Understanding Inequality of Opportunity in Child Health in Sudan

Ebaidalla M. Ebaidalla

University of Khartoum

Visiting Scholar, UNU-WIDER, 2019

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Introduction

- Health and nutrition during a child's first years are crucial to his/her health and wellbeing later in life.

- Poor health and inadequate nutrition in the first three years of life hamper a child's cognitive and physical development,

- leading to adverse health, productivity and wellbeing outcomes that persist into adulthood.

- Any developmental shortages that happen in early childhood may be persistent and permanent (UNESCO 2006).

Motivations

- Sudan is the third largest country in Africa with huge agricultural resources.

- A large segment of population suffers from hunger and nutrition insecurity.

- Child malnutrition is a widespread phenomenon.

- Moreover, inequality in access to public services such as healthcare, education, and clean water is a prevailing phenomenon across Sudanese states.

- In addition, children aged between 0 and 4 years accounts for about 15% out of Sudanese population (World Bank, 2018)
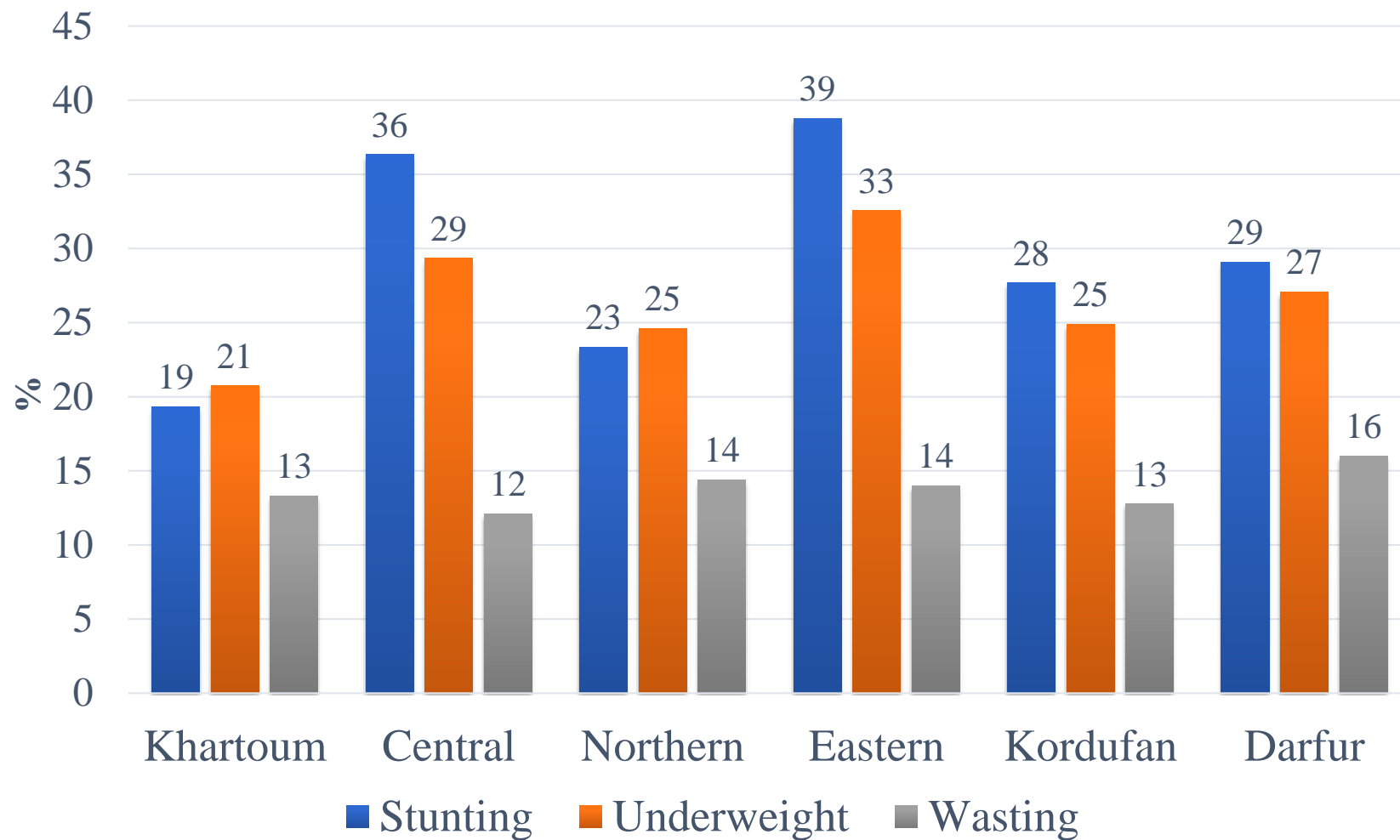
Nutritional situation in Sudan

