**Decomposing the gap in under-five mortality determinants between the low- and high-risk regions of Nigeria**


## Extended Abstract

### Background

Child mortality has reduced globally, with almost 60% decline, albeit the reduction has been uneven across the world. Sub-Saharan Africa (SSA) and southern Asia account for more than 80% of the global under-five deaths. Specifically, Nigeria has the highest burden of under-five mortality in the world and contributes 17% of the global under-five deaths. Nigeria's under-five mortality has huge sub-national variations**.** with the rate higher in some states and regions than in others (National Bureau of Statistics (NBS) & United Nations Children's Fund (UNICEF), 2022). The high national average in under-five mortality in Nigeria is largely driven by the high rate of child deaths in some regions and states in the country.

Nigeria will achieve significant reductions in childhood mortality and perhaps achieve the target 3.2 of the Sustainable Development Goals (reducing under-five mortality to at least 25 per 1,000 live births by 2030) if targeted interventions are implemented in high-risk regions of the country. This raises the need to generate evidence on the factors sustaining high risks in high under-five mortality regions of Nigeria. Besides, understanding disparities in under-five mortality and its determinants across states and regions is critical for framing appropriate interventions. Hence, this study examined the factors sustaining high under-five mortality in Nigeria by quantifying the contributions of socioeconomic, bio-demographic, and health-related factors in explaining the gap in childhood mortality between the country's high-risk and low-risk regions.

### Data and Methods

#### Data source

The study used cross-sectional secondary data from a survey conducted by Nigeria Demographic and Health in 2018 (2018 NDHS) among a randomly selected sample of women aged 15-49. We used the dataset's child code, and the unit of analysis was the child born five years before the survey. The analytic sample for this study was 32,234. Data on birth history are re-coded as separate datasets for children aged 0-59 months, including information on their child's sex, date of birth, current age, age at death for dead children and relevant background characteristics.

#### Variable measurements

*Outcome variable*

The dependent variable considered in this study was under-five death defined as the risk of a live-born child dying before their fifth birthday. This was measured as the duration of survival since birth in months. The analysis was child-based.

*Explanatory variables*

Relevant explanatory variables were selected for the study with the guidance of the literature. We identified key drivers of under-five mortality as available in the NDHS data. The selected variables for the study and variable definitions are presented in Table 1 (available in the full paper).

**Statistical analysis**

The study presents the descriptive and inferential statistics. We explored significant relationships using bivariate and multivariable analytical approaches. In an attempt to assess low and high intra- and inter-regional clustering of under-five mortality, the study employed the Local Moran's I spatial analysis. Local Moran's I spatial analysis showed the spatial autocorrelation of the under-five mortality rates (U5MR) at 0.05 significant level, highlighting clusters and outliers. We also undertook a Blinder-Oaxaca decomposition analysis of the gap in under-five mortality determinants between the low- and high-risk regions. U5MR across the six regions of Nigeria are 187 deaths (per 1000 live births) (northwest), 134 (northeast), 95 (north-central), 75 (southeast), 73 (south-south), and 62 (southwest). In this study, any Nigerian region with U5MR below 100 deaths per 1000 live births was considered a low-risk region while those above 100 deaths per 1000 live births were treated as a high-risk region. A detailed description of the analysis is available in the full report.

**Results**

**Descriptive**

The background characteristics of the respondents are presented in Table 2 (available in the full paper). The table highlights the differences in selected characteristics between high-mortality and low-mortality regions. When compared with high-mortality regions, factors such as education, wealth status, access to safe drinking water, family planning uptake, and media exposure considerably contribute to reductions in under-five mortality rates in low-mortality regions. Detailed respondents' characteristics are available in the full paper.

**Spatial analysis**

The rate of under-five mortality (per 1000 live births) is higher in high-risk regions (172/1000) compared to low-risk regions (82/1000). The study also explored the rates of under-five mortality by selected characteristics (available in the full report). Results from spatial analysis presented in Figure 1 show that the North West and parts of the North East regions were clear hotspots for under-five mortality in Nigeria, with most states in these areas showing significantly higher rates. The South West, along with specific states in the South East (Abia, Enugu) and South South (Rivers, Delta), were coldspots, indicating lower under-five mortality rates. Notable outliers included Kogi (High-Low) in the North Central and Niger (Low-High) in the same region, highlighting areas with rates that deviate from regional trends.

