

Changing Trends and Patterns of Infant and Child Mortality in Nepal: Evidence from Nationally Representative Surveys, 1996–2022

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Abstract

Nepal has experienced the changing trends of infant and child mortality over the past three decades. Understanding these trends and patterns is crucial for sustaining progress and guiding future policy. This study examines trends and patterns in infant and child mortality in Nepal (1996-2022) and their association with maternal, geographical, and socio-economic factors. A trend and pattern analysis using the Nepal Family Health Survey (NFHS) 1996 and the Nepal Demographic and Health Survey (NDHS) 2001, 2006, 2011, 2016, and 2022 assessed infant mortality rate (IMR) and child mortality rate (CMR) across maternal, geographical, and socio-economic factors. National IMR declined from 93.0 per 1,000 live births in 1996 to 28.0 in 2022, while CMR declined from 50.9 per 1,000 in 1996 to 5.0 in 2022. The most rapid reduction in IMR occurred from 1996 to 2006, followed by a continued decline after 2006. Overall, the reduction in IMR was slower than the decline in CMR, reflecting ongoing risk among infants. Nepal has made tremendous progress in reducing infant and child mortality rates, as reflected in the study findings. However, further reduction in IMR and CMR will require continued, equity-focused efforts, including maternal and child health care services. Strengthening maternal and child health services, promoting optimal birth spacing, enhancing awareness through educational programs, and addressing socio-economic and geographical disparities remain critical for achieving sustainable development goals.

Keywords: child mortality, demographic and Health Survey, infant mortality, patterns, trends

Introduction

Infant and child mortality rates are crucial indicators of population health (Reidpath, & Allotey, 2003), indicating the health systems of the nations and their socio-economic status (Rajapakse, & Jayathilaka, 2025). While there has been global progress over the last three decades (Sharro et al., 2022), high rates of infant and child mortality, especially in low- and

middle-income countries, are still a major public health issue (Atrash, 2013; Langlois et al., 2025). Reduction in under-five mortality by nearly 60 percent has occurred globally since 2015 (United Nations Inter-agency Group for Child Mortality Estimation, 2025); however, progress has slowed in recent years. To address these issues, Sustainable Development Goal (SDG) 3.2 aims to end preventable deaths of newborns and



children under five by 2030, with the target of 12 neonatal mortality (Lawn et al., 2023) and 25 under-five mortality per 1,000 live births (The Statistics Division of the United Nations Department of Economic and Social Affairs, 2022).

In this global context, Nepal has made substantial strides in reducing infant and child mortality rates in Nepal from 1990 to 2022 through improving the health of infants and children (Basra et al., 2024), resulting primarily from the increased availability of quality maternal and child health care services, expanded immunization coverage, and improved access to basic health care (Devkota, & Panda, 2016). Analyses based on Nepal Demographic and Health Surveys indicate a consistent decline in under-five mortality over time (Upadhyay, 2025), reflecting broader improvements in health systems and living conditions (Sreeramareddy et al., 2015; Thapa, 2008). NDHS 2006 and 2011 identified key socio-economic disparities in infant mortality (Lamichhane et al., 2017), while another study also highlighted regional and socio-economic disparities in child survival outcomes (Goli et al., 2015). Further reduction will require targeted efforts focused on infants' health and quality of care.

South Asian countries have the highest burden of global child mortality, with large disparities that can be attributed to socio-economic inequities, geographical barriers, and differences in access to quality health services (United Nations Inter-agency Group for Child Mortality Estimation, 2023). Nepal's achievements and ongoing challenges in infant and child mortality should be understood within a broader regional and global context. Disparities in infant and child mortality persist in Nepal across place of residence, province, maternal education, and household wealth quintile (Ministry of Health and Population et al., 2023). These inequalities emphasize the need to examine long-term trends in infant and child mortality alongside contextual changes in health policy and service delivery systems.

