

CHAPTER 7

MORTALITY DETERMINANTS AND DIFFERENTIALS

Socioeconomic, Reproductive, and Geographic Inequalities in
Childhood Survival in Ethiopia

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CHAPTER 7

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Introduction

The decline of childhood mortality is one of the most consequential dimensions of Ethiopia's demographic and epidemiological transformation. Yet a national mortality rate, however valuable for monitoring progress, is an average across children born into markedly different social, reproductive, and geographic circumstances. A declining national rate does not imply that the probability of surviving the neonatal period, infancy, or the first five years of life is evenly distributed. The central question of this chapter is therefore not only how much mortality has declined—a question examined in Chapter 6—but how the remaining burden is patterned, which children face higher observed risks, and what those patterns can and cannot tell us about the determinants of survival.

Child survival is shaped by multiple levels of influence. The influential framework of Mosley and Chen (1984) distinguished socioeconomic conditions from proximate mechanisms through which children become exposed to illness and death, including maternal factors, environmental contamination, nutritional deficiencies, injury, and the prevention or management of illness. Its lasting contribution was to show why social circumstances matter without treating education, income, or place as direct biological causes. Subsequent hierarchical approaches to epidemiological analysis emphasized that distal and proximate factors are linked through ordered causal pathways; indiscriminate adjustment for intermediate variables can obscure rather than clarify the role of structural conditions (Victora et al., 1997). These frameworks inform the organization and interpretation of the present chapter.

Maternal education and household wealth occupy a prominent position in this framework, but they are not interchangeable measures. Schooling may influence knowledge, health literacy, autonomy, and the capacity to navigate health services; household resources may shape food security, transport, housing conditions, sanitation, and the ability to obtain timely care. Both can be associated with fertility behavior and place of residence, and both may operate through multiple pathways at once. Consequently, an observed mortality gradient across educational or wealth categories is a meaningful measure of inequality, but not, on its own, an estimate of the independent effect of education or material resources (Mosley & Chen, 1984; Victora et al., 1997).

Reproductive histories provide a second, partially overlapping dimension of differentiation. Maternal age at childbirth, birth order, and the length of the preceding birth interval can reflect biological, behavioral, and social processes, including maternal health, family size, access to contraception, and allocation of household care. Evidence from multicountry analyses has associated shorter birth intervals with adverse perinatal and child outcomes, while also raising questions about confounding and the pathways linking reproductive timing to survival (Conde-Agudelo et al., 2006; Rutstein, 2005). In this chapter, these characteristics are examined as observed national mortality differentials, not presumed to be independent or causal effects.

Geography provides a third essential dimension. Regions differ in settlement patterns, infrastructure, health-service availability, economic conditions, environmental exposure, and experiences of disruption. These contextual features may help frame differences in survival, but regional contrasts cannot be read as direct evidence that any single mechanism produced an observed mortality level. A high regional mortality estimate does not by itself identify the responsible exposure, just as a low

estimate does not establish the effectiveness of a particular program. The distinction between geographic description and causal explanation is especially important when evidence comes from separate datasets measured at different times or spatial scales (Victora et al., 1997).

The empirical foundation is the Ethiopia Demographic and Health Survey (EDHS) series, with particular emphasis on the 2024–25 survey for national mortality stratifications. Full birth histories allow the estimation of neonatal, postneonatal, infant, child, and under-five mortality through the Demographic and Health Surveys (DHS) synthetic-cohort life-table approach. Mortality probabilities are calculated across defined age segments and combined into standard age-specific indicators rather than obtained by simply dividing deaths by all births recorded in a category (ICF, n.d.). Because deaths are comparatively uncommon events, DHS guidance ordinarily uses a ten-year reference period for subgroup mortality estimates to improve stability (ICF, n.d.).

Five mortality indicators are examined: neonatal mortality (NNMR), postneonatal mortality (PNNMR), infant mortality (IMR), child mortality between exact ages one and five (CMR), and under-five mortality (U5MR). Although the measures describe related stages of survival, they are not equivalent. In particular, child mortality refers to the conditional probability of dying between the first and fifth birthdays among children who survived infancy. Examining multiple age segments helps distinguish patterns concentrated around birth from those emerging later in childhood (ICF, n.d.).

The chapter is organized into four analytical quarters. Part I establishes the conceptual and methodological foundations and evaluates national mortality differentials by maternal education and household wealth. Part II examines maternal age at childbirth, birth order, and preceding birth interval. Part III situates mortality patterns within the certified regional historical evidence developed in Chapter 6 and discusses health-system, environmental, and social context without treating hypothesized mechanisms as estimated effects. Part IV integrates the national socioeconomic and reproductive contrasts with geographic evidence, evaluates limitations, and considers public-health and research implications.

Two methodological boundaries govern interpretation throughout. First, the national stratifications from the 2024–25 EDHS refer to the preceding ten-year mortality estimation window; they do not, by themselves, demonstrate how socioeconomic or reproductive gradients changed between 2000 and 2024–25. Historical claims require independently validated series. Second, further cross-classification of regional mortality by maternal education or household wealth was deliberately avoided because the limited frequency of deaths, particularly neonatal deaths, could generate sparse cells and unstable estimates. This is a restriction adopted for statistical reliability, not an assertion that inequalities are geographically uniform.

Finally, the chapter differentiates observed rate differences and rate ratios from adjusted associations and causal effects. Where confidence intervals or design-based variance estimates are unavailable, the results are interpreted descriptively; apparent reversals in an otherwise plausible gradient are neither smoothed away nor declared statistically meaningful. This approach prioritizes transparency over artificial regularity. Its objective is to identify robustly documented patterns of mortality inequality, situate them within a defensible conceptual framework, and define the additional evidence required to move from describing differences to explaining them.

PART I. 7.1 Purpose and analytical scope

This part establishes the conceptual basis for analyzing childhood mortality determinants and presents the national socioeconomic differentials that can be estimated directly from the uploaded 2024–25 Ethiopia Demographic and Health Survey (EDHS) birth-history outputs. The empirical results concern maternal education and household wealth, each cross-tabulated separately against neonatal, postneonatal, infant, conditional child, and under-five mortality. The analysis is descriptive: observed differences are associations, not identified causal effects.

The broader book considers Ethiopia’s quarter-century transformation. However, the two source CSVs supplied for this part represent only the 2024–25 survey and its preceding ten-year mortality window. They cannot establish 2000–2024/25 trends in education- or wealth-specific mortality. Any historical comparison requires separately certified survey-specific strata, harmonized definitions, and uncertainty estimates.

7.2 Conceptual framework: social position, pathways, and survival

A useful organizing framework distinguishes distal socioeconomic circumstances from intermediate reproductive and service-access pathways and proximate exposures. Maternal schooling may influence health literacy, autonomy, use of preventive and curative care, and household decisions; household wealth may influence food security, living conditions, transportation, and ability to obtain timely treatment. These pathways overlap and can be modified by geography, maternal age, parity, and health-system capacity (Mosley & Chen, 1984; Victora et al., 2003).

Schooling and wealth are also strongly correlated with other determinants. Consequently, their separate unadjusted mortality gradients should not be read as independent or net effects. The observed education contrast may partly reflect economic resources and residence; the observed wealth contrast may partly reflect maternal education and reproductive histories. A multivariable causal interpretation would require an explicit estimand, confounder assessment, appropriate birth-history survival modeling, and design-consistent uncertainty (Croft et al., 2018; Rutstein & Johnson, 2004).

Figure 7.1. Conceptual organization of determinants

Distal social position (maternal education; household wealth) → intermediate pathways (reproductive behavior; household environment; health-service access) → proximate conditions (illness, nutrition, obstetric and newborn complications) → age-specific childhood mortality. Geography and health-system conditions may influence multiple links; this diagram is a conceptual framework, not a fitted path model.

7.3 Data, outcomes, and estimation

The source files are `07_mortality_by_mothers_education.csv` and `08_mortality_by_wealth_quintile.csv`, exported from the uploaded EDHS 2024–25 R replication script using the `DHS.rates::chmort()` procedure on the birth recode (BR) file. The configured retrospective period is 120 months preceding interview. Maternal education is classified from v106

into no education, primary, secondary, and more than secondary; household wealth from v190 into five ordered quintiles. Both domains were analyzed independently at the national level (Croft et al., 2018).

The five reported outcomes are neonatal mortality (NNMR), postneonatal mortality (PNNMR), infant mortality (IMR), child mortality conditional on survival to age one (CMR), and under-five mortality (U5MR). Rates are expressed per 1,000, although CMR has the conditional-survivor denominator appropriate to ages one through four. U5MR is a life-table probability; it should not be calculated by naively adding the five indicator estimates. The supplied R output records indicator-specific unweighted N and weighted WN, but not standard errors, confidence intervals, or death-event counts.

Deliberate restriction of regional cross-classification

Socioeconomic and reproductive differentials in childhood mortality were estimated at the national level. Further stratification by region and maternal education or household wealth was deliberately avoided because the relatively low frequency of childhood deaths, particularly neonatal deaths, could produce sparse cells, unstable estimates, and imprecise comparisons. This restriction was adopted to preserve statistical reliability and interpretability rather than to imply that socioeconomic mortality inequalities are geographically uniform.

Interpretation and validation safeguards

The script was configured with RUN_JACKKNIFE = FALSE. Thus the present CSVs provide point estimates, not design-based standard errors or confidence intervals. All reported U5MR category bases exceed 500 unweighted observations according to the script’s display criterion, but that threshold alone does not establish precision: death counts, exposure distribution, clustering, and weights remain important. Differences, ratios, and non-monotonicity are presented descriptively; no statistical significance is claimed.