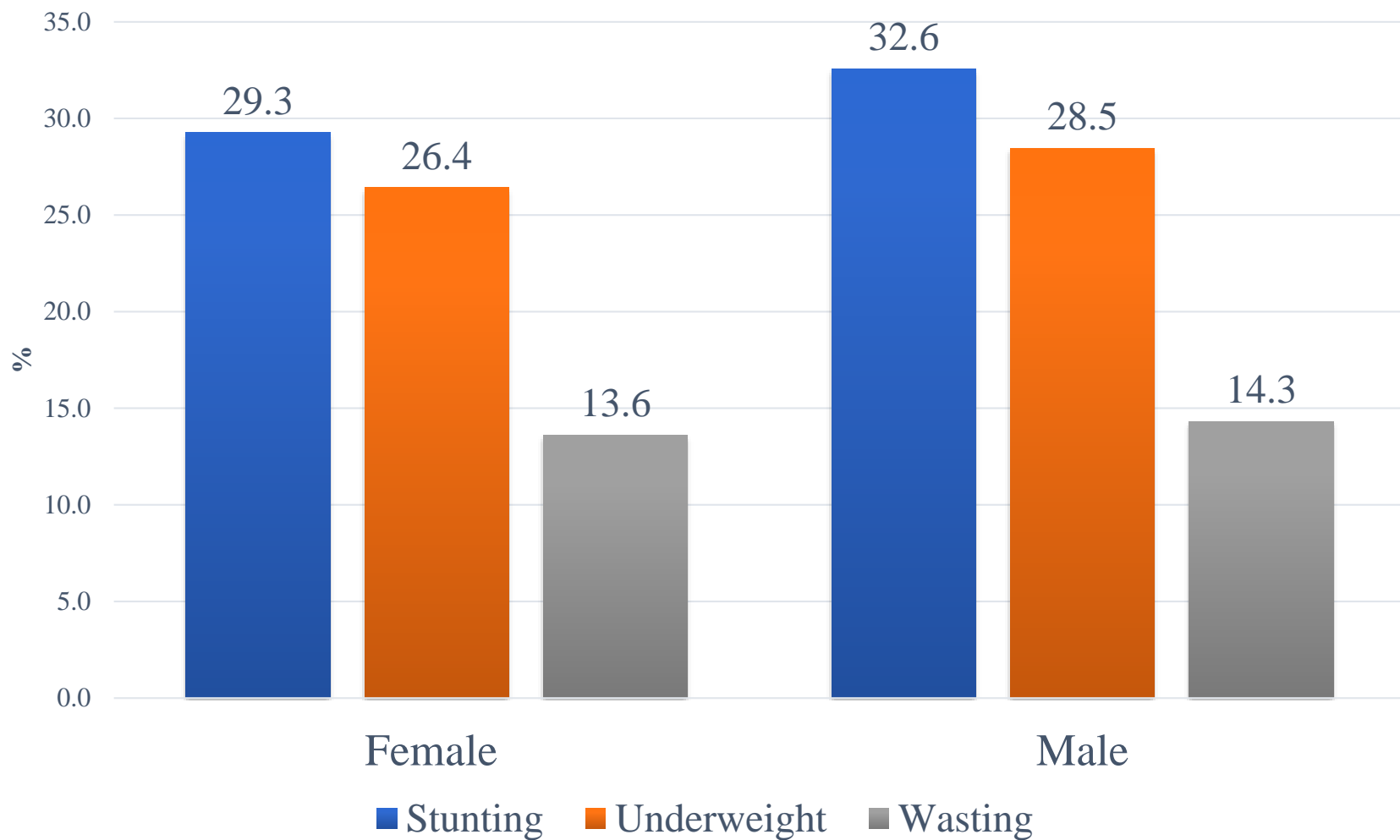## Nutritional Status of Children under age five
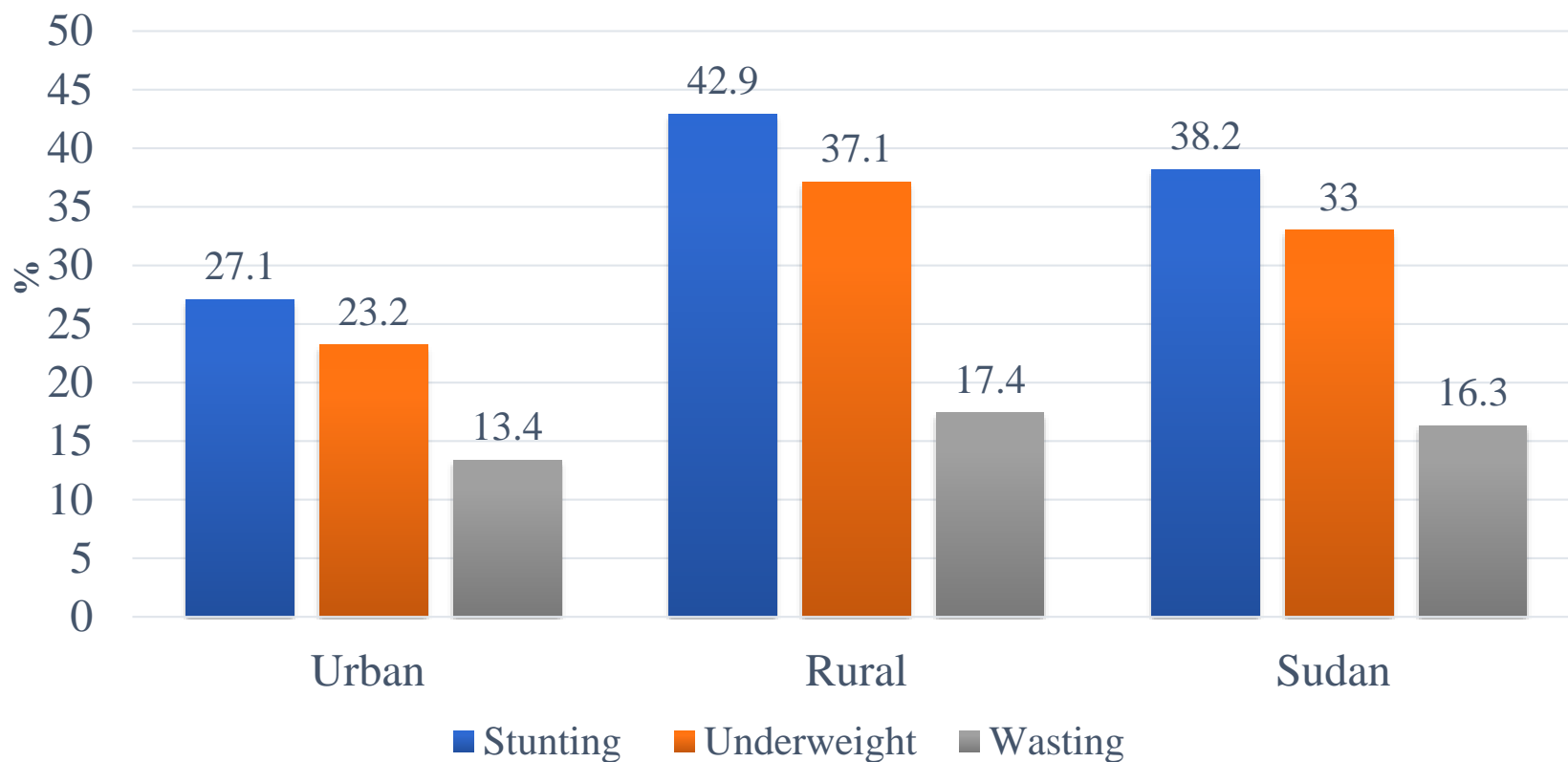
Source: Sudan MICS, 2014

