Proximate determinants of childhood mortality in selected developing countries

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Abstract

Background: Childhood mortality remains a critical public health issue in many developing countries. Despite progress in reducing childhood mortality globally, disparities persist, particularly in low- and middle-income countries. There is a need for comprehensive studies across multiple countries to better understand the proximate determinants and inform targeted interventions. This study aims to explore the proximate determinants of childhood mortality in selected developing countries with the highest global rates of childhood mortality.

Methods: The study used Demographic and Health Survey (DHS) data from eight developing countries (Angola, Bangladesh, India, Indonesia, Nigeria, Pakistan, and Tanzania). We analyzed a total sample of 73,363 children under five years. Descriptive analysis and multivariate hierarchical logistic regression modelling was performed in STATA 17.

Results: Nigeria has the highest rates of childhood mortality, with neonatal mortality at 39 deaths per 1,000 live births, infant mortality at 67 per 1,000 live births, and under-five mortality at 132 per 1,000 live births. Children born to mothers in the poorest wealth index had higher odds of neonatal mortality (aOR: 1.27; 95% CI: 1.03-1.57), infant mortality (aOR: 1.25; 95% CI: 1.04-1.49), and under-five mortality (aOR: 1.36; 95% CI: 1.16-1.60). Similarly, children of mothers with no education had significantly higher odds of neonatal mortality (aOR: 1.69; 95% CI: 1.30-2.21), infant mortality (aOR: 1.75; 95% CI: 1.40-2.18), and under-five mortality (aOR: 1.90; 95% CI: 1.56-2.31). Children of mothers working in sales had increased odds of neonatal mortality (aOR: 1.55; 95% CI: 1.36-1.76), infant mortality (aOR: 1.62; 95% CI: 1.47-1.79), and under-five mortality (aOR: 2.01; 95% CI: 1.92-2.30). Female children had lower odds of neonatal mortality (aOR: 0.67; 95% CI: 0.61-0.74), infant mortality (aOR: 0.79; 95% CI: 0.73-0.86), and under-five mortality (aOR: 0.80; 95% CI: 0.76-0.87) compared to male children. Children with a birth interval of more than two years (aOR: 0.81, 95%CI: 0.75-0.87) had lower risk of under-five mortality.

Conclusion: Targeted interventions aimed at improving maternal education, reducing socio-economic disparities, and enhancing maternal health and childcare practices are essential to reducing childhood mortality in developing countries. Addressing these proximate determinants can contribute to achieving Sustainable Development Goal (SDG) targets related to child survival.

Keywords: Children; Mortality; Demography; Public Health

Background

Globally, deaths of children before age five has seen a 60% decline between 1990 and 2020 [1]. In 2020, the global under-5 mortality rate (U5MR) dropped to 37 (35–40) deaths per 1,000 live births. However, children in sub-Saharan Africa continued to face the highest mortality rates worldwide, with 74 (68–86) deaths per 1,000 live births, which is 14 times higher than the rate for children in Europe and North America [1]. Half of all under-5 deaths occurred in just five countries: Nigeria, India, Pakistan, the Democratic Republic of the Congo, and Ethiopia. Nigeria and India alone were responsible for almost a third of these deaths [1]. As such, the question is that, what is accounting for the high child mortality in these countries. This study examines the proximate determinants of childhood mortality in developing countries with high childhood mortality rates.

Methods

Data Source

The study used Demographic and Health Survey (DHS) data from eight developing countries. The DHS used a standard model questionnaire developed by the Measure DHS Program. The DHS utilized a two stage stratified sampling technique. A total sample of 73,363 children under five years made up 7,419 children from Angola, 8,272 children from Ethiopia, 20,740 children from India, 10,539 children from Indonesia, 14,642 children from Nigeria, 7,783 children from Pakistan and 3,968 children from Tanzania were included for the study. Permission to use the data set was given by the MEASURE DHS following the assessment of our concept note. The dataset is freely available to the public at https://dhsprogram.com/data/dataset/Nigeria_Standard-DHS_2018.cfm?flag=1

Study variables and measurement

Dependent variable

Three dependent variables were used for the study, thus, neonatal mortality (which is the death of a child below 28 days), infant mortality (which is the death of a child below 1 year) and under-five mortality (which is the death of a child below 5 years).

Explanatory variables

Several factors supported by theoretic and empirical research on under-five mortality [2,3,4,5] included in the analyses as the explanatory variables. These variables included community level socio-economic factors (place of residence), household/individual socio-economic variables (wealth index, maternal education, mother's occupation) and proximate determinants factors (age, assisted delivery, place of delivery, sex of child, size of child at birth and birth interval).