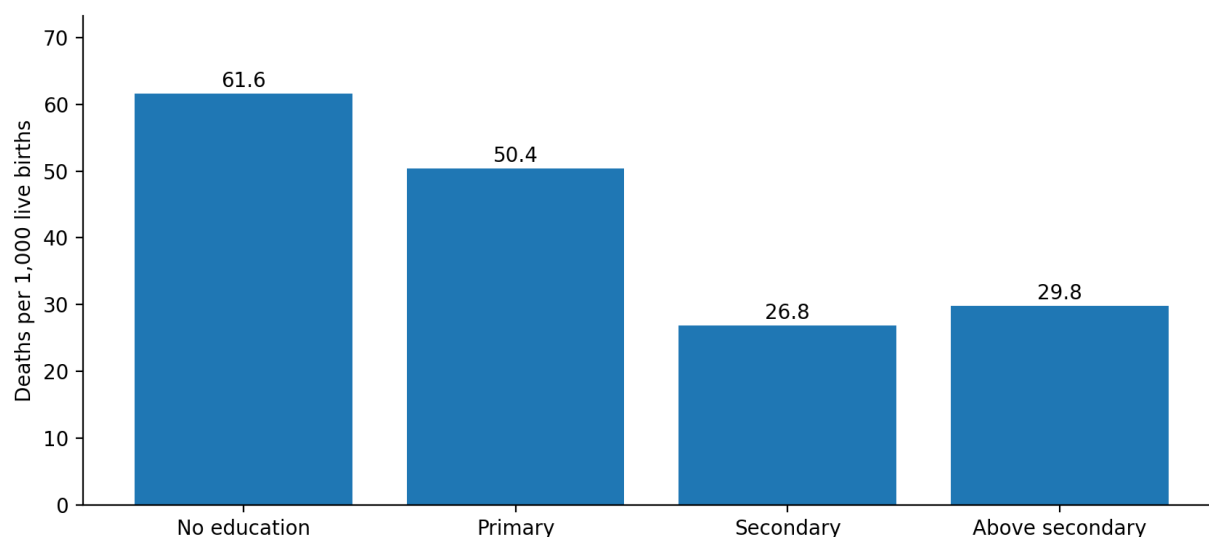
7.4 Maternal education and childhood mortality

Table 7.1. National childhood mortality by maternal education, EDHS 2024–25 (ten-year period)

Category	NNMR	PNNMR	IMR	CMR	U5MR	U5MR N
No education	28.76	17.19	45.95	16.36	61.56	13,804
Primary	28.62	10.74	39.36	11.47	50.38	7,408
Secondary	10.24	9.67	19.91	7.06	26.82	2,244
More than secondary	14.83	9.45	24.28	5.66	29.80	1,523

Note. Point estimates per 1,000 on each indicator’s defined denominator; U5MR N is the indicator-specific unweighted base recorded in the CSV, not the number of deaths. NNMR, neonatal; PNNMR, postneonatal; IMR, infant; CMR, conditional child; U5MR, under-five mortality. No design-based intervals were supplied.

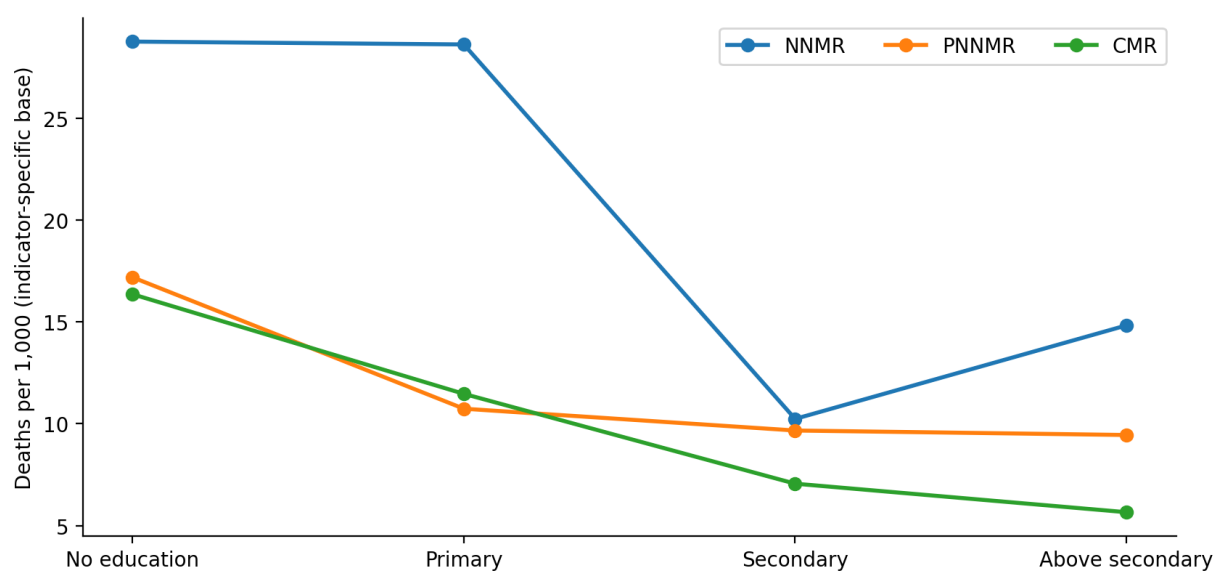
Figure 7.2. Under-five mortality by maternal education



Under-five mortality was 61.56 per 1,000 among children whose mothers had no schooling and 29.80 among those whose mothers had education above secondary: an absolute difference of 31.76 per 1,000 and a ratio of 2.07. The primary-education estimate was 50.38; the secondary-education estimate was 26.82. These results indicate a marked overall educational gradient, but not a strictly monotonic one.

The secondary and above-secondary estimates differ by only 2.98 per 1,000 (26.82 versus 29.80). The slight reversal could reflect sampling variability, differing distributions of births or exposure, or differences in the composition of the two maternal groups. It is not evidence that additional schooling increases child mortality. Both categories pass the recorded minimum unweighted base criterion, but without design-based uncertainty and event counts, their ordering should not be treated as statistically established.

Figure 7.3. Age-component mortality by maternal education



The component indicators show where mortality differentials emerge within childhood. The patterns should be interpreted separately rather than added to form U5MR. In particular, the neonatal and postneonatal periods have distinct underlying risks and potentially distinct relationships with schooling, access to skilled care, infection prevention, and household resources (Croft et al., 2018; Victora et al., 2003).

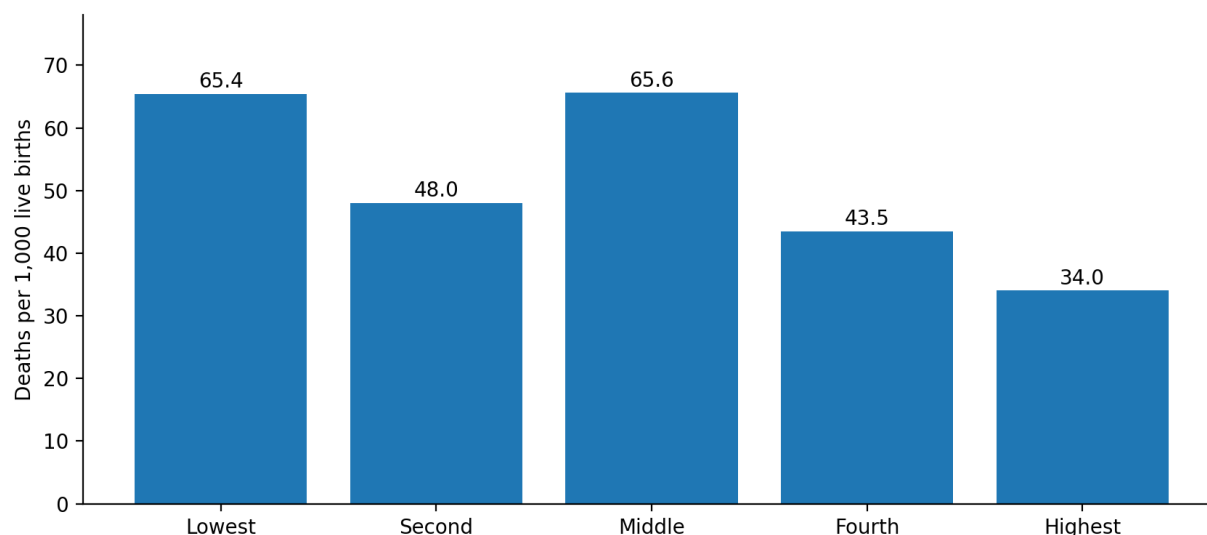
7.5 Household wealth and childhood mortality

Table 7.2. National childhood mortality by household wealth quintile, EDHS 2024–25 (ten-year period)

Category	NNMR	PNNMR	IMR	CMR	U5MR	U5MR N
Lowest	30.81	17.46	48.27	18.02	65.42	9,304
Second	22.75	12.94	35.69	12.79	48.02	4,950
Middle	31.98	18.99	50.97	15.42	65.60	3,812
Fourth	25.43	8.03	33.46	10.38	43.49	3,144
Highest	15.73	9.96	25.69	8.55	34.02	3,768

Note. Point estimates per 1,000; U5MR N is an indicator-specific unweighted base, not a death count. Quintiles derive from the DHS household wealth index and represent relative asset-based economic position, not directly measured income or expenditure (Rutstein & Johnson, 2004).

Figure 7.4. Under-five mortality by household wealth quintile

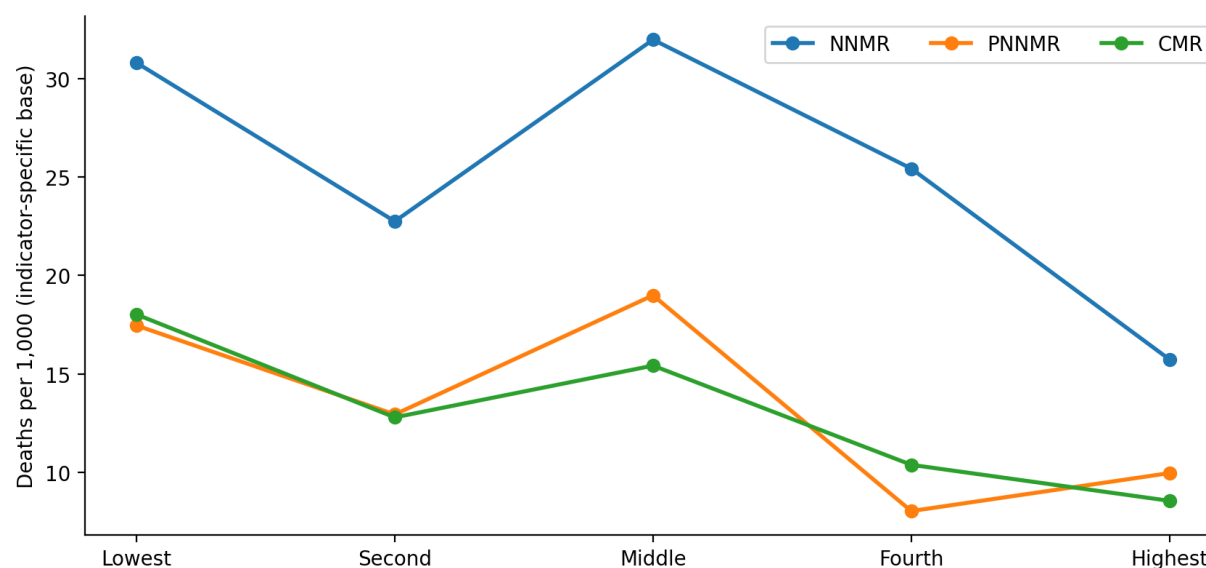


The lowest-quintile U5MR was 65.42 per 1,000, compared with 34.02 in the highest quintile: a difference of 31.40 per 1,000 and a poorest-to-richest ratio of 1.92. However, the pattern is not monotonic. The middle quintile had an observed estimate of 65.60, marginally above the lowest quintile (65.42), whereas the second and fourth quintiles were 48.02 and 43.49, respectively.