Nutritional Status of Children under Age Five by Regions in Sudan

Nutritional Status of Children under Age Five by Gender in Sudan

Objectives

i. Measuring total inequality in child health outcome

ii. Measuring the share of inequality of opportunity in overall inequality.

iii. Identifying the contributions of different sets of circumstances, such as geographic location and parental education and wealth, to the measured inequality of opportunity.

iv. Stimulate the standardized height and weight for children with the "best" (most advantaged) and "worst" (least advantaged) combination of observed circumstances.

Conceptual Framework

❖We follow the Roemer' (2002) framework: difference between inequality of outcomes and inequality of opportunity.

❖Inequality of outcomes is primarily due to:

➢Individuals' effort - morally justifiable

➢Circumstances like family background and parental education- morally unjustifiable.

❖Inequality due parental background, ethnicity, religion and region over which the child has no control over; it is inequality of opportunity

❖All observed health inequality would be inequality of opportunity

Conceptual Framework ⟩

- Child health production function:

- Grossman (1972) and Strauss and Thomas (1998)

$$H = H(IN, FB, PS, \varepsilon_h)$$

- Child health inequality due to differences in above factors is inequality of opportunity, which is morally unacceptable.

- Child is not accountable for differences in geographic location, parental background including ethnicity, religion, and education, access to public services such as clean water, sanitation and infrastructure.

Methodology

❖ Compute the standardized anthropometric indicators of child health outcome namely, height-for-age and weight-for-height variables.

❖ Measure inequality for these indicators

❖ and then decompose these measures into a portion that is due to observable circumstances (i.e. to inequality of opportunity) and a residual

❖ Identify the partial effect of each set of circumstances to inequality of opportunity

❖ Stimulate the standardized height and weight for children with the "best" (most advantaged) and "worst" (least advantaged) combination of observed circumstances.

i. Computing Standardized Child' health Outcome

- Child' height and weight grow with age and vary according to gender of the child.

- Using World Health Organization's (WHO) reference distribution for "healthy" children to compute the **z-scores** of the child's health and weight

- The z-score measures the child's deviation from the median of the reference distribution, measured in SD.

- z-score transformation changes the scale of measurement, and hence alters inequality measures in arbitrary ways

i. Computing Standardized Child' health Outcome

- We follow the lead of literature on child' health inequality (e.g. Pradhan, et al, 2003) to generate "standardized" height and weight variables.

- This is done by transforming the z-score of the height or weight of the child using the reference WHO distribution into the equivalent height or weight for a twenty four month old female with the same z-score.

- This procedure allows comparing weight-for-height across age and sex groups

i. Measuring Inequality

- The study uses general entropy (GE) measures-decomposable indices.

- The GE class of measures relies on a parameter a , include GE(0), GE(1) and GE(2); each one determines the degree of sensitivity of the index to differences in the welfare measure at different points in the distribution.

- We measure all GE class namely, GE(0), GE(1) and GE(2) for the comparison purpose.

ii. Decomposing Inequality

- The next step is to decompose the total inequality into within and between group inequality.

- Groups are made up of individuals with unique combination of circumstances, which we call types. The share of between-type inequality to total inequality, is our measure of inequality of opportunity.

$$GE(\alpha) = \sum_{k=1}^{K} \emptyset(k) \left(\frac{\mu_k}{\mu}\right)^{\emptyset} GE(K; \alpha) + \bar{G}\bar{E}(\alpha)$$

The path of decomposition

• The share of inequality of opportunity in total inequality

• Can either be measured directly or as a residual depending on the path of the decomposition, which in turn depends on whether a smoothed distribution or a standardized distribution is used.