The government of Nepal has developed multiple policy frameworks, including the National Neonatal Health Strategy 2015 (Family Health Division, 2004) and the Safe Motherhood and Newborn Health Roadmap 2030 (Ministry of Health and Population, 2019), in addition to Nepal's Every Newborn Action Plan (Ministry of Health, 2016). The policies emphasize expanding access to skilled birth attendants, promoting institutional delivery, antenatal and postnatal care, and strengthening referral systems to reduce preventable maternal and child mortality (Ministry of Health, 2016; Thasineku et al., 2025). However, despite expanded maternal and child health coverage, there are still significant gaps regarding implementation, quality of care, workforce capacity, and equitable access to needed services, especially in remote and marginalized populations (Khatri et al., 2022; Ministry of Health and Population et al., 2023).

Infant and child mortality patterns have evolved from 1996 to 2022, which is critical for assessing the effectiveness of past interventions, identifying periods of accelerated progress, and informing future policy directions. Therefore, this study aims to analyze the dynamics of trends and patterns of

infant and child mortality in Nepal. It mainly focused on specific determinants with evidence on long-term trends and patterns across maternal factors, geographical factors, and socio-economic factors using data from national representative surveys conducted from 1996 to 2022, to generate evidence to support targeted, equity-oriented, and policy-relevant strategies for accelerating progress in reducing infant and child mortality.

Methods

Study Design and Data Sources

This study used cross-sectional data from nationally representative surveys conducted in Nepal from 1996 to 2022 to analyze trends and patterns in infant and child mortality. Data for this analysis were obtained from the Nepal Family Health Survey (NFHS) 1996 and the Nepal Demographic and Health Survey (NDHS) 2001, 2006, 2011, 2016, and 2022. Each survey was followed by standardized DHS methodologies, ensuring comparability across survey years.

Study Population

The study population included live births reported by women of reproductive age (15-49 years) within the reference periods of each survey. Infant mortality rates (IMR) and child mortality rates (CMR) collected for each reference period were the primary data used in the analysis.

Outcome Measures

The primary outcome measures of this study were IMR (number of deaths of children under one year of age per 1,000 live births) and CMR (number of deaths of children aged 1-4 years per 1,000 children aged 1-4 years). IMR and CMR were calculated and reported in the DHS surveys using direct estimation methods.

Explanatory Variables

Trends and patterns in IMR and CMR were examined across maternal factors (mother's age at childbirth, birth order, and previous birth interval), geographical factors (rural/urban residence, ecological region, and province), and socio-economic factors (mother's education, wealth quintile, and child's sex), which were explanatory variables.

Data Analysis

Descriptive analysis was used to analyze the changing trends and patterns of IMR and CMR over time across survey years and population subgroups. Differences in infant and child mortality rates across survey years and population subgroups were assessed.

Results

The IMR decreased from 93 per 1,000 live births in 1996 to 28 per 1,000 in 2022, while the CMR decreased from 50.9 to 5 per 1,000 live births over the same period. These declines are more than threefold for IMR and more than tenfold for CMR, showing Nepal's progress in improving child survival over the past three decades. The sharpest declines in both IMR and CMR occurred between 1996 and 2006, followed by a continued but gradual reduction in subsequent survey periods. Although both IMR and CMR showed continuous declines across all survey periods, the rate of decline was steeper for

child mortality than for infant mortality, as shown in Figure 1, reflecting that improvements in child mortality were more noticeable than those in infant mortality.

Table 1 shows that mortality rates of infants born to very young mothers (<20 years) and older mothers (30+ years) are consistently higher compared to those born to mothers aged 20-29 years across all survey years. However, IMR declined among those born to mothers of all the age groups; the lowest IMR was observed among those born to mothers aged 20-29 years. A clear pattern was also observed by birth order: in all surveys, infants in the first and higher birth orders (4 and above) had higher IMR than infants in the second to third birth orders. Despite the overall decline, mortality rates of infants are relatively high at high-parity births in recent surveys. IMR appears to decrease as the previous birth interval increases. Infants born after short birth intervals (<2 years) consistently had the highest IMR across all the survey periods. However, infants born after higher birth intervals (4+ years) had lower IMR than those born after short birth intervals, demonstrating the continued positive effect of a long birth interval.

