

SUB-NATIONAL DISPARITIES IN UNDER-FIVE MORTALITY IN NIGERIA: AN ELEVEN-FOLD GAP AND ITS CORRELATES

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ABSTRACT

Nigeria's national under-5 mortality rate (U5MR) of 110 per 1000 live births conceals substantial sub-national variation, and disaggregated evidence is needed to target Nigeria's child survival programmes effectively. This study used state-level indicators from the 2023-24 Nigeria Demographic and Health Survey to quantify inter-state disparities in U5MR and their association with birth registration coverage and fertility, using independent-samples t-tests and Pearson correlations with states as the unit of analysis. U5MR ranged from 14 per 1000 live births in Kwara State to 161 per 1000 in Jigawa State, an 11.5-fold gap. Northern states had significantly higher mean U5MR than southern states (110.2 vs. 53.2 per 1000; $P < 0.001$) and lower birth registration coverage (32.7% vs. 61.6%; $P < 0.001$). U5MR correlated positively with total fertility rate ($r = 0.83$) and negatively with birth registration coverage ($r = -0.66$; both $P < 0.001$). Fieldwork was not completed in 20 of 1400 sampled clusters across seven states because of insecurity, likely understating mortality in the highest-risk areas. Nigeria's child survival crisis is geographically concentrated in the north and closely tied to low civil registration and high fertility. Disaggregated, state-specific programming is needed to accelerate progress toward the SDG 3.2 target of 25 per 1000 live births, prioritising: (i) intensified primary health care delivery in the North West and North East zones; and (ii) parallel investment in civil registration and family planning to address the two strongest correlates of the gap identified here.

Keywords: under-5 mortality; Nigeria; sub-national disparities; birth registration; total fertility rate; NDHS

INTRODUCTION

Nigeria contributes the world's largest absolute burden of under-five deaths. In 2023-24, the Nigeria Demographic and Health Survey (NDHS) reported a national under-5 mortality rate (U5MR) of 110 deaths per 1000 live births, more than four times the Sustainable Development Goal (SDG) 3.2 target of 25 per 1000 by 2030 (FMOHSW, NPC & ICF, 2024). At the same time, Nigeria has 220 million people distributed across 36 states and the Federal Capital Territory (FCT), and six geopolitical zones that differ markedly in health infrastructure, fertility patterns, and civil registration capacity. A single national figure therefore averages across highly heterogeneous units.

Prior analyses using earlier NDHS rounds identified persistent north-south gradients in child mortality, with northern zones

consistently recording rates two to three times higher than southern zones (Antai, 2011; Adedini et al., 2025). The 2023-24 NDHS Key Indicators Report, the most recent available, provides state-level estimates that allow this gradient to be precisely quantified. Understanding the magnitude of sub-national disparities, and the indicators that co-vary with them at the state level, is a prerequisite for effective targeting of Nigeria's national child survival programmes (FMOHSW, 2025).

This study has three objectives: (i) to quantify inter-state and inter-zonal disparities in child mortality using the 2023-24 NDHS; (ii) to test whether birth registration coverage and total fertility rate are statistically associated with state-level U5MR; and (iii) to examine the implications of security-related survey non-coverage for the interpretation of state-level mortality estimates.

MATERIALS AND METHODS

Study design and data source. This is a cross-sectional, secondary ecological analysis of aggregate indicators published in the 2023-24 NDHS Key Indicators Report (FMOHSW, NPC & ICF, 2024). Nigeria's National Population Commission implemented the NDHS using a stratified two-stage cluster design, yielding a nationally representative sample of 40 047 interviewed households across 1400 clusters (701 urban, 699 rural). Data collection ran from 1 Dec 2023 to 7 May 2024, with results weighted to be representative at the national, urban-rural, and state levels.