• The smoothed distribution emphasizes the between-group differences

$$\theta_d = I\big(\{\mu_i^k\}\big)\big/I\big(\{y_i^k\}\big)$$

• The standardized distribution emphasizes within-group differences

$$\theta_r = 1 - I\big(\{v_i^k\}\big)\big/I\big(\{y_i^k\}\big)$$

iii. Parametric and non-parametric methods

- To decompose the inequality measure the study adopts both parametric and non-parametric methods.

- Hence, we apply three methods, a parametric method that uses regression to link circumstances to the outcome of interest

➢and two non-parametric methods that measure the variation of the outcome across the k circumstance groups. The non-parametric methodologies are referred to as decomposition by type and by tranche

1. Parametric method

- Parametric equation describing how the welfare outcome y depends on the vector of circumstances C.

$$y_i = C_i \gamma + \varepsilon_i$$

- The smoothed distribution:

$$\tilde{\tilde{Z}}_i = C_i \hat{\gamma}$$

- The standardized distribution:

$$\tilde{\hat{y}}_i = \bar{C}_i \hat{\gamma} + \hat{\varepsilon}_i$$

- One of the advantages of parametric method is to Obtain the partial effect of a particular circumstance

- The share of inequality attributable to circumstance M

$$\theta_r^M = 1 - I\left(\{\tilde{\hat{y}}_i^M\}\right)/I(\{y_i\})$$

2. Non-parametric methods

- Based on two alternative partitions of the total population:

- The first partition splits the population into groups by circumstance categories (*types*), contain individuals with similar circumstances. Both directly and residual

- The second partition divides the population into subsets (*tranches*) of individuals who exert the same percentile of the distribution for each type.

- This is close to Roemer's (1998) theoretical definition of equality of opportunity: individuals in the same location of the "effort" distribution in each type should be rewarded similarly.

Data

- The data for this study is sourced from the 2014 Sudan Multiple Indicator Cluster Survey (MICS)

- Is a nationally representative, cross-sectional, household survey. The survey is carried by the Central Bureau of Statistics (CBS) Sudan, as part of a broader international household survey designed and implemented by the United Nations Children's Fund (UNICEF).

- The MICS survey includes anthropometric information (i.e. height and weight) for children under age 5 and contains all detailed information on health, social and economic circumstances of women, children and other household member characteristics that are needed in our study.

- The analysis in this research focuses on the sample of 12,923 children aged less than five years.
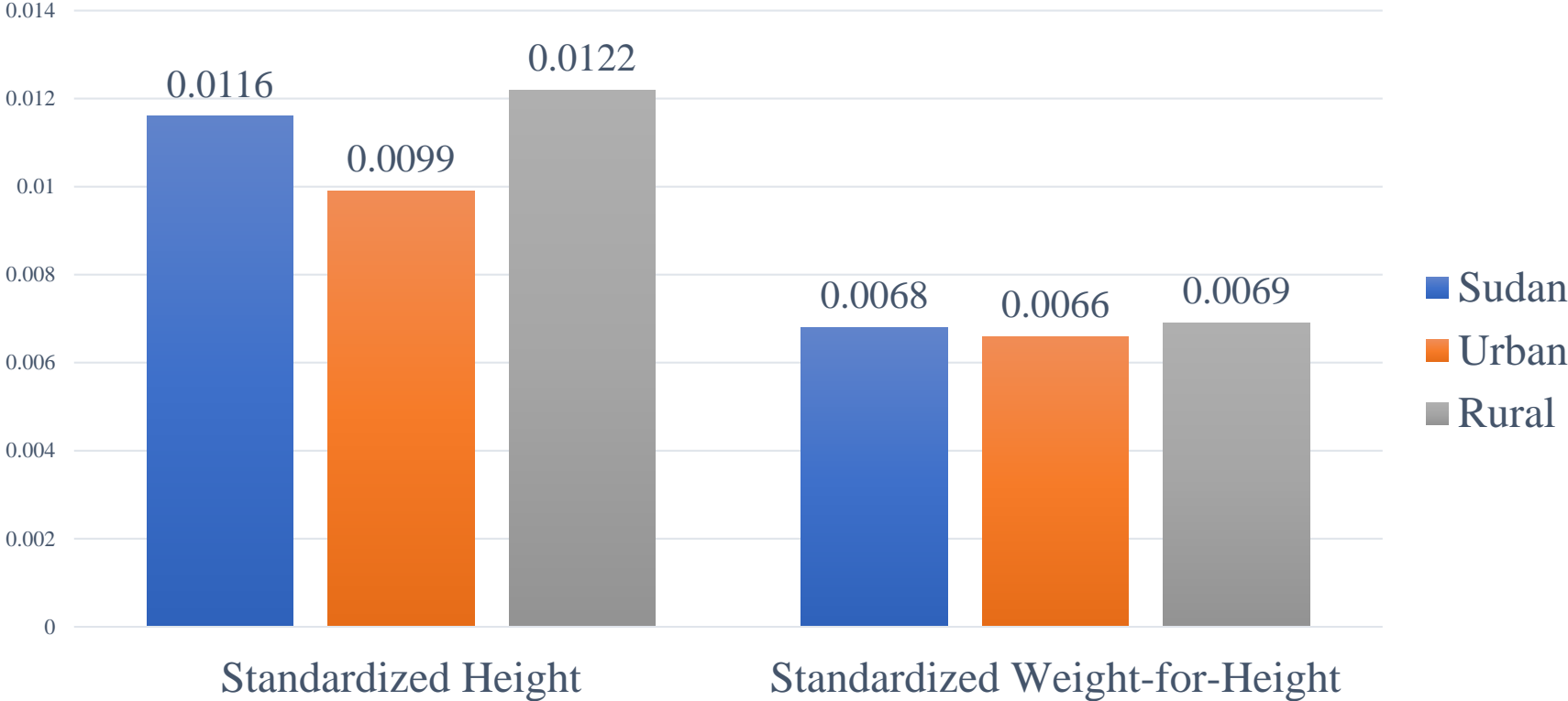
Circumstance variables

