

Test file: Urban-Rural Disparities in Maternal Mortality: A Cross-National Comparative Study

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Abstract

This cross-national study examines urban-rural disparities in maternal mortality across 45 low and middle-income countries using demographic and health survey data. Multilevel logistic regression models reveal significantly higher maternal mortality risks in rural areas, with the largest disparities observed in countries with weak health systems. Healthcare access, education, and economic factors mediated approximately 60% of the urban-rural disparity. Targeted interventions addressing rural healthcare infrastructure and socioeconomic barriers are urgently needed to reduce geographic inequities in maternal survival.

Keywords: Maternal Mortality; Health Disparities; Urban-Rural Differences; Health Equity; Multilevel Analysis; Global Health

1. Introduction

Maternal mortality remains a major public health challenge, with approximately 295,000 women dying during pregnancy or childbirth annually worldwide. The risk of maternal death is disproportionately concentrated in low and middle-income countries, where 94% of all maternal deaths occur. Within these countries, significant geographic disparities exist, with rural populations often experiencing substantially higher maternal mortality ratios than their urban counterparts. Understanding the magnitude and determinants of these urban-rural disparities is crucial for designing targeted interventions and achieving the Sustainable Development Goal target of reducing global maternal mortality to less than 70 per 100,000 live births. While previous studies have documented urban-rural differences in maternal healthcare utilization, comprehensive cross-national analyses of mortality disparities and their mediating factors remain limited. This study aims to quantify urban-rural disparities in maternal mortality across 45 low and middle-income countries, identify key mediating factors, and examine variations in disparity patterns across different health system contexts.

2. Methods

2.1 Data Sources and Study Population

We analyzed data from 45 Demographic and Health Surveys (DHS) conducted between 2010 and 2022, representing 1.2 million women aged 15-49 years. The DHS employs stratified multistage cluster sampling to provide nationally representative data on maternal and child health indicators. Maternal mortality was assessed using the sisterhood method, which collects information about sisters' survival and pregnancy-related deaths. Urban-rural classification followed each country's national statistical office definitions.

2.2 Statistical Analysis

We employed multilevel logistic regression models with random intercepts for survey clusters and countries to account for hierarchical data structure. The primary analysis estimated urban-rural disparities in maternal mortality risk after adjusting for individual-level covariates (age, education, wealth quintile) and country-level factors (health expenditure, physician density). Mediation analysis using the product of coefficients method quantified the proportion of urban-rural disparity explained by healthcare access, educational attainment, and economic factors. Subgroup analyses examined variation in disparities by geographic region, health system strength, and time period.

3. Results

3.1 Urban-Rural Disparities in Maternal Mortality

Pooled analysis across all countries revealed significantly higher maternal mortality risk in rural areas (OR: 2.45, 95% CI: 2.18-2.76) after adjusting for individual and country-level covariates. The absolute maternal mortality ratio was 357 per 100,000 live births in rural areas compared to 156 in urban areas. Disparities were most pronounced in West African countries, where rural women faced 3.8 times higher mortality risk than urban women. Countries with weaker health systems, measured by health expenditure per capita and healthcare workforce density, demonstrated larger urban-rural disparities.

3.2 Mediating Factors

Healthcare access factors, particularly distance to health facilities and skilled birth attendance, mediated 35% of the urban-rural disparity. Educational attainment mediated 18% of the disparity, while economic factors mediated 12%. Combined, these factors explained 65% of the excess maternal mortality risk in rural areas. The remaining disparity suggests additional unmeasured factors, including quality of care differences, cultural barriers, and environmental factors.

4. Discussion

This comprehensive cross-national study demonstrates substantial urban-rural disparities in maternal mortality across low and middle-income countries. The findings highlight that rural residence remains a significant risk factor for maternal death, independent of individual socioeconomic status. The mediation analysis suggests that improving healthcare access in rural areas could substantially reduce geographic inequities in maternal survival. However, the persistence of significant disparities even after accounting for measured mediators indicates the need for multifaceted approaches addressing both healthcare system strengthening and broader social determinants of health. Limitations include potential misclassification of maternal deaths and cross-sectional design preventing causal inference. Future research should employ longitudinal designs to examine temporal trends in disparities and evaluate intervention effectiveness.

5. Conclusion

Substantial urban-rural disparities in maternal mortality persist in low and middle-income countries, driven primarily by differences in healthcare access, education, and economic resources. Reducing these disparities requires targeted investments in rural healthcare infrastructure, transportation systems for emergency obstetric care, and programs addressing socioeconomic barriers to care. Policy efforts should prioritize equitable resource allocation and innovative service delivery models to ensure all women have access to quality maternal healthcare, regardless

of geographic location.

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