The middle-quintile elevation warrants an explicit validation note rather than smoothing or recoding. Plausible explanations include sampling variability, composition of birth histories across maternal ages and parity, geographic concentration of households within quintiles, and differences between

current household wealth and resources at the time of births or deaths. The uploaded output does not distinguish these explanations. The national wealth index is a relative asset measure, and its relationship with child survival need not be linear in an unadjusted table (Rutstein & Johnson, 2004).

Figure 7.5. Age-component mortality by household wealth quintile



Component mortality patterns also vary across quintiles. A single pooled wealth slope would conceal this heterogeneity. The priority for future verification is the jackknife-enabled replication of the five mortality indicators, with confidence intervals and indicator-specific event/exposure diagnostics; until then, interpretation should focus on the magnitude and configuration of point estimates rather than adjacent-rank significance.

7.6 Comparing the two socioeconomic gradients

Table 7.3. Descriptive contrasts between the socioeconomic extremes

Contrast	Disadvantaged U5MR	Advantaged U5MR	Gap per 1,000	Rate ratio
No schooling vs above secondary	61.56	29.80	31.76	2.07
Lowest vs highest wealth quintile	65.42	34.02	31.40	1.92

Note. Ratios are unadjusted descriptive comparisons of two groups. Their sampling uncertainty is unavailable in the supplied files; the ratios are not causal risk ratios and should not be interpreted as such.

Both dimensions show substantial differences between their socioeconomic extremes. The education gap (31.76 deaths per 1,000) and wealth gap (31.40) are numerically similar, but this does not imply equal causal importance: the groups have different definitions, distributions, and confounding

structures. The non-monotonic wealth pattern is more conspicuous than the small reversal at the upper end of education. Both patterns should be preserved as empirical observations pending design-based uncertainty estimation.

These findings are consistent with the broad social-determinants proposition that child survival is shaped by cumulative social and material advantage, but the EDHS tables do not establish the mechanisms. International frameworks distinguish observed inequities from explanations that require measurement of proximate determinants and explicit adjustment for shared causes (Mosley & Chen, 1984; Victora et al., 2003).

7.7 Limitations and implications for the remaining parts

This part relies on a single survey round and its ten-year retrospective window, not a certified five-survey stratified trend. Maternal schooling and household wealth are measured at interview and may not perfectly represent circumstances at every child's birth or death. Birth-history recall, age-at-death reporting, mortality rarity, sampling design, and potential selection affect precision. The available CSVs do not contain jackknife intervals or deaths by category. Consequently, the manuscript makes no significance claims and does not estimate independent effects of education or wealth.

The next part will analyze national mortality by maternal age at birth, birth order, and preceding birth interval using the three uploaded CSVs. Part III will discuss geographic and health-system context without crossing education or wealth with region; Part IV will synthesize the results and articulate the public-health implications. Where additional outcomes or temporal comparisons lack certified evidence, they will be identified as gaps rather than populated with modeled or illustrative numbers.

7.8 Part I synthesis

The 2024–25 EDHS national tables reveal substantial socioeconomic differentials in childhood mortality: children of mothers without formal education and children in the lowest wealth quintile experienced markedly higher under-five mortality than their most advantaged counterparts. Yet neither gradient is perfectly monotonic. Retaining the observed deviations, while distinguishing point estimates from statistically verified contrasts, provides a stronger basis for subsequent analysis than forcing an idealized gradient. The next analytical question is how reproductive histories and maternal age contribute to the national distribution of childhood mortality.

PART II. 7.9 Analytical scope and interpretation

This part examines three national reproductive characteristics: maternal age at the child's birth, birth order, and the interval since the preceding live birth. Each is tabulated against neonatal (NNMR), postneonatal (PNNMR), infant (IMR), child (CMR), and under-five mortality (U5MR). The estimates refer to the 120 months preceding the 2024–25 EDHS interviews. Rates are descriptive estimates from separate one-way stratifications; they are not mutually adjusted regression coefficients, causal effects, or annual mortality estimates.

The birth recode variables used in the underlying script are v011 and b3 for maternal age at birth, bord for birth order, and b11 for preceding birth interval. First births are excluded from the interval classification because they have no preceding live birth. All reported strata exceed the script’s 500-unweighted-base display threshold for U5MR, but this does not establish adequate numbers of deaths or precision for every age-specific component. The CSV outputs do not contain design-based standard errors, confidence intervals, or death-event counts.

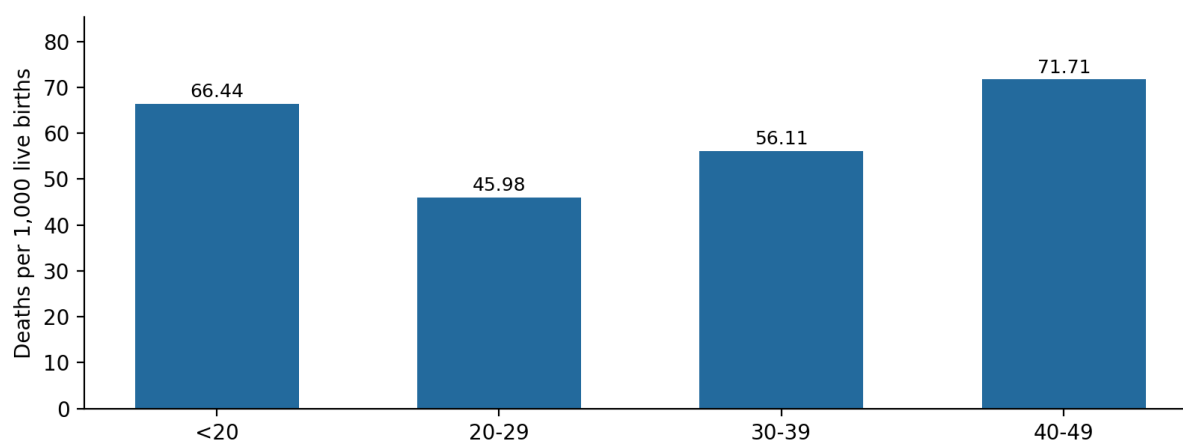
7.10 Maternal age at childbirth

Table 7.10.1. Childhood mortality by maternal age at birth, 2024–25 EDHS

Category	NNMR	PNNMR	IMR	CMR	U5MR	U5MR base (N)
<20	36.54	14.41	50.95	16.32	66.44	3,656
20-29	21.30	13.34	34.64	11.74	45.98	13,414
30-39	28.92	13.63	42.55	14.17	56.11	7,230
40-49	26.48	20.70	47.18	25.74	71.71	680

Note. Rates are expressed per 1,000 live births, except CMR, which is conditional on survival to exact age one. N is the indicator-specific unweighted base reported by the estimation software; it is not an observed death count. Source: 2024–25 EDHS birth recode, DHS.rates 120-month analysis; corresponding uploaded CSV.

Figure 7.10.1. Under-five mortality by maternal age at birth



Note. National, unadjusted under-five mortality estimates from the 120 months preceding interview. The bar heights are point estimates; uncertainty intervals were not available in the uploaded output.

The lowest U5MR is observed among births to mothers aged 20–29 years (45.98 per 1,000), followed by ages 30–39 (56.11), under 20 (66.44), and ages 40–49 (71.71). Compared with ages 20–29, the excess is 20.46 per 1,000 for births to mothers younger than 20 (rate ratio 1.44) and 25.73 for ages

40–49 (rate ratio 1.56). The resulting age profile is broadly U-shaped rather than a linear increase with age.

The pattern varies across child ages. NNMR is 36.54 for mothers younger than 20, 21.30 at ages 20–29, 28.92 at 30–39, and 26.48 at 40–49. Thus the oldest category does not have the highest observed neonatal rate. Its U5MR elevation instead coincides with a notably high CMR (25.74) and PNNMR (20.70). The 40–49 group has a smaller U5MR unweighted base (680), so the apparent ordering of neonatal and later-childhood components deserves additional precision assessment. Maternal age may be associated with biological risks, parity, spacing, socioeconomic position, and care access; the present stratification cannot separate these pathways.