IMR may vary by maternal education level, with IMR consistently lower in infants born to mothers with higher educational levels. This reduction was most common in infants born to mothers with a secondary or higher level of education, highlighting a strong inverse relationship between maternal education and IMR. Infants from the family's lowest wealth quantile had a consistently higher IMR than those from the highest wealth quantile. Earlier surveys had shown higher IMR among male infants, while recent surveys indicated inconsistent differences between male and female infants, suggesting fluctuations in survival outcomes across gender gaps.

Table 2 shows that the child mortality rate is higher for those whose mothers are aged 30-39 years than for those whose mothers are aged 20-29 years. A declining trend was also observed in birth order; higher birth orders (4 and above) had higher CMR than first- and second-to-third birth orders across the surveys. Despite the overall decline, child mortality rates are relatively high at high-parity births in surveys. A short interval in a previous birth remained associated with a higher child mortality rate. Children born within less than two years of the previous birth interval consistently showed the highest mortality rates across all surveys, while those born after a long birth interval (four years and more) were associated with the lowest child mortality, especially in recent years. It was higher in rural areas than in urban areas in earlier survey periods; however, in 2016 and 2022, the gap in CMR narrowed noticeably. Across ecological regions, the mountain region consistently recorded the highest CMR despite notable improvements over time. The Hill region had the lowest CMR throughout the survey periods, while the Terai region had an average CMR, reflecting regional disparities. The lowest CMRs were observed in Bagmati, Gandaki, and Lumbini provinces in 2022, whereas Karnali and Sudurpaschim observed relatively high levels of child mortality.

Mothers with no formal education consistently experienced

the highest CMR, while those whose mothers had secondary or higher education had the lowest CMR, especially in recent surveys. Children from the poorest households consistently observed a higher CMR than those from the richest wealth quantile households in 2022. CMR regarding child sex at birth showed a higher CMR in earlier surveys among female children, while recent surveys indicate smaller and inconsistent differences between male and female children, showing a narrowing gender gap.

Discussion

The findings of this study show that both IMR and CMR declined sharply over the study period, reflecting many years of dedicated work to improve maternal and child health services, socioeconomic factors, and public health programs. Thus, this trend indicates long-term structural growth rather than temporary fluctuations in rates.

Declining National Trends in IMR and CMR

Between 1996 and 2006, there was a considerable reduction in overall IMR and CMR in Nepal. During this time frame, there were increased public health interventions that were taken by Nepal to reduce preventable causes of infant and child mortality by essential child survival interventions, including immunization coverage (Patel et al., 2021), vitamin A supplementation (Nguyen et al., 2012), oral rehydration therapy (B. P. Shrestha et al., 2011), and community-based management of childhood illnesses (Kandel, & Lamichhane, 2019), which were scaled up in Nepal (Singh et al., 2019). The Female Community Health Volunteer (FCHV) program in Nepal is often cited as a critical contributing element in the country's advancement of maternal and child health services (Lee, 2020; Panday et al., 2024). The percentage of children aged 12-23 months who receive all basic antigens at any time before the survey increased from 43 percent in 1996 to 80 percent in 2022 (Ministry of Health and Population et al., 2023). Vaccines prevent major infectious diseases that cause death in infancy and early childhood (Funari et al., 2025) and are a main reason for the decline in child mortality globally (Javeed et al., 2025; Shattock et al., 2024), including in Nepal. Nepal's nationwide zinc scale-up for childhood diarrhea increased zinc use from 0.4 percent in 2005 to nearly 16 percent in 2008, improving diarrhea management and reducing diarrhea-related child morbidity and mortality (Global Report, 2009; Wang et al., 2011). Malnutrition has been an important contributor to infant and child mortality (Neupane et al., 2021). As observed during the study period, Nepal experienced a significant increase in per capita income (Partap, & Hill, 2012) due to overall economic development, leading to a substantial reduction in poverty. Higher per capita household income enables parents to provide adequate food, thereby reducing child malnutrition and related morbidity and mortality. Studies provide evidence that poverty and improvements in household socioeconomic conditions are indirectly associated with infant and child mortality (Headey, & Hoddinott, 2015).