The circumstances variables employed in our analysis are categorized into five groups:

• Parental education

• Parental wealth

• Geographic regions

• Public services and
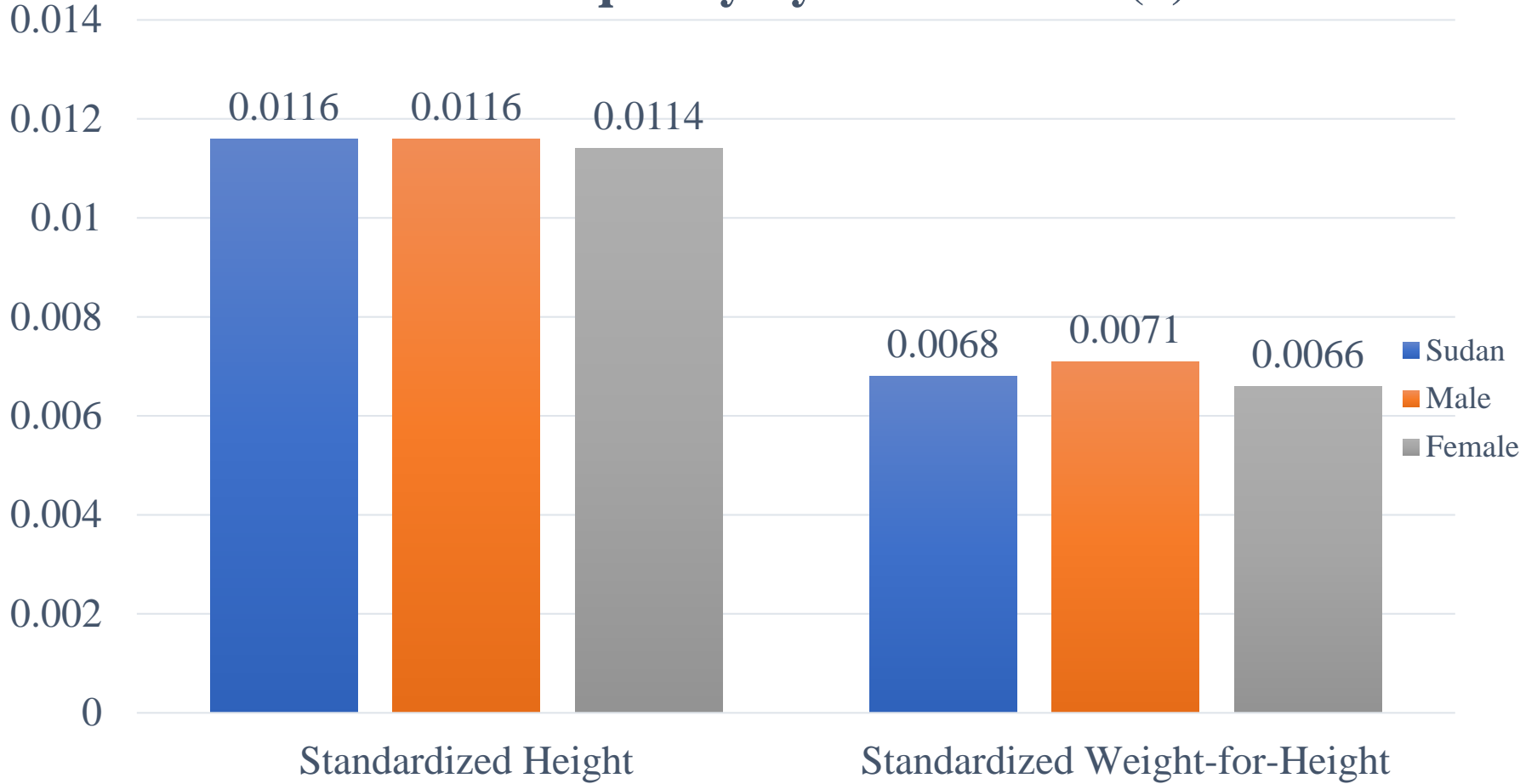
• Demographic characteristics.