Variables. The primary outcome was U5MR for the ten years preceding the survey, as reported by state and zone in the NDHS report's early-childhood-mortality tables. We used ten-year estimates at the state level because the NDHS report presents sub-national mortality only for this window, which provides adequate case counts. We also extracted component rates— neonatal mortality rate (NNMR) and infant mortality rate (IMR). Explanatory variables were the total fertility rate (TFR; three-year period) and total birth registration coverage among children under five years of age, both reported by state.

Statistical analysis. We ranked states and the FCT ($n = 37$) by U5MR. We used direct NDHS report estimates for zone-level comparisons. For a supplementary ecological comparison, we grouped states into North (North Central, North East, North West; $n = 20$) and South (South East, South, South West; $n = 17$) and compared them using independent-samples t-tests, weighting each state equally regardless of population. Pearson correlation coefficients were computed between U5MR and (a) TFR, (b) birth

registration, and between NNMR and birth registration. We set statistical significance at $\alpha = 0.05$. We conducted analyses in Python 3.12 (pandas, SciPy).

Ethical considerations. This study used only aggregate, de-identified indicators from a publicly available government report. We did not conduct any primary data collection involving human participants. Ethical approval was not required; the original 2023-24 NDHS received ethical clearance from the ICF Institutional Review Board and Nigeria's National Health Research Ethics Committee (FMOHSW, NPC & ICF, 2024). We limited AI-assisted tools to grammar and consistency checks during manuscript preparation.

Survey non-coverage. Fieldwork was not completed in 20 of 1400 sampled clusters across seven states (Zamfara, 10 clusters; Borno, 3; Benue, 2; Imo, 2; Katsina, Kaduna, Niger, 1 each) owing to insecurity (FMOHSW, NPC & ICF, 2024). The implications of this exclusion are discussed below.

RESULTS

Zonal disparities. Table 1 shows zone-level estimates. U5MR ranged from 42 per 1000 live births in the South West to 140 per 1000 in the North West, a 3.3-fold difference—the same north-south ordering held for NNMR and IMR. Birth registration and TFR were inversely associated with this gradient: zones with the highest child mortality (North West and North East) recorded the lowest birth registration coverage (36.5% and 28.0%, respectively) and the highest fertility (5.9 and 6.1 births per woman).

Table 1: Fertility, mortality, and birth registration by geopolitical zone, Nigeria NDHS 2023-24

Zone	TFR/woman	NNMR/1000 live births	IMR/1000 live births	U5MR/1000 live births	Birth reg. (%)
North Central	4.2	28	42	65	32.7
North East	6.1	40	66	127	28
North West	5.9	48	76	140	36.5
South East	4.1	33	48	70	57.3
South South	3.3	25	36	50	59.2
South West	3.4	24	33	42	67.7
National	4.8	41	63	110	39.7

NDHS = Nigeria Demographic and Health Survey; TFR = total fertility rate (births per woman, 3-year period); NNMR = neonatal mortality rate; IMR = infant mortality rate; U5MR = under-5 mortality rate; all mortality rates per 1000 live births (10-year period). Source: FMOHSW, NPC & ICF (2024).

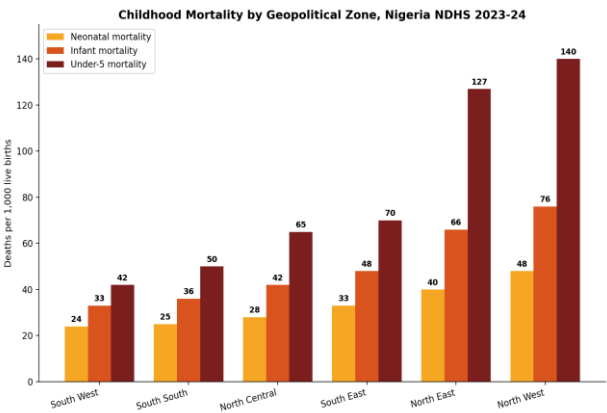


Figure 1: Neonatal, infant, and under-5 mortality by geopolitical zone, Nigeria NDHS 2023-24 (mean of constituent states).