**Decomposition analysis**

Results on the decomposition of the differentials in under-five mortality likelihoods between the low-risk regions (LRR) and high-risk regions (HRR) in Nigeria are presented in the study. The analysis decomposed the gap into explained and unexplained components with the former reflecting the disparity attributable to differences in the levels of the observed characteristics (the endowment effects - E), while the latter indicates the gap due to differences in the effect of the coefficients of the determinants (the coefficient effects - C). In the summary results presented in Table 3 (available in the full paper), the differential subsection shows the average prevalence of under-five mortality in the LRR and HRR, and the gap between the groups. The results revealed a prevalence of about 6.1% in LRR compared with 11.3% in HRR, culminating in approximately 5.1%-point significant difference between the groups. This translates to about 58.9% higher under-five deaths in HRR relative to LRR, consistent with the results in Figure 1 depicting considerably greater risks of under-five deaths in the HRR relative to the LRR. Figure 2 and

other tables (available in the full report) convey the relative significance of the regressors with respect to their endowment and coefficient effects on under-five mortality risk differentials between LRR and HRR. Regarding the endowment part, the findings revealed that disparities in the distribution of child's birth order and interval, mother's family planning status and educational attainment, as well as family structure, household wealth status, and number of household members, contributed significantly to the observed LRR-HRR gap in under-five mortality risks ($p \leq 0.05$).

**Discussion and Conclusion**

This study examined the factors sustaining high under-five mortality in Nigeria by quantifying the contributions of socioeconomic, bio-demographic, and health-related factors in explaining the gap in childhood mortality between the country's high-risk and low-risk regions.

Aligning with the findings from descriptive analysis, results obtained from the Blinder-Oaxaca multivariate logistic regression decomposition established considerable inter-regional inequality in survival chances among under-five children in Nigeria. On the average, the rates of dying among children under age 5 was approximately 59% higher in high-risk regions relative to low-risk regions. Empirical studies highlight significant regional variations in under-five mortality likelihoods in Nigeria with more pronounced risks often observed among children born in the high-risk settings – the Northeastern and Northwestern regions – compared with their peers born elsewhere, especially the Southwestern region (S. A. Adedini et al., 2015; Ezeh et al., 2015; Okoli et al., 2022). The aggregate decomposition further suggests that improving the demographic and socioeconomic conditions in the high-risk regions to the average levels observed in the low-risk regions has the potential to close the survival inequality by roughly 60%. Estimates from national household surveys revealed stark demographic and socioeconomic disparities, with most states in northern Nigeria exhibiting poorer outcomes in education, living standard, and health (National Bureau of Statistics, 2018, 2022; NPC [Nigeria] & ICF, 2019).

The study indicates that the gap in under-five mortality between the regions are influenced by geographical disparities in child-, mother-, and household-level factors. Specifically, differential composition of birth order, birth interval, family planning uptake, educational attainment, family structure, household wealth status, and household size contributed significantly to explaining the inter-regional variances in under-five mortality risks. Meanwhile, maternal education, household wealth status, and family size emerged as the strongest drivers.

The study established that interventions aimed at enhancing maternal education and increasing access to economic resources in high-risk regions could be effective in addressing the enduring regional disparities in childhood survival in Nigeria. Also, the relative contributions and significance of birth order, birth interval, and family planning uptake in explaining the observed mortality disparity underscore the need to expand access to low-cost, effective and culturally acceptable contraceptive methods in the high-risk regions of Nigeria.