Preliminary Results

A. Total Inequality in Child Health Outcomes
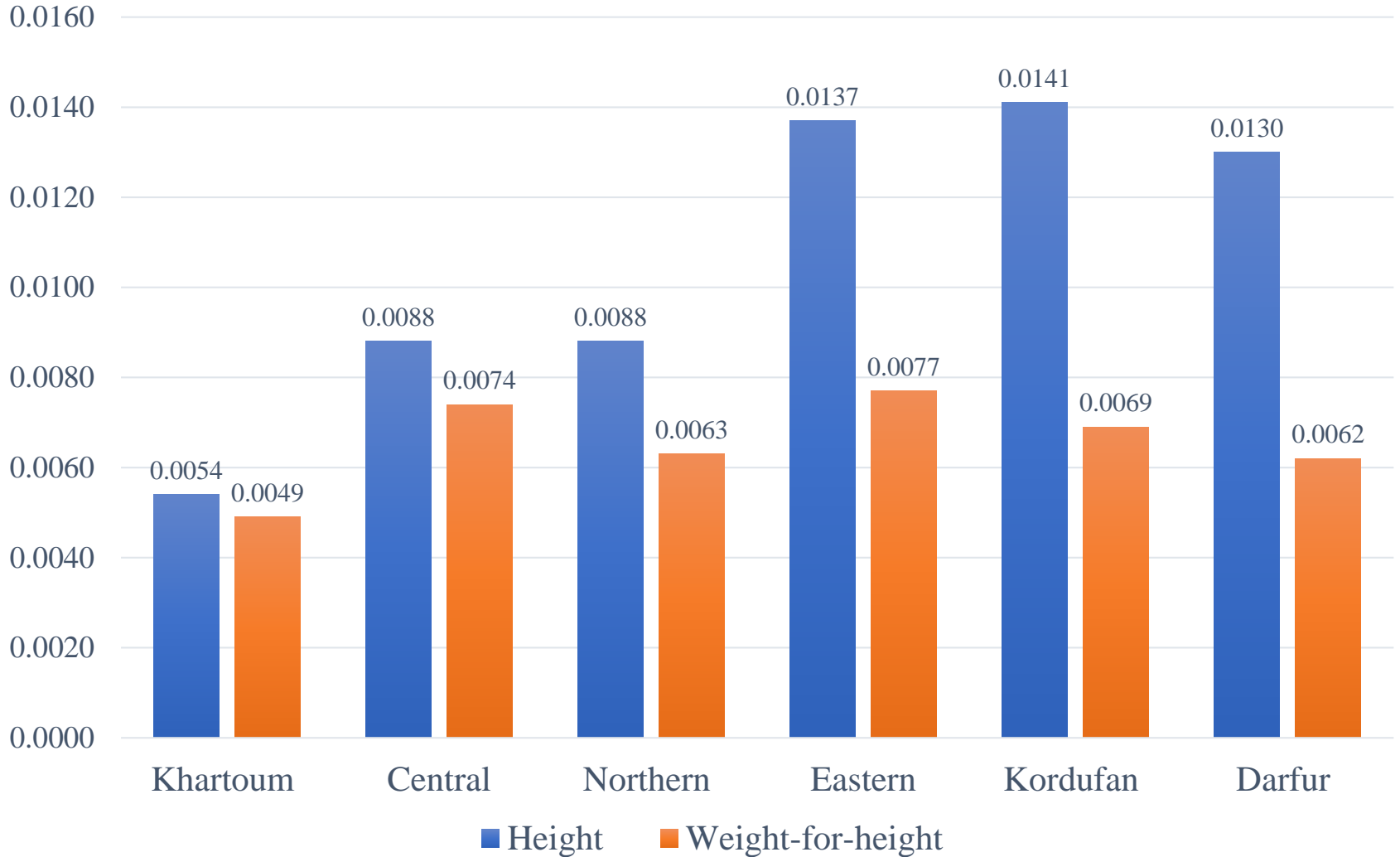

Total Inequality by Place of Residence GE (1)

A. Total Inequality: Height and Weight-for-age by Gender

Total Inequality by Gender –GE(1)
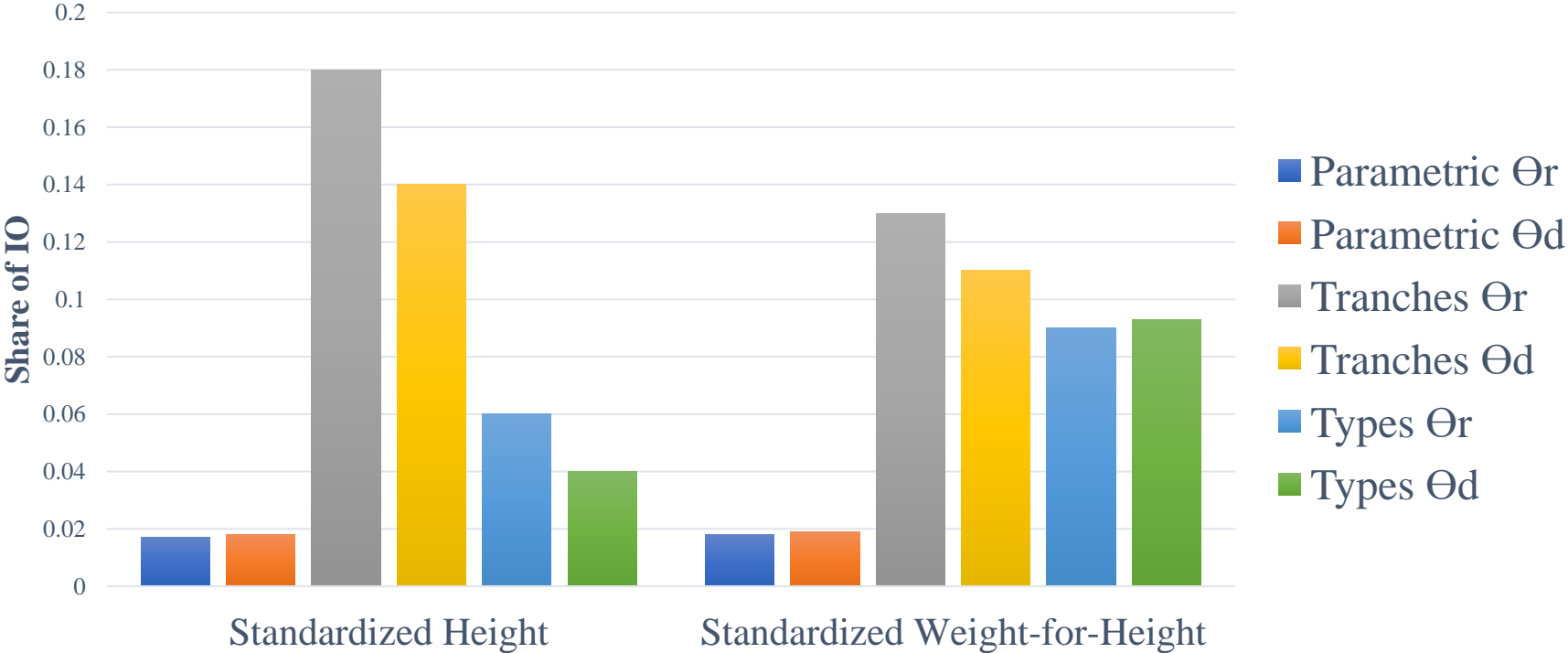
Inequality of opportunity by region –GE(1)