Maternal Factors and Reproductive Behaviors Differentials

Table 1*Trends and Patterns of Infant Mortality Rate, 1996–2022*

Characteristics	Infant Mortality Rate					
	NFHS, 1996	NDHS, 2001	NDHS,2006	NDHS, 2011	NDHS,2016	NDHS,2022
Mother's age at birth						
<20	120.1	108.2	83	69	54	43
20-29	79.5	67.6	50	49	33	28
30-39	103.9	72.9	62	49	42	33
40-49	-	-	91	-	-	-
Birth order						
1	100.7	88.8	67	59	43	34
2-3	83.2	71.6	48	49	29	26
4-6	91.2	69.4	62	46	44	47
7+	116.7	94.1	106	83	116	-
Previous birth interval						
<2 years	141.4	124.4	96	87	68	61
2 years	78.8	67.8	57	50	35	29
3 years	44.7	45.2	38	38	27	25
4+ years	-	38.9	28	26	18	17
Residence						
Urban	61.1	50.1	37	38	28	25
Rural	95.3	79.3	64	55	38	34
Ecological Region						
Mountain	136.5	112.0	99	73	57	47
Hill	87.4	66.2	47	50	32	27
Terai	90.9	80.8	65	53	41	33
Province						
Koshi	-	-	-	-	31	28
Madhesh	-	-	-	-	43	38
Bagmati	-	-	-	-	29	21
Gandaki	-	-	-	-	23	19
Lumbini	-	-	-	-	42	34
Karnali	-	-	-	-	47	36
Sudurpaschim	-	-	-	-	58	40
Mother's education						
No education	97.5	84.6	69	62	50	41
Primary ¹	80.0	61.0	58	53	39	36
Some secondary ²	53.4	49.9	35	37	33	21
SLC and above ³	-	11.2	13	31 ⁴	18	-
Wealth Quantile						
Lowest	-	-	71	61	50	45
Second	-	-	62	56	45	41
Middle	-	-	70	55	42	26
Fourth	-	-	51	53	31	23
Highest	-	-	40	32	20	15
Child's sex						
Male	101.9	79.2	60	54	31	30
Female	83.7	75.2	61	52	34	27
Nepal	93.0	64.4	48	46	32	28

Note. ¹ Basic education (1-8); ² Secondary education (9-12); ³ Secondary+; ⁴ SLC: School Leaving Certificate; -: Not applicable.

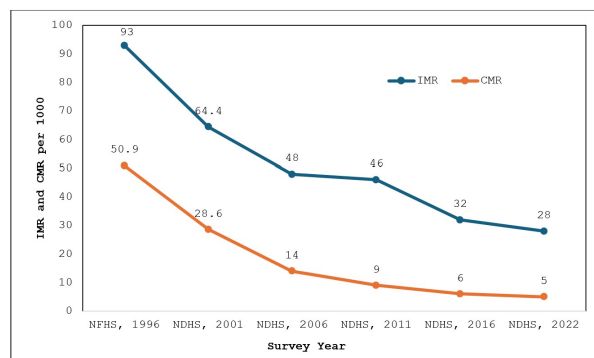
Table 2
Trends and Patterns of Child Mortality Rate, 1996-2022