State-level disparities. Table 2 and Fig. 2 show U5MR by state, ranked from highest to lowest. U5MR ranged from 14 per 1000 in Kwara State to 161 per 1000 in Jigawa State, an 11.5-fold difference (Table 2). Ondo (15 per 1000) and Edo (19 per 1000) also recorded very low U5MR; the ratio between Jigawa and Ondo is 10.7. Four of the five states with the highest U5MR (Jigawa 161; Kebbi 159; Kano 158; Kaduna 153) are in the North West zone. All ten states with U5MR above 100 per 1000 are in northern zones. All ten states with U5MR below 55 per 1000 are in southern zones or the FCT, with the single exception of Kwara (North Central). Thirty-three of the 36 states and the FCT exceed the SDG 3.2 target of 25 per 1000.

Table 2a: State-level indicators, Nigeria NDHS 2023-24, ranked by under-5 mortality rate (descending) — states ranked 1–19

State	Zone	TFR/woman	NNMR/1000 live births	IMR/1000 live births	U5MR/1000 live births	Birth reg. (%)
Jigawa	North West	6.9	53	81	161	15.7
Kebbi	North West	6.6	49	90	159	18.8
Kano	North West	5.8	59	86	158	50.7
Gombe	North East	5.5	45	81	157	33.7
Kaduna	North West	5.6	47	85	153	25.7
Yobe	North East	7.5	34	54	145	19.4
Adamawa	North East	5.3	43	75	144	39.3
Taraba	North East	5.2	38	64	126	31.1
Bauchi	North East	6.2	48	77	125	24.8
Zamfara	North West	6.3	42	60	119	29.1
Sokoto	North West	5.4	28	56	109	19.0
Nasarawa	North Central	4.3	50	70	106	51.9
Katsina	North West	5.7	42	63	105	40.2
Plateau	North	4.4	31	59	98	27.0

Borno	Central					
	North	6.5	30	48	86	28.9
Imo	East					
	South	4.4	51	62	85	58.2
Akwa Ibom	East					
	South	3.3	38	56	80	48.0
Kogi	South					
	North	4.9	39	59	78	27.2
Bayelsa	Central					
	South	3.8	32	56	73	49.1

Highlighted row: Jigawa (highest U5MR). TFR = total fertility rate (births per woman); NNMR = neonatal mortality rate; IMR = infant mortality rate; U5MR = under-5 mortality rate (all mortality rates per 1000 live births, 10-year period); Birth reg. = total birth registration coverage among children under 5 years—source: FMOHSW, NPC & ICF (2024).

Table 2b: State-level indicators, Nigeria NDHS 2023-24, ranked by under-5 mortality rate (descending) — states ranked 20–37

State	Zone	TFR/ woman	NNM R/100 0 live births	IMR/ 100 0 live births	U5M R/100 0 live births	Birth reg. (%)
Anambra	South	3.7	32	50	72	62.9
Abia	East					
Abia	South	3.7	27	49	69	55.9
Ebonyi	East					
	South	4.7	26	42	68	43.2
FCT- Abuja	East					
	North	3.2	25	35	60	70.6
Cross River	Centr al					
	South	3.0	24	39	60	44.3
Ogun	South	4.1	35	47	60	53.9
Osun	West					
Osun	South	3.3	36	49	55	81.1
Rivers	West					
Rivers	South	2.9	30	39	54	69.2
Benue	South					
	North	3.5	19	34	53	37.8
Niger	Centr al					
	North	4.4	22	31	49	27.3
Enugu	Centr al					
Enugu	South	3.5	25	34	49	80.1
Lagos	East					
	South	3.2	25	36	46	78.1
Ekiti	West					
	South	3.8	18	27	44	57.9
Delta	West					
	South	3.7	19	26	33	62.4
Oyo	South	3.3	17	18	23	62.2
Edo	West					
Edo	South	3.3	7	13	19	62.5
Ondo	South					
Ondo	Sout	3.1	3	8	15	77.6