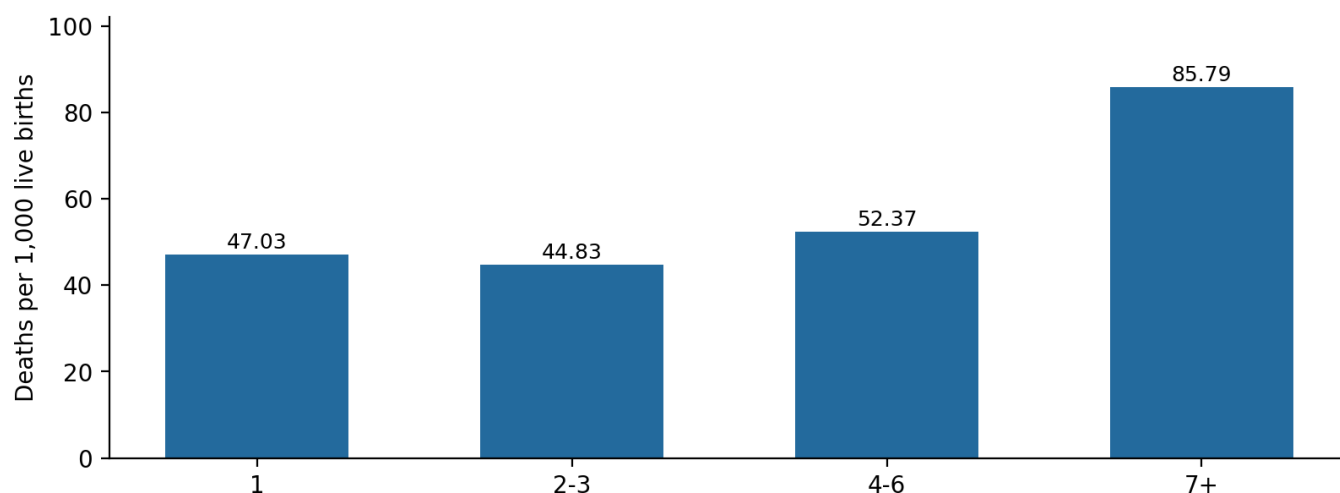
7.11 Birth order

Table 7.11.1. Childhood mortality by birth order, 2024–25 EDHS

Category	NNMR	PNNMR	IMR	CMR	U5MR	U5MR base (N)
1	28.35	11.66	40.01	7.31	47.03	5,630
2-3	21.65	11.32	32.97	12.27	44.83	8,804
4-6	21.64	14.75	36.40	16.57	52.37	7,722
7+	42.93	22.71	65.65	21.56	85.79	2,822

Note. Rates are expressed per 1,000 live births, except CMR, which is conditional on survival to exact age one. N is the indicator-specific unweighted base reported by the estimation software; it is not an observed death count. Source: 2024–25 EDHS birth recode, DHS.rates 120-month analysis; corresponding uploaded CSV.

Figure 7.11.1. Under-five mortality by birth order



Note. National, unadjusted under-five mortality estimates from the 120 months preceding interview. The bar heights are point estimates; uncertainty intervals were not available in the uploaded output.

Under-five mortality is 47.03 for first births, 44.83 for orders 2–3, 52.37 for orders 4–6, and 85.79 for seventh or higher births. The seventh-or-higher group exceeds orders 2–3 by 40.96 deaths per 1,000 (rate ratio 1.91) and first births by 38.76 (rate ratio 1.82). The lower U5MR at orders 2–3 compared with first births is small (2.20 per 1,000) and should not be treated as a meaningful difference without uncertainty estimates.

High birth order is associated with higher mortality at multiple ages: NNMR is 42.93 for order 7+ versus 21.65 at orders 2–3; PNNMR is 22.71 versus 11.32; and CMR is 21.56 versus 12.27. The pattern is therefore not confined to the neonatal period. Conversely, first births show a higher NNMR (28.35) than orders 2–3 (21.65), despite their comparatively low CMR (7.31). This difference illustrates why a single under-five indicator may conceal distinct mortality processes before and after infancy.

Birth order is correlated with maternal age, completed fertility, household resources, and birth spacing. It should be interpreted as a marker of reproductive context, not as an isolated biological exposure.

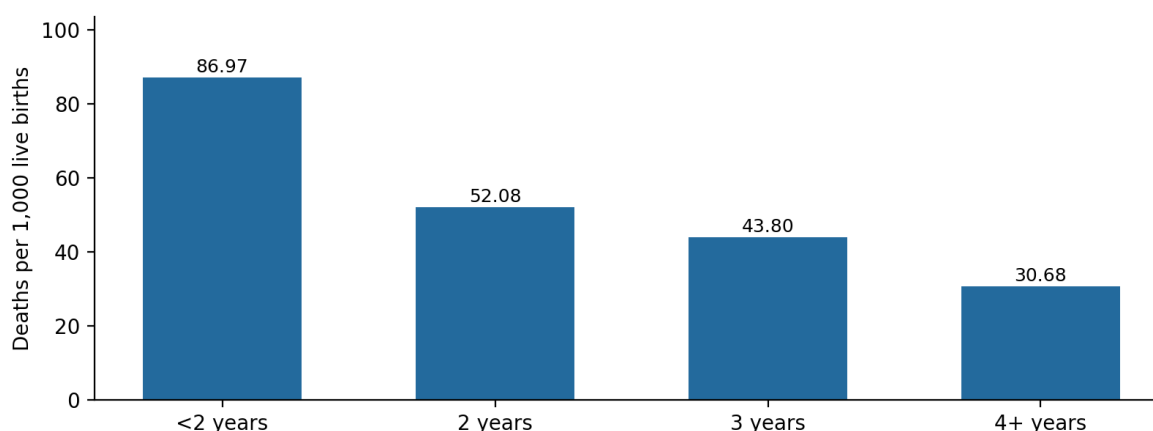
7.12 Preceding birth interval

Table 7.12.1. Childhood mortality by preceding birth interval, 2024–25 EDHS

Category	NNMR	PNNMR	IMR	CMR	U5MR	U5MR base (N)
<2 years	36.48	28.35	64.84	23.66	86.97	5,442
2 years	23.88	14.59	38.47	14.15	52.08	5,851
3 years	21.45	7.86	29.32	14.92	43.80	3,334
4+ years	17.08	6.17	23.25	7.60	30.68	4,663

Note. Rates are expressed per 1,000 live births, except CMR, which is conditional on survival to exact age one. N is the indicator-specific unweighted base reported by the estimation software; it is not an observed death count. Source: 2024–25 EDHS birth recode, DHS.rates 120-month analysis; corresponding uploaded CSV.

Figure 7.12.1. Under-five mortality by preceding birth interval



Note. National, unadjusted under-five mortality estimates from the 120 months preceding interview. The bar heights are point estimates; uncertainty intervals were not available in the uploaded output.

The preceding birth interval produces the steepest and most consistent gradient of the three reproductive stratifiers. U5MR declines from 86.97 per 1,000 following intervals shorter than two years to 52.08 at two years, 43.80 at three years, and 30.68 at four or more years. The shortest-versus-longest contrast is 56.29 per 1,000 (rate ratio 2.83), while the reduction between intervals shorter than two years and intervals of two years is 34.89 per 1,000.

This gradient is present in every mortality component. For intervals shorter than two years versus four or more years, NNMR is 36.48 versus 17.08 (ratio 2.14); PNNMR 28.35 versus 6.17 (ratio 4.59); IMR 64.84 versus 23.25 (ratio 2.79); and CMR 23.66 versus 7.60 (ratio 3.11). The especially pronounced postneonatal contrast is compatible with hypotheses concerning maternal depletion, sibling competition for caregiving resources, infection exposure, and feeding practices, but the observational table does not test these mechanisms.

The preceding interval is defined from successive live births, not pregnancies or all pregnancy outcomes. First-order births are excluded. This analysis does not measure the interpregnancy interval, and the observational association should not be presented as the effect of increasing spacing by a specific number of months.

7.13 Cross-domain synthesis

Table 7.13.1. Contrasts in national under-five mortality across reproductive characteristics

Comparison	Higher rate	Lower rate	Difference	Ratio
Maternal age 40–49 vs 20–29	71.71	45.98	25.73	1.56
Maternal age <20 vs 20–29	66.44	45.98	20.46	1.44
Birth order 7+ vs 2–3	85.79	44.83	40.96	1.91
Interval <2 years vs 4+ years	86.97	30.68	56.29	2.83

Note. Differences are deaths per 1,000 live births; ratios compare the first named group with the second. These are descriptive, unadjusted contrasts; no confidence intervals or hypothesis tests are implied.

Across the three domains, short preceding birth intervals and high birth order show the largest U5MR contrasts in the selected comparisons, while the maternal-age profile suggests elevated mortality at both ends of the reproductive age distribution. These characteristics overlap: high-order births are

more common at older ages, and spacing patterns may vary by education, wealth, residence, and access to contraception. Comparing their unadjusted ratios does not rank their independent causal importance.

The policy relevance is therefore twofold. First, the findings motivate further examination of family planning, birth-spacing counseling, and reproductive care within the maternal–child health continuum. Second, they caution against simplistic attribution: the observational gradients could be partly explained by household conditions, maternal characteristics, and selection into different fertility histories. An appropriately specified multivariable and survey-design-aware analysis would be needed to assess independent associations.

7.14 Strengths, limitations, and next steps

The analysis applies a common 120-month reference period, a single DHS mortality estimation procedure, and the same five age-specific mortality indicators to all three characteristics. It preserves two-decimal point estimates and indicator-specific unweighted bases, enabling transparent replication. None of the three files contains the design-based uncertainty estimates required to characterize small differences as statistically significant; nor do the files provide direct death-event counts. All groups meet the script’s display base threshold, but the number of deaths and effective sample sizes may be much smaller, particularly for later childhood mortality and births at maternal ages 40–49.

As agreed for Chapter 7, these are national analyses only. Region-by-education and region-by-wealth cross-classification is deliberately excluded to avoid sparse cells and unstable mortality estimates. The same principle cautions against unnecessary fine-grained cross-classification of maternal age, parity, and spacing. These results describe the 2024–25 survey’s retrospective window and do not establish historical trends across all five EDHS rounds.

PART III. 7.15 Scope and evidentiary boundary

Parts I and II examined national-level childhood mortality differentials by maternal education, household wealth, maternal age at birth, birth order, and preceding birth interval. Part III considers the geographic context in which those national associations arise. It draws on the independently certified historical under-five mortality panel already presented in Chapter 6. The purpose is to characterize regional heterogeneity and formulate defensible hypotheses about service access and contextual exposures—not to estimate unobserved region-specific education or wealth gradients.

No region-by-education or region-by-wealth stratification is undertaken. Subdividing regional birth histories into four educational groups or five wealth quintiles would frequently leave small death-event counts and imprecise age-specific mortality estimates. The decision preserves analytical reliability and does not imply that socioeconomic inequality is geographically uniform.