**Selected figures**

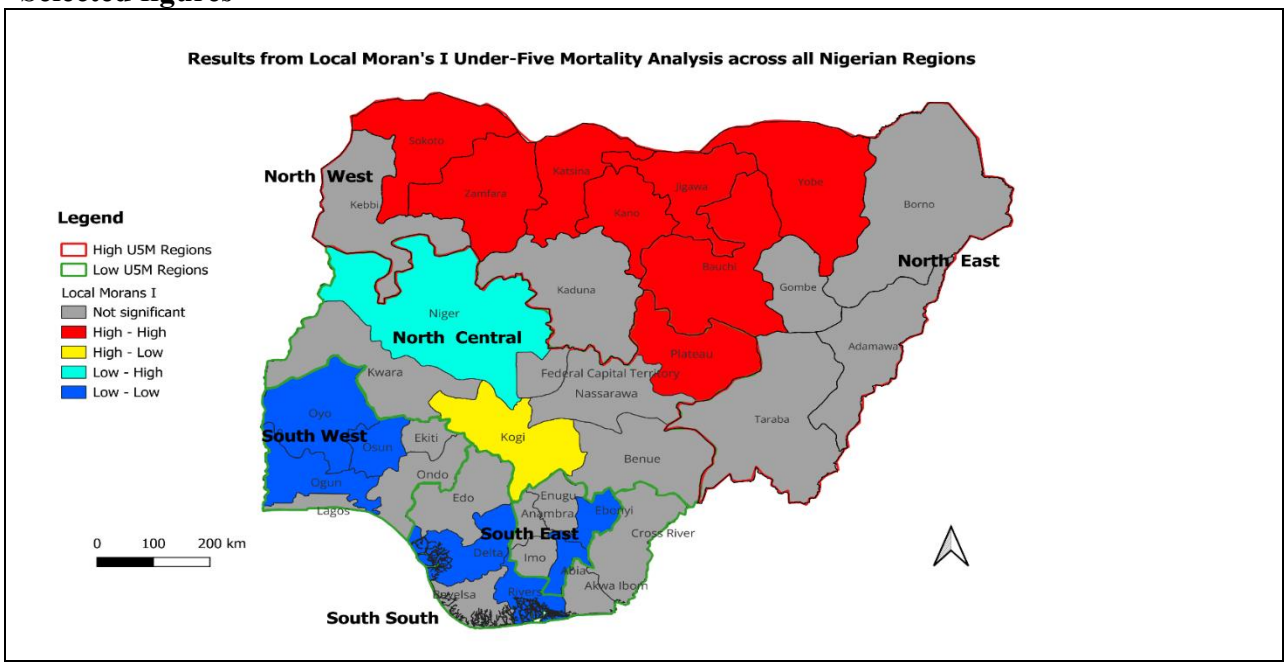


Figure 1: Results from Local Moran's I Analysis in Nigeria's High U5M Regions

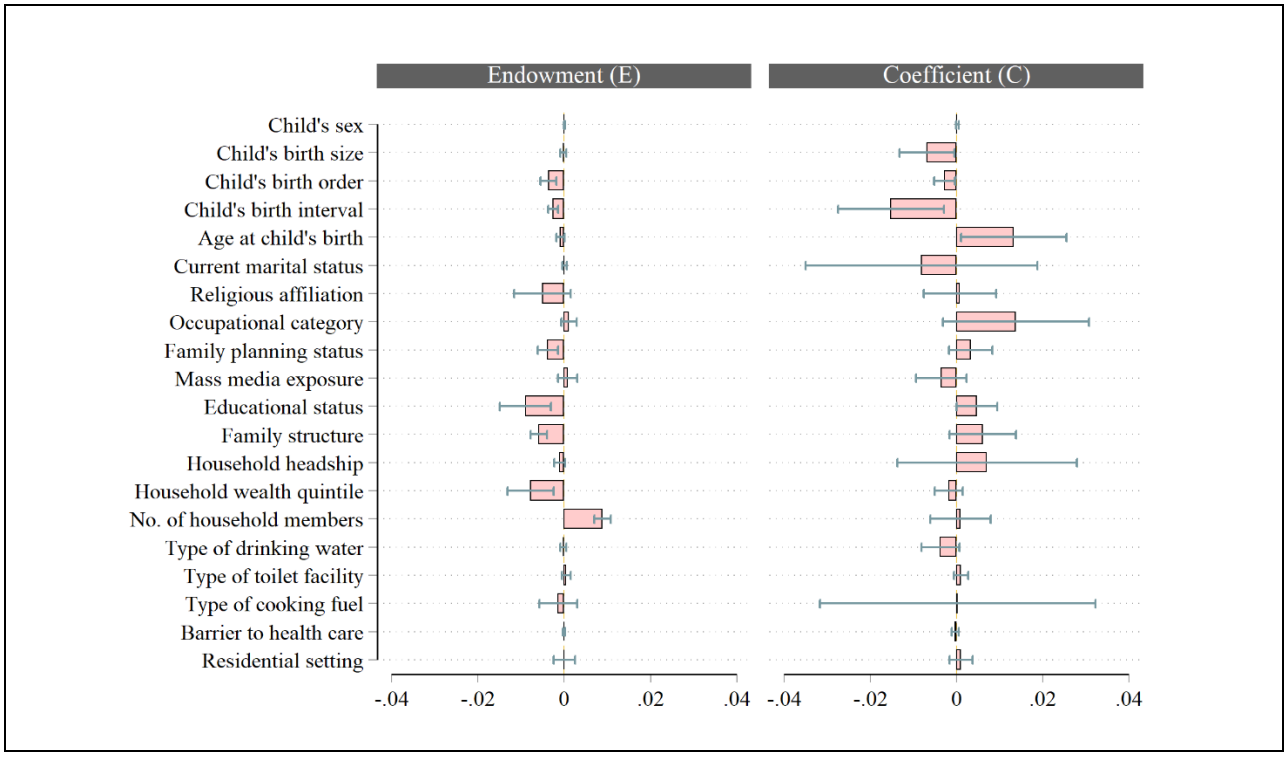


Figure 2: Chart showing the summary decomposition of the gap in under-five mortality risk between LRR and HRR and relative contributions of the observed predictors of under-five deaths to (un)explained components.