Kwara	h					
	West					
Kwara	North	4.0	12	12	14	36.6
	Centr al					

Highlighted rows: Ondo (second-lowest U5MR), Kwara (lowest U5MR). TFR = total fertility rate (births per woman); NNMR = neonatal mortality rate; IMR = infant mortality rate; U5MR = under-5 mortality rate (all mortality rates per 1000 live births, 10-year period); Birth reg. = total birth registration coverage among children under 5 years—source: FMOHSW, NPC & ICF (2024).

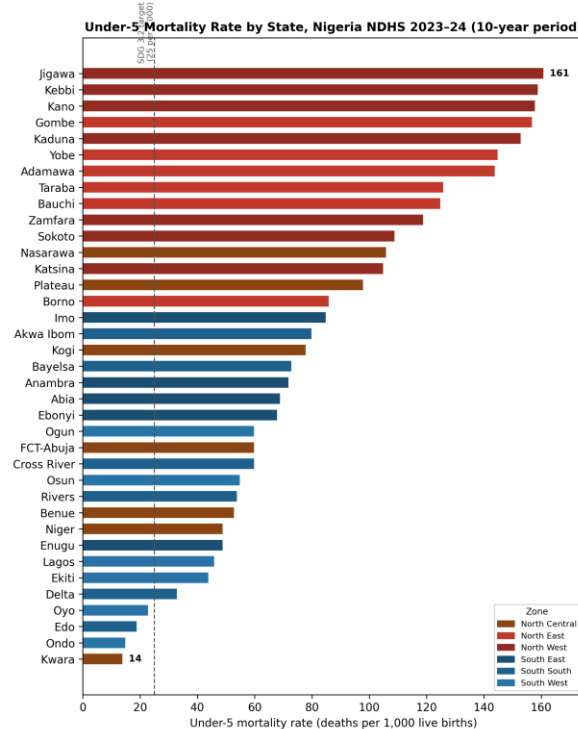


Figure 2. Under-5 mortality rate by state, Nigeria NDHS 2023-24, ranked lowest to highest. Dashed line marks the SDG 3.2 target of 25 per 1000 live births.

North-south comparison. Northern states had a mean U5MR more than twice that of southern states (110.2 vs. 53.2 per 1000; $t = 4.99$, $P < 0.001$) and significantly lower mean birth registration coverage (32.7% vs. 61.6%; $t = -6.81$, $P < 0.001$). Mean TFR was 5.4 in the North vs. 3.6 in the South. This north-south difference is a broad regional pattern rather than an artefact of one or two outlying states: U5MR exceeded 100 per 1000 in 13 northern states and in none of the 17 southern states.

Correlates of under-5 mortality. Across 36 states and Abuja, TFR correlated strongly and positively with U5MR ($r = 0.83$, $P < 0.001$). Birth registration correlated moderately and negatively with U5MR ($r = -0.66$, $P < 0.001$) and with NNMR ($r = -0.42$, $P = 0.010$). Fig. 3 shows these relationships: northern states cluster in the high-mortality, low-registration quadrant, and southern states in the low-mortality, high-registration quadrant. Kwara is a notable exception, sitting in the low-mortality, low-registration quadrant, which illustrates that birth registration is a correlate rather than a direct

causal determinant of survival.

Table 3: Pearson correlations between fertility, birth registration, and childhood mortality across 36 states and the FCT

Variable pair (n = 36 states and the FCT)	Pearson r	p value	Direction
Total fertility rate – Under-5 mortality rate	0.826	< 0.001	Positive
Birth registration (%) – Under-5 mortality rate	-0.660	< 0.001	Negative
Birth registration (%) – Neonatal mortality rate	-0.419	0.010	Negative

FCT = Federal Capital Territory. *P* values are two-sided.