7.16 Sources, outcome, and analytic approach

The regional empirical series is taken from the certified Historical_Diagnostics worksheet in PROSPECTS2030_02_CH01_U5MR_STAGE02_DIAGNOSTICS_BACKTEST_ELIGIBILITY_v1_0_1.xlsx. It contains the national series and 14 harmonized current-region series for EDHS 2000, 2005, 2011, 2016, and 2024–25, a total of 75 historical estimates. The Input_Gates worksheet documents a complete 75/75-cell historical panel. Although the workbook filename refers to a projections project, this chapter uses ONLY its observed historical series; no forecast or model backtest is interpreted as a mortality observation.

The outcome is the reconstructed under-five mortality rate (U5MR), expressed per 1,000 live births. For each region, the analysis reports the first and last historical estimates, absolute change, percentage change, and 2024–25 difference from the contemporaneous national rate. The historical series is aligned to the 14 successor-region geography. These estimates are not substituted for official survey-report regional rates without checking definitions and reconstruction procedures.

The available workbook contains a 2024–25 standard-error column, but not the complete joint design-based covariance for contrasts between a region and the national total. Consequently, the region–national gaps and changes presented here are descriptive. No significance tests or causal effect estimates are asserted (Croft et al., 2018).

7.17 Current geography: regional inequality at the end of the period

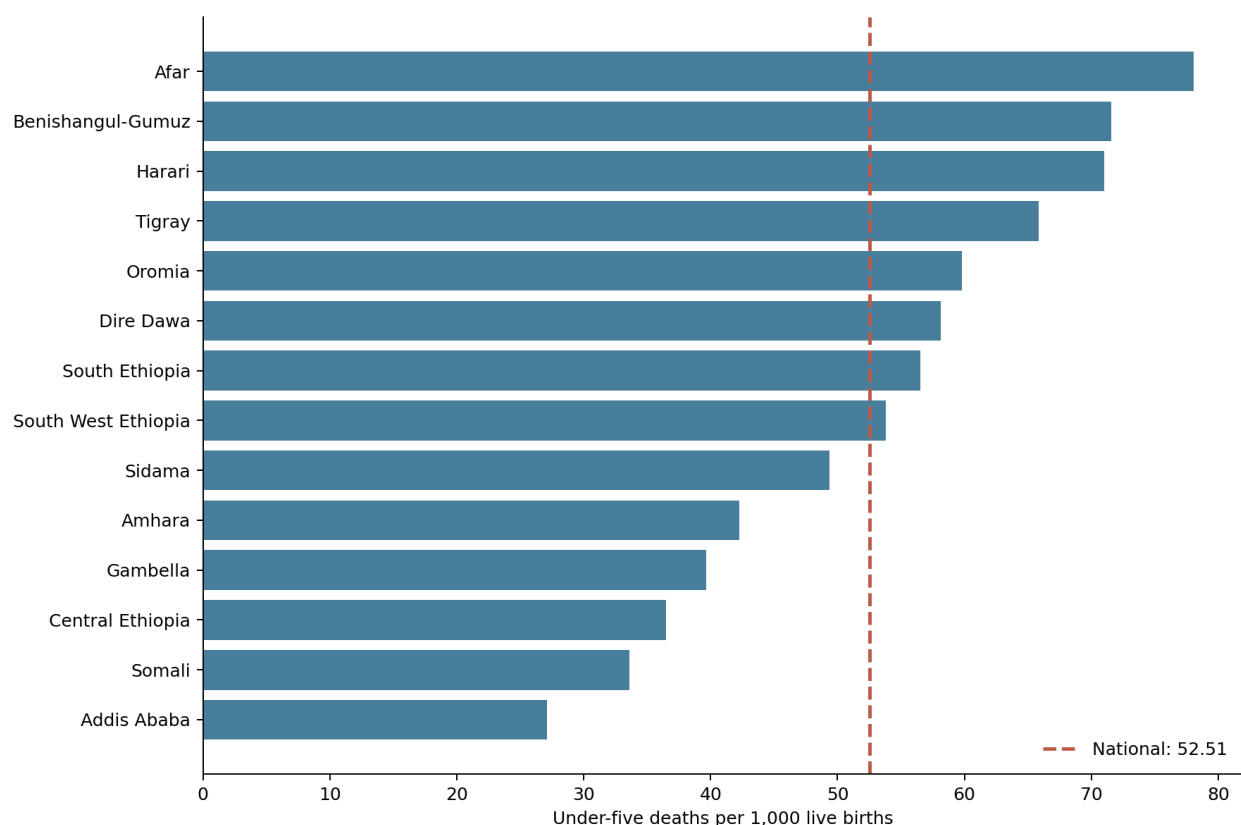


Figure 7.9. Reconstructed under-five mortality by current region, EDHS 2024–25. Dashed line denotes the reconstructed national rate.

In the certified panel, national U5MR was 52.51 per 1,000 live births in 2024–25. Regional endpoints varied considerably. The figure identifies the highest observed regional levels and distinguishes them from the national benchmark; its bars are not confidence intervals and its ordering should not be interpreted as a statistically certified ranking.

Table 7.9. Regional historical endpoints and national differences

Current geography	2000	2024–25	Change	Change (%)	Gap vs national
Afar	229.25	78.04	-151.21	-66.0%	+25.53
Benishangul-Gumuz	197.72	71.55	-126.17	-63.8%	+19.04
Harari	190.99	71.03	-119.96	-62.8%	+18.52
Tigray	169.02	65.84	-103.18	-61.0%	+13.33
Oromia	193.98	59.78	-134.20	-69.2%	+7.27
Dire Dawa	175.74	58.14	-117.60	-66.9%	+5.63
South Ethiopia	193.83	56.51	-137.32	-70.8%	+4.00
South West Ethiopia	220.58	53.83	-166.75	-75.6%	+1.32
Sidama	175.24	49.37	-125.87	-71.8%	-3.14
Amhara	183.36	42.27	-141.09	-76.9%	-10.24
Gambella	233.13	39.66	-193.47	-83.0%	-12.85
Central Ethiopia	194.03	36.50	-157.53	-81.2%	-16.01
Somali	184.18	33.63	-150.55	-81.7%	-18.88
Addis Ababa	113.53	27.13	-86.40	-76.1%	-25.38

Note. Rates per 1,000 live births. Gap is regional 2024–25 U5MR minus national 2024–25 U5MR (52.51). Positive gaps indicate higher observed regional rates. Historical regional geographies are reconstructed to match the current 14-region frame. Source: certified Historical_Diagnostics worksheet; calculations from displayed source values.

7.18 Historical trajectories: progress, persistence, and reversals

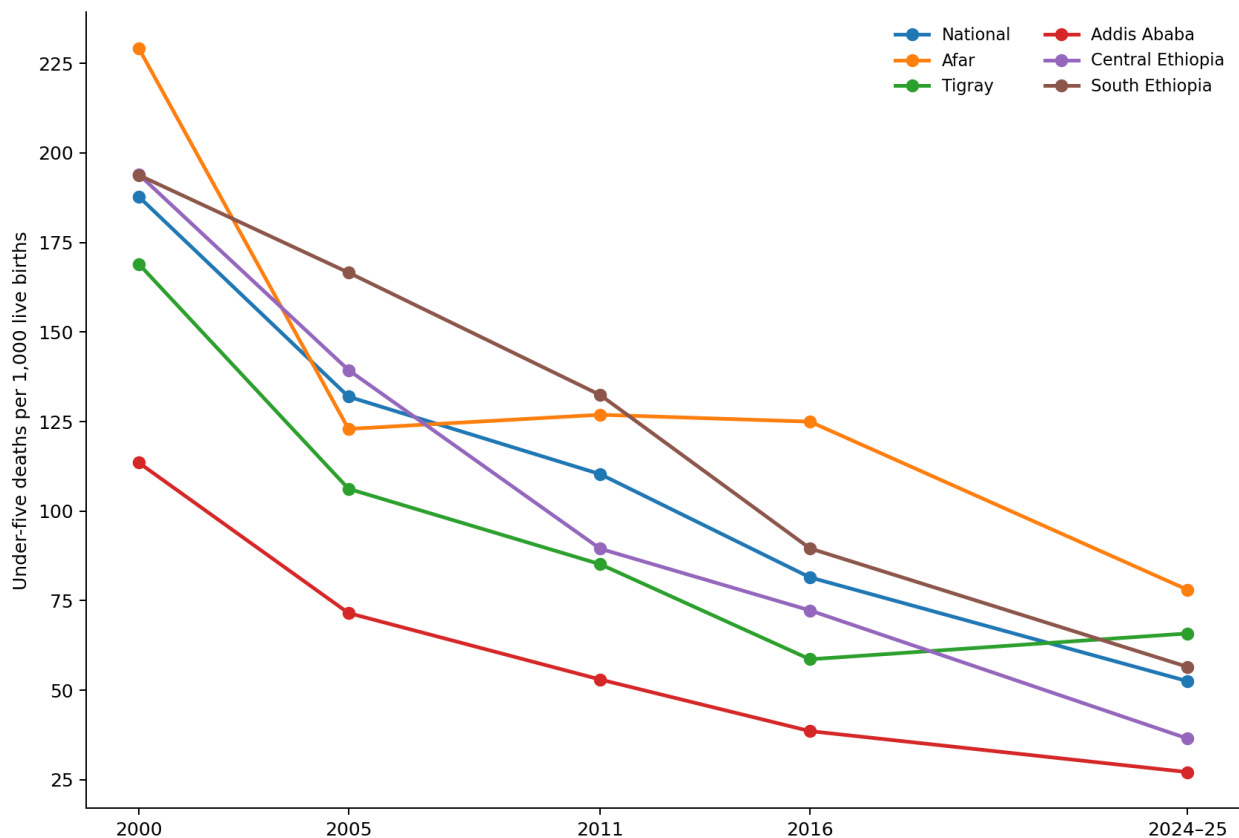


Figure 7.10. Selected historical regional under-five mortality trajectories compared with the national series, EDHS 2000–2024/25.

The historical trajectories underscore why endpoint rankings alone are inadequate. Afar recorded a high starting level (229.25) and remained above the national rate in 2024–25 (78.04), despite a large absolute reduction. Tigray declined from 169.02 in 2000 to 58.63 in 2016, followed by a higher observed value of 65.84 in 2024–25. The latter difference is a descriptive interval reversal; these survey estimates do not identify the precise timing or causes of the increase.

