1965. “A theory of the allocation of time”. *The Economic Journal*: 493–517.

Behrman, J.R. and B.L. Wolfe 1984. “More evidence on nutrition demand: Income seems overrated and women's schooling underemphasized”. *Journal of development economics,* 14(1), pp.105-128.

Blinder, A.S. 1973. “Wage discrimination: Reduced form and structural estimates”. *Journal of Human Resources:* 436–55.

Conde-Agudelo, A., J.M. Belizán and C. Lammers. 2005. “Maternal-perinatal morbidity and mortality associated with adolescent pregnancy in Latin America: Cross-sectional study”. *American Journal of Obstetrics and Gynecology*, 192(2): 342–49.

Central Statistical Office [CSO] (Zambia), Ministry of Health, Macro International. 1997. *Zambia Demographic and Health Survey 1996.*

Central Statistical Office [CSO] [Zambia], Central Board of Health [Zambia], and ORC Macro. 2003. *Zambia demographic and health survey 2001–2002*. Calverton, Maryland, USA: central Statistical Office, Central Board of Health, and ORC Macro, 155-161.

Central Statistical Office (CSO), Ministry of Health (MOH), Tropical Diseases Research Centre (TDRC), University of Zambia, and Macro International Inc. 2009. *Zambia Demographic and Health Survey 2007.* Calverton, Maryland, USA: CSO and Macro International Inc.

Central Statistical Office [CSO]. 2016. 2015 *Living Conditions Monitoring Survey Report*.

Central Statistical Office [CSO]. 2012. 2015 *Living Conditions Monitoring Survey Report for 2006 and 2010.*

Central Statistical Office (CSO) [Zambia], Ministry of Health (MOH) [Zambia], and ICF International. 2014. *Zambia Demographic and Health Survey 2013-14*. Rockville, Maryland, USA: Central Statistical Office, Ministry of Health, and ICF International.

Desai, S. and S. Alva 1998. “Maternal education and child health: is there a strong causal relationship?” *Demography*, 35(1), pp.71-81.

Du Plessis, H.M., R. Bell and T. Richards. 1997. “Adolescent pregnancy: Understanding the impact of age and race on outcomes”. *Journal of Adolescent Health*, 20(3): 187–97.

Freedman, J.L. 1975. Crowding and Behavior. W.H. Freeman.

Gribble, J.N., N.J. Murray and E.P. Menotti. 2009. “Reconsidering childhood undernutrition: Can birth spacing make a difference? An analysis of the 2002–2003 El Salvador National Family Health Survey”. *Maternal & Child Nutrition*, 5(1), 49–63.

Headey, D.D. 2013. “Developmental drivers of nutritional change: A cross-country analysis”. *World Developmen*t, 42: 76–88.

Headey, D., J. Hoddinott and S. Park. 2017. “Accounting for nutritional changes in six success stories: A regression-decomposition approach”. *Global Food Security*, 13, 12–20.

Kennedy, G., T. Ballard and M.C. Dop. 2011. *Guidelines for Measuring Household and Individual Dietary Diversity.* Rome, Italy: Food and Agriculture Organization of the United Nations.

Ministry of Health [MoH] (2012). *National Health Policy: A nation of healthy and productive people.* Republic of Zambia.

Ministry of Health [MoH], USAID, Food and Nutrition Technical Assistance [FANTA III], and FHI 360 (2017). *Zambia Nutrition Advocacy Plan 2017–2019*. Republic of Zambia.

Ngure, F.M., B.M. Reid, J.H. Humphrey, M.N. Mbuya, G. Pelto and R.J. Stoltzfus. 2014. “Water, sanitation, and hygiene (WASH), environmental enteropathy, nutrition, and early child development: Making the links”. *Annals of the New York Academy of Sciences*, 1308(1): 118–28.

Oaxaca, R. 1973. “Male-female wage differentials in urban labour markets”. *International Economic Review*, 14: 693–709.

Pitt, M.M. and M.R. Rosenzweig. 1990. “Estimating the intrahousehold incidence of illness: Child health and gender-inequality in the allocation of time”. *International Economic Review:* 969–89.

Sharaf, M.F. and A.S. Rashad. 2016. “Regional inequalities in child malnutrition in Egypt, Jordan, and Yemen: A Blinder-Oaxaca decomposition analysis”. *Health Economics Review*, 6(1): 23.

Smith, L.C. and A. Subandoro. 2007. *Measuring Food Security Using Household Expenditure Surveys,* vol. 3. Washington, D.C.: International Food Policy Research Institute.

Strauss, J. and D. Thomas. 1995. “Human resources: Empirical modeling of household and family decisions”. In: *Handbook of Development Economics*, 3, 1883–2023.

Srinivasan, C.S., G. Zanello and B. Shankar. 2013. “Rural-urban disparities in child nutrition in Bangladesh and Nepal”. *BMC Public Health*, 13(1): 581.

Thomas, D., V. Lavy and J. Strauss. 1996. “Public policy and anthropometric outcomes in the Côte d'Ivoire”. *Journal of Public Economics*, 61(2): 155–92.

UNICEF (United Nations Children’s Fund). 2008. *UNICEF Handbook on Water Quality.* New York, USA: United Nations Children’s Fund.

UNICEF (United Nations Children's Fund). 1990. *Strategy for Improved Nutrition of Children and Women in Developing Countries.* A UNICEF Policy Review. New York, USA: United Nations Children's Fund.

University of Zambia [UNZA], Central Statistical Office, Ministry of Health, Macro International, Institute for Resource Development, Demographic, & Health Surveys. 1993. *Zambia Demographic and Health Survey, 1992: Summary Report.* University of Zambia.

Webb, P., and S. Block 2004. "Nutrition information and formal schooling as inputs to child nutrition". *Economic Development and cultural change*, 52(4), 801-820.

Zambia Statistics Agency [ZSA], Ministry of Health [MOH] Zambia, and ICF 2019. "*Zambia Demographic and Health Survey 2018*". Lusaka, Zambia, and Rockville, Maryland, USA: Zambia Statistics Agency, Ministry of Health, and ICF.

Mission

To strengthen local capacity for conducting independent, rigorous inquiry into the problems facing the management of economies in sub-Saharan Africa.

The mission rests on two basic premises: that development is more likely to occur where there is sustained sound management of the economy, and that such management is more likely to happen where there is an active, well-informed group of locally based professional economists to conduct policy-relevant research.

www.aercafrica.org

Learn More

www.facebook.com/aercafrica

twitter.com/aercafrica

www.instagram.com/aercafrica_official/

www.linkedin.com/school/aercafrica/

Contact Us
African Economic Research Consortium
Consortium pour la Recherche Economique en Afrique
Middle East Bank Towers,
3rd Floor, Jakaya Kikwete Road
Nairobi 00200, Kenya
Tel: +254 (0) 20 273 4150
communications@aercafrica.org