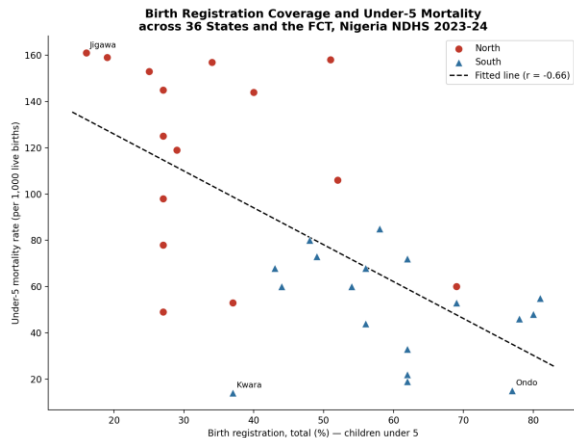


Figure 3: Birth registration coverage and under-5 mortality across 36 states and the FCT, with fitted linear trend ($r = -0.66$, $P < 0.001$).

Survey non-coverage in high-insecurity states. Twenty of 1400 sampled clusters were not visited because of insecurity, concentrated in Zamfara (10 clusters) and Borno (3 clusters) — the two states from which the largest amounts of missing data originate (FMOHSW, NPC & ICF, 2024). Both states rank in the highest-mortality tier (Zamfara 119; Borno 86 per 1000). Because insecurity co-occurs with disrupted health services and elevated mortality, this non-random exclusion likely biases state-level U5MR estimates toward underestimation. The north-south gap documented in this study is therefore probably conservative.

DISCUSSION

This analysis of the 2023-24 NDHS reveals an 11.5-fold gap in U5MR between Nigeria's best- and worst-performing states — the largest state-level differential quantified from a Nigerian DHS round to date. The gap runs consistently along a north-south line and is tightly correlated with birth registration coverage ($r = -0.66$) and TFR ($r = 0.83$). Despite a 43 % national reduction in U5MR since the 1990 NDHS, 33 of the 36 states and the FCT remain above the SDG 3.2 target, and 13 states record mortality more than four times that target.

The strong association with TFR is consistent with well-established biological and behavioural pathways: high-fertility zones also record the highest rates of adolescent childbearing, the shortest birth intervals, and the lowest contraceptive use (Rutstein, 2005; Yaya et al., 2018; Ahinkorah, 2021). The North West and North East zones, which record U5MR of 140 and 127 per 1000, respectively, also record national peaks in all three risk factors in the same survey round (FMOHSW, NPC & ICF, 2024). The negative association with birth registration is best interpreted as a proxy for civil registration system strength and breadth of health-system contact. States where births go unregistered are also states where children are more likely to be born and to fall ill outside the reach of routine health services (Ebbers & Smits, 2022; Aboagye et al., 2023). The Kwara exception — low U5MR despite only 36.6 % birth registration — highlights that no single indicator fully accounts for a state's mortality trajectory. State-specific diagnostic work is needed to identify each state's binding constraints on child survival.

Public health implications. These findings carry direct implications for Nigeria's Child Survival Action Plan 2025-2029, which categorises states by risk level to direct resources (Blackstone et al., 2017). The evidence here confirms that such risk stratification is warranted and that the highest-priority states — particularly those in the North West and North East zones — require not only intensified primary health care delivery, but also investment in civil registration and family planning, and appropriate adjustments for the mortality surveillance blind spots created by ongoing insecurity (Eboime et al., 2017; Musa et al., 2024).

Limitations. This is an ecological analysis, and associations observed at the state level should not be assumed to hold at the individual level. T-tests treat each state as an equally weighted unit without adjustment for population size or the survey's complex design. Ten-year mortality rates span a longer reference window than the national five-year rate, potentially masking recent trends. Security-related cluster exclusions likely bias estimates in the highest-risk states toward underestimation. Despite these limitations, the consistent north-south ordering across all three mortality indicators and across two correlates reduces the likelihood that the main findings are artefactual.