|	Height	Weight-for-height
Khartoum	0.0054	0.0049
Central	0.0088	0.0074
Northern	0.0088	0.0063
Eastern	0.0137	0.0077
Kordufan	0.0141	0.0069
Darfur	0.0130	0.0062

B. Contribution of Inequality of Opportunity: Parametric and non-Parametric Specifications

Share of Inequality of Opportunity to Total Inequality

Legend:
- Parametric Ɵr
- Parametric Ɵd
- Tranches Ɵr
- Tranches Ɵd
- Types Ɵr
- Types Ɵd

C. Contribution of Circumstance Groups to Inequality of Opportunity

Share of Circumstances in Inequality of Opportunity
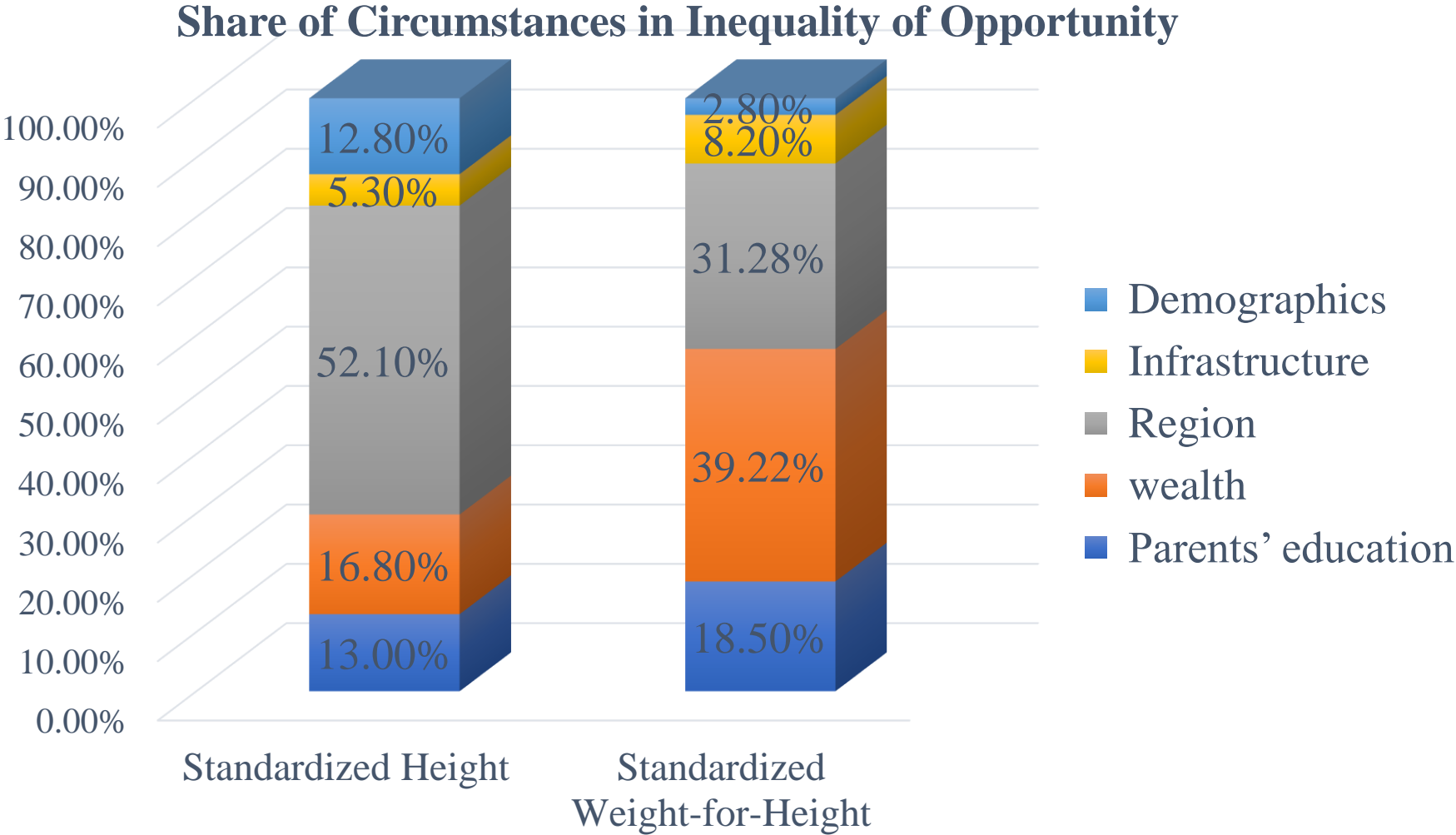
D. Most and least Advantaged child simulations