The selected series in Figure 7.10 illustrate contrasting regional pathways, not a selection of regions based on statistical significance. The complete 14-region endpoint table above and the full set of regional historical profiles in Chapter 6 should remain the definitive empirical reference. National averages are weighted aggregates, so a region’s deviation from the national line is not independent of that line.

Regional disparity and convergence are distinct questions

A large absolute mortality reduction can coexist with a high final rate. Conversely, a low final rate does not establish that improvement was especially rapid. To assess geographic convergence, both baseline-adjusted change and endpoint dispersion matter. A region may reduce its rate substantially yet remain above the national benchmark; a temporary rise may also interrupt a long-run downward trend. The available data support these descriptive statements, not formal convergence tests with design-based uncertainty.

7.19 Harmonizing the former SNNPR and its successor regions

A major comparability issue is the division of the former Southern Nations, Nationalities, and Peoples' Region (SNNPR). Chapter 6 reconstructs the four present-day successor geographies—Central Ethiopia, Sidama, South Ethiopia, and South West Ethiopia—within earlier EDHS rounds, rather than comparing the present-day regions against an undivided historical SNNPR. This supports geographically consistent comparisons from 2000 to 2024–25.

The reverse operation, reconstructing the former unified SNNPR for a different historical question, is not interchangeable with this backward allocation. Neither operation can be performed by taking an unweighted mean of published regional mortality rates. Mortality probabilities require compatible births, exposure histories, weights, and age-specific risk calculations. The Methodological Preface to Chapter 6 documents these decisions in greater detail.

7.20 Health-system accessibility: explanatory pathways, not measured effects

Regional mortality differences may reflect variation in timely access to antenatal and delivery services, emergency obstetric and newborn care, immunization, treatment of childhood illness, nutrition support, referral systems, and transportation. The conceptual plausibility of these pathways is well established in global child-survival and health-system literature (Black et al., 2016; Kruk et al., 2018). However, the mortality panel contains no linked measures of individual care-seeking, travel time, facility quality, or service utilization. This part therefore does not estimate the fraction of regional mortality differences attributable to any of these factors.

Availability is not the same as effective access

A mapped facility, or even a short straight-line distance to a facility, does not establish 24-hour staffing, medicines, transport, clinical readiness, affordability, or quality of care. Geographic accessibility, realized utilization, and effective coverage are related but analytically distinct. Future linkage of validated facility inventories with georeferenced survey clusters would require attention to DHS geographic displacement, service catchments, population denominators, and temporal alignment between facility and mortality data (Kruk et al., 2018).

Urban–rural context

Urban–rural residence is an important potential determinant because it can summarize differences in infrastructure, care access, and living conditions. Yet no validated residence-stratified mortality output has been provided for this part. Accordingly, the text identifies urban–rural residence as a proposed explanatory dimension rather than supplying an unverified urban–rural mortality contrast. Urban regions such as Addis Ababa should not be used as a proxy for all urban households in Ethiopia.

7.21 Environment, conflict, and mortality shocks

Environmental exposures—including water and sanitation, seasonal food insecurity, climatic hazards, and disease ecology—may interact with household vulnerability and service delivery to influence

child survival. Armed conflict and displacement may additionally interrupt immunization, maternal care, referral, and routine surveillance. These are plausible pathways, not variables measured in the present historical U5MR workbook. Causal claims would require independently validated spatial and temporal exposure data, appropriate control of confounding, and careful consideration of selection and population displacement.

The Tigray interval reversal merits investigation in light of the region's recent disruptions, but assigning its magnitude to conflict from two retrospective survey estimates would overstate the evidence. The EDHS mortality estimates summarize events across recall periods; the interview year is not the date of every contributing death. Differences in fieldwork coverage and population composition also require assessment (Croft et al., 2018).

7.22 Integrating geography with national socioeconomic and reproductive differentials

Part I showed that under-five mortality differed by maternal education and wealth quintile; Part II documented differences by maternal age, birth order, and preceding birth interval. The present regional analysis adds a contextual layer, but these separate marginal distributions cannot be combined to infer a region-specific education effect, wealth effect, or adjusted reproductive effect. Such a claim would commit an ecological or cross-tabulation inference error.

The appropriate synthesis is therefore layered: national socioeconomic and reproductive associations describe population-wide differentials; harmonized regional mortality series describe geographic heterogeneity; external evidence identifies mechanisms worth testing. The chapter should avoid statements such as “regional mortality is high because regional maternal education is low” unless that relationship is directly estimated with defensible data and adjustment.

7.23 Methodological limitations and research priorities

First, the 75 historical cells passed documented input gates, but these gates do not replace a comprehensive design-based uncertainty analysis. Second, regional estimates and the national estimate are statistically dependent; the provided workbook lacks their joint covariance. Third, regional harmonization involves classification decisions that should remain auditable. Fourth, the outcome is all-cause U5MR, not a cause-of-death distribution. Fifth, no validated regional education, wealth, residence, facility-access, or environmental exposure effects are estimated in this part.

The strongest next steps are (a) audit regional unweighted births, mortality exposure, and observed death events by survey; (b) derive confidence intervals and region–national contrasts using the full survey design; (c) validate a separate urban–rural national series if it is to be included; and (d) triangulate geographic mortality with time-matched health-system and environmental indicators. These tasks would deepen explanation without fragmenting the data into unreliable region-by-socioeconomic cells.

7.24 PART III synthesis

The certified record documents a major national decline in under-five mortality alongside persistent geographic variation. Current regional rates differ markedly, historical trajectories are not identical, and some series contain reversals. These findings justify a place-sensitive public-health response, but they do not identify which geographic, health-system, or environmental exposures caused the observed differences. The scientific contribution of Part III is to preserve the distinction between measured geographic differentials and plausible contextual mechanisms while maintaining the sample-size safeguards established for Chapter 7.

7.25 Purpose and scope of the integrated synthesis

This part draws together the national socioeconomic gradients examined in Part I, the reproductive and maternal characteristics examined in Part II, and the regional mortality context examined in Part III. Its purpose is to establish what the observed differentials reveal, identify the most consequential descriptive contrasts, and distinguish findings from explanations that require additional data. The five national stratification datasets were estimated for the ten years preceding the 2024–25 EDHS interviews. They are not five-survey historical trend series. Regional historical trends, by contrast, derive from the separately certified Chapter 6 panel and should retain that distinct provenance.

The analytical distinction between differential and determinant is consequential. A differential is an observed difference in mortality across groups; a determinant is a factor contributing causally to mortality under an appropriate identification strategy. Education, wealth, maternal age, birth order, and spacing can each be associated with child survival, but their unadjusted gradients are intertwined through fertility behavior, place, access, nutrition, and social circumstances (Mosley & Chen, 1984; Victora et al., 1997). The results in this chapter document differentials and motivate hypotheses; they do not estimate independent causal effects.

7.26 Comparative magnitude of national under-five mortality differentials

Table 7.25 brings the principal national contrasts onto one scale. Each rate is expressed per 1,000 live births, and each ratio divides the higher-risk comparison category by its specified reference category. The contrasts are deliberately transparent but are not statistically adjusted. Ratios from different stratifiers are not additive, and the groups overlap: a child may simultaneously belong to a low-wealth household, have a mother with no formal schooling, be of high birth order, and follow a short preceding birth interval.

Table 7.25. Selected national under-five mortality contrasts, EDHS 2024–25

Characteristic	Higher-rate category	Reference category	Difference ¹	Ratio ¹
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Maternal education	No education (61.56)	More than secondary (29.8)	31.76	2.07
Household wealth	Lowest quintile (65.42)	Highest quintile (34.02)	31.40	1.92
Maternal age at birth	40–49 years (71.71)	20–29 years (45.98)	25.73	1.56
Birth order	Seventh or higher (85.79)	Second–third (44.83)	40.96	1.91
Preceding birth interval	Under 2 years (86.97)	4+ years (30.68)	56.29	2.83

¹ Descriptive unadjusted absolute difference (per 1,000 live births) and ratio. Selected comparisons are not interchangeable with adjusted effects. Source: uploaded EDHS 2024–25 national mortality stratification CSV files (03, 04, 05, 07, and 08).

7.27 Socioeconomic gradients: broad disadvantage without perfect monotonicity

Maternal education and household wealth display substantial endpoint disparities. U5MR among children of mothers without formal schooling was 61.56, compared with 29.80 among children of mothers with more than secondary education—a difference of 31.76 and a ratio of 2.07. Across the lowest and highest wealth quintiles, U5MR was 65.42 versus 34.02, a difference of 31.40 and a ratio of 1.92. These contrasts are consistent with the importance of material resources, knowledge, autonomy, and access as pathways connecting social position to survival, but the DHS comparisons do not isolate those pathways (Mosley & Chen, 1984; Victora et al., 1997).

Neither gradient is strictly monotonic. Secondary maternal education was associated with a slightly lower observed U5MR (26.82) than more than secondary education (29.80). The middle wealth quintile (65.60) exceeded both the lowest (65.42) and second (48.02) quintiles. These departures should be reported without smoothing. Differences in age and parity composition, birth timing, residence, exposure, and random sampling variation are possible explanations, not demonstrated findings. The supplied point-estimate CSV files do not contain design-based standard errors or death-event counts needed to test these local contrasts. A sample base above a threshold does not establish precision for a comparatively rare event.

Why the two socioeconomic dimensions should not be combined mechanically

Maternal education and household wealth are correlated but conceptually distinct. Education may influence literacy, health knowledge, negotiation, and care-seeking; wealth may influence nutrition, transportation, sanitation, and the ability to obtain timely treatment. Their observed gradients can share common pathways and confound one another. Without a prespecified multivariable model and valid variance estimation, the two contrasts cannot be interpreted as separate attributable fractions or summed to estimate an overall socioeconomic burden.