Conclusion

Nigeria's national under-5 mortality rate conceals an eleven-fold state-level gap that uniform national programmes poorly address. The gap is largest in the North West and North East zones, where it converges with the highest fertility, lowest birth registration, and least complete mortality surveillance. National averages, including those used to monitor SDG 3.2 progress, are an inadequate basis for resource allocation across a country of this heterogeneity. Disaggregated, state-specific programming — grounded in the kind of sub-national data the NDHS now provides — is the most direct path toward reducing preventable child deaths in Nigeria.

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Competing Interests

None declared.

Authors' Contributions

[To be completed by authors: describe each author's specific contribution in accordance with ICMJE criteria.]

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REFERENCES

- Aboagye, R.G., Okyere, J., Seidu, A.-A., Ahinkorah, B.O., Budu, E. & Yaya, S. (2023). Determinants of birth registration in sub-Saharan Africa: Evidence from demographic and health surveys. *Frontiers in Public Health*, 11:1193816. <https://doi.org/10.3389/fpubh.2023.1193816>
- Adedini, S.A., Ibrahim, E.A., Ogunwemimo, H.S., Oladele, O.S., Abatan, S.M. & Adekola, P.O. (2025). Decomposing the gap in under-five mortality determinants between the low- and high-risk regions of Nigeria. *Scientific Reports*, 15:36407. <https://doi.org/10.1038/s41598-025-20365-3>
- Ahinkorah, B.O. (2021). Under-5 mortality in sub-Saharan Africa: Is maternal age at first childbirth below 20 years a risk factor? *BMJ Open*, 11(9):e049337.
- Antai, D. (2011). Regional inequalities in under-5 mortality in Nigeria: A population-based analysis of individual- and community-level determinants. *Population Health Metrics*, 9:6. <https://doi.org/10.1186/1478-7954-9-6>
- Blackstone, S.R., Nwaozuru, U. & Iwelunmor, J. (2017). An examination of the maternal social determinants influencing under-5 mortality in Nigeria: Evidence from the 2013 Nigeria Demographic Health Survey. *Global Public Health*, 12(6):744–56.
- Ebbers, A.L. & Smits, J. (2022). Household and context-level determinants of birth registration in sub-Saharan Africa. *PLoS One*, 17(3):e0265882.
- Eboreime, E.A., Abimbola, S., Obi, F.A., Ehirim, O., Olubajo, O. & Eyles, J. (2017). Evaluating the sub-national fidelity of national initiatives in decentralized health systems: Integrated primary health care governance in Nigeria. *BMC Health Services Research*, 17:227. <https://doi.org/10.1186/s12913-017-2179-2>
- Federal Ministry of Health and Social Welfare (FMOHSW), National Population Commission (NPC) [Nigeria] & ICF (2024). Nigeria Demographic and Health Survey 2023-24: Key Indicators Report. Abuja: NPC and ICF.
- Federal Ministry of Health and Social Welfare (FMOHSW) (2025). Nigeria Child Survival Action Plan 2025-2029. Abuja: FMOHSW.
- Musa, S.S., Ibrahim, A.M., Ogbodum, M.U., Haruna, U.A., Gololo, A.A. & Abdulkadir, A.K. (2024). Revitalizing primary healthcare in conflict-affected northeastern Nigeria: Challenges, strategies and way forward. *Narra X*, 2(3):e178.
- Rutstein, S.O. (2005). Effects of preceding birth intervals on neonatal, infant and under-five years mortality and nutritional status in developing countries: Evidence from the demographic and health surveys. *International Journal of Gynaecology and Obstetrics*, 89(Suppl 1): S7-24.
- Yaya, S., Bishwajit, G., Okonofua, F. & Uthman, O.A. (2018). Under-five mortality patterns and associated maternal risk factors in sub-Saharan Africa: A multi-country analysis. *PLoS One*, 13(10):e0205977.