Simulations of standardized HAZ and WHZ
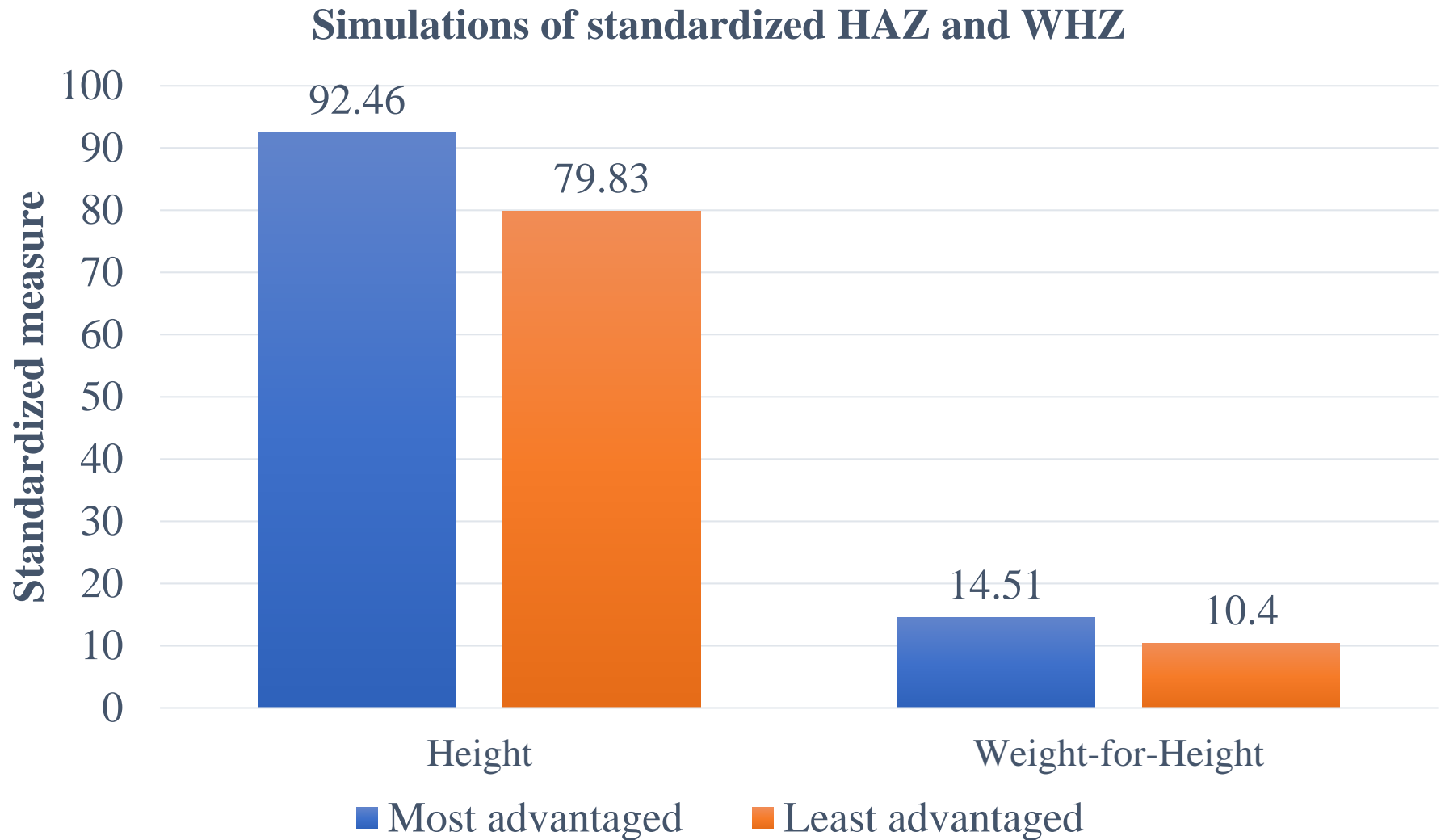
Conclusion

- Inequality in child health in Sudan is higher in comparison to neighboring countries.

- The estimated share of inequality of opportunity in total inequality is substantial and varying according to the method of inequality measure.

- Circumstances are found to contribute significantly to inequality of opportunity in child health.

- Parental wealth, parental education and geographic regions represent the largest source of inequality of opportunity in both height-for-age and weight-for-height indicators.

- Policy actions that reducing wealth inequality, enhancing infrastructure, and access to healthcare services, education and clean water to rural population would play significant role in reducing inequality of opportunity in child health in Sudan.

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