Statistical analysis

Stata version 17 was used to conduct the statistical analysis. Statistics were performed using both descriptive and inferential methods. Frequency tabulations were used in the first phase to describe the proportions of each explanatory variable. The second phase of analysis was calculating of under-five mortality per the explanatory variables with their respective confidence interval using direct estimation

method. This was done using the 'syncmrates' command to calculate the childhood mortality (neonatal mortality, Infant mortality, under-five mortality) based on synthetic cohort probability [6]. We further conducted a bivariate logistic analysis between the dependent variable and the explanatory variables. The third phase was the multivariate hierarchical logistic regression. Three models were fitted. Model I examined the association between neonatal mortality and the explanatory variables (place of residence, wealth index, maternal education, mother's occupation, age, assisted delivery, place of delivery, sex of child, size of child at birth and birth interval). Model II examined the association between infant mortality and the explanatory variables (place of residence, wealth index, maternal education, mother's occupation, age, assisted delivery, place of delivery, sex of child, size of child at birth and birth interval). The final model (III) examined the association between under five mortality and the explanatory variables (place of residence, wealth index, maternal education, mother's occupation, age, assisted delivery, place of delivery, sex of child, size of child at birth and birth interval). To account for any sampling bias from under or over-sampling of respondents in the total population, all descriptive estimates were weighted using the individual weight variable (v005/1000000) in the dataset. To consider the complex survey design of the DHS data, the "svy" command in Stata was employed.

Results

Prevalence of childhood mortality in developing countries

We observed a wide variation in childhood mortality rate across the countries of study. Nigeria recorded the highest rates, with neonatal mortality at 39 deaths per 1,000 live births, infant mortality at 67 per 1,000 live births, and under-five mortality at 132 per 1,000 live births. Conversely, Indonesia reported the lowest neonatal mortality at 15 per 1,000 live births, infant mortality at 24 per 1,000 live, and under-five mortality at 32 per 1,000 live births. Pakistan also exhibited elevated mortality rates, while Bangladesh reported comparatively lower rates. Tanzania and India had moderate mortality levels, with neonatal rates of 25 per 1,000 live births and 25 per 1,000 live births, respectively (Table 1).

Table 1: Country, survey year childhood mortality and 95% confidence interval (CI)

Country	Survey year	Childhood mortality		
		Neonatal mortality rate (95% CI)	Infant mortality rate (95% CI)	Under five mortality rate (95% CI)
Angola	2015-2016	24 (20-29)	44(37-50)	68(59-77)
Bangladesh	2022	22(18-26)	28(23-32)	36(28-44)
India	2019-2020	25(24-26)	35(34-37)	43(42-45)
Indonesia	2017	15(13-17)	24(21-27)	32(29-37)
Nigeria	2018	39(35-44)	67(62-77)	132(123-143)
Pakistan	2017-2018	42(36-49)	63(55-71)	76(66-87)
Tanzania	2022	25(21-28)	34(29-39)	39(34-45)

Proximate determinants of childhood mortality

The results show that poverty, no formal education, being a female child, and mother's occupation exacerbated the risk of childhood mortality while long birth intervals was a protective factor. Children born to mothers in the poorest wealth index had higher odds of neonatal mortality (aOR: 1.27; 95% CI:

1.03-1.57), infant mortality (aOR: 1.25; 95% CI: 1.04-1.49), and under-five mortality (aOR: 1.36; 95% CI: 1.16-1.60) compared to those in the richest wealth index. Similarly, children of mothers with no education had significantly higher odds of neonatal mortality (aOR: 1.69; 95% CI: 1.30-2.21), infant mortality (aOR: 1.75; 95% CI: 1.40-2.18), and under-five mortality (aOR: 1.90; 95% CI: 1.56-2.31) compared to those with higher education. Children of mothers working in sales had increased odds of neonatal mortality (aOR: 1.55; 95% CI: 1.36-1.76), infant mortality (aOR: 1.62; 95% CI: 1.47-1.79), and under-five mortality (aOR: 2.01; 95% CI: 1.92-2.30) compared to mothers not working. Female children had lower odds of neonatal mortality (aOR: 0.67; 95% CI: 0.61-0.74), infant mortality (aOR: 0.79; 95% CI: 0.73-0.86), and under-five mortality (aOR: 0.80; 95% CI: 0.76-0.87) compared to male children. Children with a birth interval of more than two years (aOR: 0.81, 95%CI: 0.75-0.87) had lower risk of under-five mortality.

Conclusion

Targeted interventions aimed at improving maternal education, reducing socio-economic disparities, and enhancing maternal health and childcare practices are essential to reducing childhood mortality in developing countries. The significant association between low maternal education and increased childhood mortality highlights the need for policies that promote female education, especially among disadvantaged populations. Investing in educational opportunities for women can have a cascading effect on child health outcomes. Addressing socio-economic disparities through poverty alleviation programs and improved access to healthcare services for the poorest households is crucial. Moreover, targeted interventions aimed at improving maternal health knowledge and practices, especially in relation to birth spacing, breastfeeding, and nutrition, can help reduce childhood mortality.

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