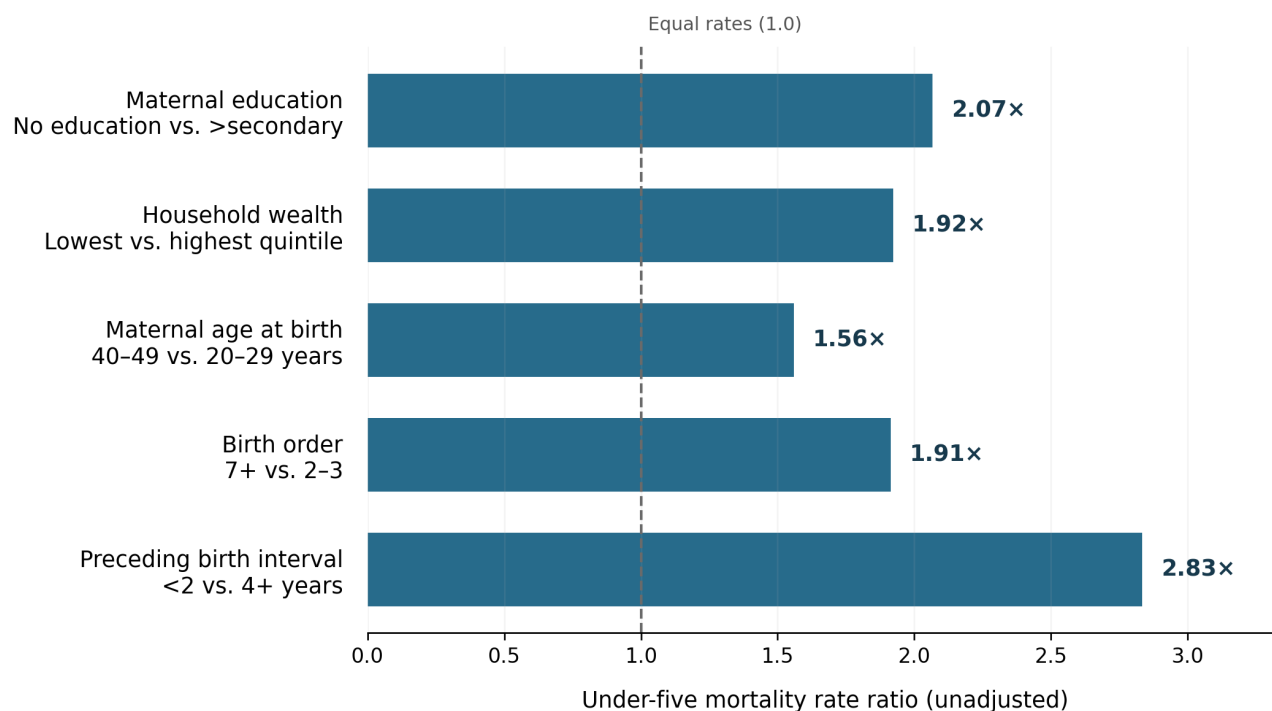
7.28 Reproductive differentials and their interdependence

The largest selected national contrast concerns preceding birth interval. U5MR was 86.97 following an interval shorter than two years and 30.68 following an interval of at least four years, a difference of 56.29 per 1,000 and a ratio of 2.83. The birth-order contrast was also pronounced: 85.79 among seventh-or-higher-order births versus 44.83 among second- or third-order births (ratio 1.91). Maternal age showed elevated rates at both ends of the reproductive age distribution, including 71.71 for births at ages 40–49 versus 45.98 at ages 20–29 (ratio 1.56), and 66.44 for births before age 20 (ratio 1.44 relative to ages 20–29).

These associations should be interpreted jointly in substantive discussion but not treated as independent effects. Higher-order births are more common at older maternal ages, and preceding birth intervals are shaped by fertility histories and reproductive circumstances. Short spacing may act through maternal depletion, competition for care and resources, or other pathways; nonetheless, unadjusted contrasts may also reflect shared household or maternal risk factors. Prior demographic and epidemiological research identifies birth spacing as an important child-survival correlate, while emphasizing the need to account for confounding and selection (Conde-Agudelo et al., 2006; Rutstein, 2005).

A comparative figure for the five major contrasts

Figure 7.11. Selected descriptive U5MR ratios across five national characteristics



Note. Ratios compare different specified categories within each stratifier; they are descriptive, unadjusted, and not causal estimates. Categories and absolute rates appear in Table 7.25. Each ratio represents the under-five mortality rate (U5MR) in the higher-mortality category divided by the rate

in the specified reference category. Comparisons are: no maternal education versus more than secondary education; lowest versus highest household wealth quintile; maternal age 40–49 versus 20–29 years; seventh-or-higher versus second–third birth order; and preceding birth interval under two years versus four or more years. A ratio of 1.0 indicates equal mortality rates; values above 1.0 indicate higher mortality in the numerator category. All ratios are descriptive, unadjusted, and should not be interpreted as causal effects.

7.29 Geographic inequality as context rather than socioeconomic cross-classification

Part III established that mortality improvement over the quarter century coexisted with marked differences among the 14 current regions. Those regional histories are important context for interpreting national socioeconomic and reproductive differentials. However, they cannot establish that a particular region’s mortality level is explained by its educational composition, household wealth, or reproductive practices. Such ecological inference would require appropriate individual- and contextual-level data and a clearly specified model.

As agreed in the chapter’s methods, region-by-education and region-by-wealth mortality cross-classification is excluded. The rationale is statistical rather than conceptual: dividing the relatively rare death events across 14 regions and four or five socioeconomic categories risks sparse exposure, unstable rates, and misleading rankings, especially for neonatal deaths. National stratification preserves stronger sample bases. This design decision does not imply that socioeconomic mortality gradients are identical across regions; it means the present data are insufficiently precise to estimate their full regional heterogeneity.

Health-system accessibility, effective coverage, environmental hazards, food insecurity, displacement, and service disruption offer plausible mechanisms for geographic inequalities. Yet these mechanisms were not linked and jointly estimated in the current analysis. A regional mortality association is not evidence of an effect from a specific facility, intervention, climate exposure, or conflict event. Such claims require temporally aligned exposure measures and a design capable of addressing confounding (Mosley & Chen, 1984; Victora et al., 1997).

7.30 Measurement, uncertainty, and methodological limitations

Denominators, time windows, and age segments

The five mortality indicators are related but distinct: neonatal mortality concerns the first 28 completed days; postneonatal mortality concerns the remainder of infancy; infant mortality concerns the first year; child mortality concerns death between exact ages one and five conditional on surviving to age one; and under-five mortality concerns death before age five. All are expressed per 1,000 in the supplied outputs, with the child-mortality denominator conditional on survival to age one. The DHS synthetic-cohort approach uses age-specific exposure and mortality probabilities; the estimates should not be treated as crude deaths divided by all recorded births (Croft et al., 2018).

Precision and the observed-event problem

The uploaded CSVs contain estimates and unweighted sample bases but do not contain jackknife standard errors, confidence intervals, or counts of deaths by category. The original R script has a jackknife option, but it was set to FALSE for the supplied point-estimate run. Without those outputs, this synthesis makes no claims of statistical significance. In addition, comparisons of adjacent education or wealth categories may be sensitive to the distribution of death events even when the number of children is large.

Selection, confounding, and temporality

Maternal age at birth, birth order, and birth interval are related by construction and by family-formation histories. Educational attainment and wealth can be affected by time-varying circumstances and can correlate with residence, fertility, and access. Wealth measured at the survey date may not perfectly represent household resources when a death occurred during the preceding decade. Birth histories can also be affected by recall, age-at-death heaping, and omission. These issues constrain interpretation of the descriptive results and motivate sensitivity analyses (Croft et al., 2018).

Historical versus cross-sectional claims

The national socioeconomic and reproductive stratifications are 2024–25 survey estimates covering a retrospective ten-year window. They do not establish how education-specific or wealth-specific mortality gradients evolved from 2000 to 2024–25. Historical claims are restricted to the independently certified regional mortality series used in Chapter 6 and Part III. No projections or synthetic mortality results are introduced.

7.31 Public-health priorities and research agenda

Three policy-relevant themes emerge. First, the magnitude of the education and wealth contrasts argues for examining equitable access to effective child-survival interventions, particularly among socially disadvantaged households. Second, the pronounced short-birth-interval differential supports close attention to voluntary, rights-based family planning, postpartum counseling, and continuity of maternal and child care. Third, the geographic heterogeneity described in Part III suggests that national program performance should be accompanied by region-sensitive monitoring and service-quality assessment. None of these observations establishes that changing a single determinant would produce the entire observed rate difference.

The most immediate research priority is precision assessment. Re-running the established DHS.rates script with jackknife estimation, subject to computational and design checks, would provide standard errors and confidence intervals for the national stratifications. An audit of unweighted births, exposure, and death events by category would help assess unexpected non-monotonic estimates. Subsequent multivariable analyses could distinguish the roles of education, wealth, age, parity, and spacing, but would require explicit causal diagrams, careful temporal ordering, and evaluation of collinearity and selection.

A further priority is linking mortality outcomes to independently validated service and contextual measures without collapsing individual and ecological inference. Where sample sizes are inadequate,

transparent descriptive reporting is preferable to unstable high-dimensional cross-tabulation. This approach is consistent with the chapter's governing principle: the objective is not to produce the greatest number of estimates, but to produce estimates that can withstand scientific scrutiny.

7.32 PART IV conclusion

Ethiopia's childhood mortality differentials reveal overlapping social and reproductive disadvantages. In the 2024–25 national EDHS data, short preceding birth intervals, high birth order, low maternal education, and low household wealth are associated with substantially elevated under-five mortality; maternal age exhibits a non-linear pattern. These findings are most persuasive as a coherent descriptive profile rather than as a ranking of causal effects. Together with the certified regional histories, they identify where stronger measurement, equitable services, and carefully designed follow-up analyses are warranted. The scientific value of Chapter 7 lies equally in its documented inequalities and in its explicit boundaries on what those inequalities can prove.

Discussion

Mortality decline and the persistence of unequal survival

The findings of Chapter 7 qualify the aggregate account of Ethiopia's mortality transition developed in Chapter 6. Although national childhood mortality declined substantially over the quarter century, the 2024–25 Ethiopia Demographic and Health Survey (EDHS) reveals pronounced differences in survival across maternal education, household wealth, reproductive history, and geography. National progress and unequal survival are therefore not contradictory findings: the first describes the direction of change in the population average, while the second identifies how mortality remains distributed across population groups. The present chapter's distinctive contribution is to bring these dimensions into one empirically disciplined interpretation, while keeping the different survey reference periods and levels of analysis separate.

The observed inequalities are compatible with the established view that child survival emerges from interconnected social and proximate mechanisms. The Mosley–Chen framework places education, resources, and community conditions upstream of maternal, nutritional, environmental, injury-related, and illness-management pathways (Mosley & Chen, 1984). A hierarchical epidemiological approach further cautions that distal determinants may act through intermediate variables, so their role cannot be understood simply by ranking bivariate coefficients or adjusting indiscriminately for everything measured (Victora et al., 1997). These perspectives are particularly pertinent here because the five stratifiers considered in the chapter overlap substantively and statistically.

Socioeconomic disadvantage: substantial endpoint gaps, imperfect gradients

Under-five mortality was 61.56 per 1,000 live births among children of mothers with no formal education and 29.80 among those whose mothers had more than secondary education, an absolute difference of 31.76 per 1,000 and a descriptive ratio of 2.07. Across household wealth, the corresponding estimates were 65.42 in the lowest quintile and 34.02 in the highest, a difference of 31.40 and a ratio of 1.92. These are large observed endpoint contrasts. They are consistent with social

gradients in access to information, material resources, living conditions, and timely preventive and curative services, although the chapter does not measure the independent contribution of any particular pathway (Mosley & Chen, 1984; Victora et al., 1997).

Importantly, neither socioeconomic series follows an uninterrupted monotonic gradient. Under-five mortality among mothers with secondary education (26.82) was slightly lower than among those with more than secondary education (29.80). The middle wealth quintile (65.60) had a higher observed rate than the second (48.02) and marginally higher than the lowest quintile (65.42). These estimates should be preserved rather than smoothed to conform to theoretical expectations. Sampling variability, differences in maternal age or parity, compositional heterogeneity, and mortality-event sparsity are plausible possibilities, but they have not been established as explanations. Without design-based standard errors and an audit of deaths and exposure within categories, neither the small educational reversal nor the middle-quintile elevation should be declared statistically significant or substantively causal.

Education and wealth should not be conflated. Education may affect care-seeking and decision-making, while wealth may influence food security, transport, sanitation, and affordability; both may also correlate with residence and reproductive histories. Consequently, the observed education and wealth gaps cannot be summed, treated as independent attributable fractions, or interpreted as mutually adjusted associations. A subsequent hierarchical analysis would need to specify which pathways are of interest before choosing covariates (Victora et al., 1997).

Reproductive histories: birth spacing as the largest selected contrast

Of the selected national under-five mortality comparisons, preceding birth interval exhibited the largest descriptive ratio. The rate was 86.97 per 1,000 for births preceded by an interval shorter than two years, compared with 30.68 for intervals of four or more years: a difference of 56.29 per 1,000 and a ratio of 2.83. Higher-order births also experienced elevated mortality (85.79 for seventh-or-higher order versus 44.83 for second–third order; ratio 1.91). Mortality among births to mothers aged 40–49 years (71.71) exceeded that for ages 20–29 (45.98; ratio 1.56). These contrasts identify reproductive histories as important dimensions of inequality in the observed data.

The particularly pronounced birth-interval gradient is consonant with multicountry DHS analyses reporting associations between shorter preceding intervals and elevated neonatal, infant, and child mortality (Rutstein, 2005), as well as a systematic review and meta-analysis of adverse perinatal outcomes associated with short birth spacing (Conde-Agudelo et al., 2006). The present results nevertheless should not be interpreted as the mortality reduction that would automatically follow an intervention to lengthen birth intervals. Birth spacing may be entangled with maternal health, socioeconomic conditions, breastfeeding, survival of preceding children, fertility preferences, and access to reproductive services. The difference between an observed association and an intervention effect remains central.

Maternal age, parity, and spacing are not independent exposures. High birth order tends to accumulate at older maternal ages, and interval length depends on the sequence and timing of previous births. Analyses that simply compare their unadjusted rate ratios risk implying a competition among ‘determinants’ that the data cannot support. A causal model specifying confounders,

mediators, and selection mechanisms would be needed to estimate distinct contributions. The chapter therefore uses the ratios to describe contrasts within categories, not to rank the causal importance of education, wealth, age, parity, and spacing.

Geographic inequality: progress, divergence, and explanatory restraint

The certified regional historical series considered in Part III demonstrates that Ethiopia's mortality transition has not proceeded uniformly across its current regions. Regional endpoint differences, long-run reductions, and occasional reversals require interpretation against changing administrative boundaries and the reconstruction of the former Southern Nations, Nationalities, and Peoples' Region into successor geographies. These are features of the historical measurement problem as well as of the underlying population experience. A national average can improve even when some regions face much slower progress or setbacks.

Health-service availability, travel barriers, effective coverage, nutrition, sanitation, conflict-related disruption, and environmental exposure offer credible hypotheses for geographic differences. However, the chapter does not jointly link those exposures to child-level mortality outcomes in a model capable of identifying their effects. It would therefore be inappropriate to attribute any region's observed mortality level to one specific factor, or to infer that regional differences demonstrate the effectiveness or failure of a particular service intervention. Ecological contrasts and individual-level associations answer different questions (Victora et al., 1997).

For the same reason, this chapter deliberately excludes region-by-education and region-by-wealth mortality tables. Dividing relatively uncommon deaths—especially neonatal deaths—among 14 current regions and multiple socioeconomic categories would invite sparse cells and unstable rankings. This choice protects inferential credibility without assuming that socioeconomic gradients are geographically homogeneous. It also identifies an important future research question: whether geographic context modifies individual socioeconomic associations, a question that will require sufficient mortality events or appropriately designed pooled data.

Interpretation across the five mortality indicators

The chapter examines neonatal, postneonatal, infant, conditional child (ages one to four), and under-five mortality rather than relying on U5MR alone. This is substantively important because mortality during the neonatal period may be especially sensitive to conditions around pregnancy and childbirth, whereas mortality at later ages may involve different patterns of exposure and care. Nevertheless, the age-specific indicators are related components of child survival, not independent outcomes; differences among them should be interpreted with attention to their distinct denominators and probability structures.

The DHS estimates use a synthetic-cohort approach, combining age-segment probabilities from retrospective birth histories, rather than a simple ratio of recorded deaths to births. The ten-year subgroup window increases the amount of information available for mortality estimation but also means that the estimates average experience over an extended period preceding the 2024–25 survey (ICF, n.d.). Thus, the national socioeconomic and reproductive estimates should not be described as mortality risks arising exclusively in 2024 or 2025, nor used as evidence of historical changes in subgroup inequalities without comparable earlier stratified series.

Strengths, limitations, and priorities for further analysis

A major strength is the chapter's reliance on observed national EDHS mortality stratifications and separately certified regional histories, rather than simulated values or unverified subgroup reconstructions. Reporting absolute rate differences alongside ratios makes the magnitude of observed inequality more interpretable. Preserving unexpected category patterns, explicitly stating reference groups, and separating descriptive findings from causal hypotheses further strengthen transparency.

The most immediate limitation is uncertainty. The available national output files contain point estimates but not design-based confidence intervals or standard errors; they also do not provide the category-specific death counts needed for a complete sparsity assessment. No significance tests are therefore reported. DHS mortality estimates additionally depend on accurate reporting of births, survival status, dates, and ages at death; recall errors, displacement of birth dates, and heaping of ages at death can affect estimation (ICF, n.d.). Survey-date household wealth may imperfectly represent resources at the time a death occurred. Cross-sectional socioeconomic and reproductive comparisons also remain vulnerable to confounding, selection, and overlapping causal pathways.

The next analytic step should be to rerun the established estimation workflow with the design-based jackknife option enabled, validate confidence intervals and exposure bases, and examine unweighted deaths by subgroup. The educational and middle-wealth departures from monotonicity deserve targeted audit before being given stronger substantive interpretations. If those diagnostics are satisfactory, prespecified multivariable and sensitivity analyses could test selected hypotheses, using a causal framework to determine adjustment sets rather than treating every available covariate as a confounder. For geographic questions, any linkage of health facilities, accessibility, conflict, or environmental conditions must be spatially and temporally aligned with the mortality exposure period.

Public-health implications and concluding interpretation

The findings support an equity-oriented interpretation of child survival policy. The education and wealth contrasts reinforce the importance of ensuring that preventive and curative services reach disadvantaged households. The large birth-spacing differential strengthens the case for attention to voluntary, rights-based family planning, postpartum counseling, and integrated maternal–child care. Regional heterogeneity argues for monitoring that goes beyond national targets to assess geographic coverage, quality, and resilience of services. These are reasonable priorities informed by the patterns observed, not estimates of intervention effectiveness or of deaths preventable through any single action.

Chapter 7 thus extends the story of mortality decline into a more demanding question: whose survival improved, whose risks remain elevated, and what evidence is needed to explain the differences? The answer emerging from the available EDHS data is that mortality inequality has multiple, overlapping socioeconomic, reproductive, and geographic dimensions. Their interpretation requires both empirical specificity and methodological restraint. Ethiopia's next gains in child survival will be judged not only by further reductions in the national average, but also by whether children born into different circumstances share more equitably in those gains.

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Internal data provenance (not bibliographic references)

National EDHS 2024–25 childhood mortality stratifications:

03_mortality_by_mothers_age_at_birth.csv; 04_mortality_by_birth_order.csv; 05_mortality_by_previous_birth_interval.csv; 07_mortality_by_mothers_education.csv; and 08_mortality_by_wealth_quintile.csv. Derived from the Ethiopia DHS Birth Recode using DHS.rates::chmort() with a 120-month reference period. Part I specifically uses 07_mortality_by_mothers_education.csv and 08_mortality_by_wealth_quintile.csv; the source R estimates were retained without additional rounding beyond displayed precision. The jackknife option was disabled in the supplied run, so design-based standard errors and confidence intervals were not generated.

Historical regional mortality:

PROSPECTS2030_02_CH01_U5MR_STAGE02_DIAGNOSTICS_BACKTEST_ELIGIBILITY_v1_0_1.xlsx (Historical_Diagnostics and Input_Gates; certified 75-cell panel), together with Chapter 6, Part II, historical regional profiles.

Chapter 7, Parts I–IV, and Chapter 6 are internal analytical manuscript materials. They are not listed as external peer-reviewed publications.

Editorial note: Ten distinct bibliographic works were retained after removing repetitions. Internal analytical files are identified separately. The Kruk et al. entry retains the abbreviated author list supplied; its full author list should be verified for strict APA 7 compliance.