Characteristics	NFHS, 1996	NDHS, 2001	NDHS, 2006	NDHS, 2011	NDHS, 2016	NDHS, 2022
Mother's age at birth						
<20	44.1	28.5	20	9	7	7
20-29	52.4	32.6	18	8	7	5
30-39	54.5	42.5	23	13	7	8
40-49	-	-	42	-	-	-
Birth order						
1	36.1	22.9	15	7	6	5
2-3	48.1	28.6	17	7	7	6
4-6	63.9	44.8	25	16	12	7
7+	57.3	51.1	34	20	9	-
Previous birth interval						
<2 years	74.7	54.8	37	16	11	12
2 years	52.4	40.0	21	13	9	6
3 years	32.1	22.4	14	6	4	8
4+ years	-	20.1	9	7	7	3
Residence						
Urban	22.5	16.7	10	7	6	5
Rural	53.2	35.4	21	10	7	4
Ecological Region						
Mountain	82.2	51.2	32	16	6	9
Hill	43.3	29.7	16	8	6	4
Terai	53.0	34.8	21	10	8	7
Province						
Koshi	-	-	-	-	5	6
Madhesh	-	-	-	-	10	5
Bagmati	-	-	-	-	7	3
Gandaki	-	-	-	-	4	5
Lumbini	-	-	-	-	3	8
Karnali	-	-	-	-	12	10
Sudurpaschim	-	-	-	-	12	9
Mother's education						
No education	56.8	39.5	25	12	10	10
Primary	21.0	13.4	10	9	4	4 ¹
Some secondary	7.7 ³	14.3	5	4	6	4 ²
SLC and above	-	3.7 ⁴	0	1 ⁴	3	-
Wealth Quantile						
Lowest	-	-	29	15	12	9
Second	-	-	22	11	10	10
Middle	-	-	22	9	4	3
Fourth	-	-	13	6	5	5
Highest	-	-	7	4	4	1
Child's sex						
Male	45.5	27.8	21	9	5	6
Female	56.5	40.2	18	10	7	4
Nepal	50.9	28.6	14	9	6	5

Note. ¹ Basic education (1-8); ² Secondary education (9-12); ³ Secondary+; ⁴ SLC: School Leaving Certificate; -: Not applicable.

Our study found infant and child mortality remained higher among births to very young mothers. Young maternal age was observed to be among the strongest risk factors of child mortality (Noori et al., 2022). Similarly, IMR and CMR remained higher among high-parity births, which is also consistent with the study, and found an elevated mortality risk for higher-order births (Sonneveldt et al., 2013). IMR and CMR also remained higher among births in the short preceding birth interval, aligning with a study showing noticeably increased IMR and CMR risks when the preceding birth interval is very short (Sonneveldt et al., 2013).

Figure 1: Trends of infant and child mortality rate in Nepal (1996-2022)



Geographical Inequalities and Regional Disparities

The mountain areas of Nepal have relatively higher IMR and CMR, which aligns with the previous study (Lamichhane et al., 2017) due to continued difficulties associated with geographic remoteness, limited health infrastructure, and climate constraints (Goli et al., 2015; Pereira et al., 2022; U. B. Shrestha et al., 2019). As previous studies (Khadka et al., 2015) showed higher IMR and CMR in rural areas compared to urban areas. This rural disadvantage was largely attributed to limited access to healthcare services, low socio-economic status, and delayed care-seeking behaviors among the rural population (Ashworth et al., 2019; Schofield et al., 2019). IMR and CMR remained higher in the Karnali and Sudurpaschim provinces of Nepal; these provincial disparities continue to exist due to several causes, including higher poverty rates and geographic difficulties, lack of adequate health care resources, and limited access to maternal and child health services in both the Karnali and Sudurpaschim provinces (NGO Federation of Nepal, 2025).

Socio-economic Inclination in Infant and Child Mortality

An educated mother determines the likelihood of seeking healthcare, sanitation, and nutritional value. Maternal education is widely accepted as the most important factor for influencing a child's chances of survival (NGO Federation of Nepal, 2025) and maternal health (Thasineku, 2022). Infant and child mortality remained higher among children from the poorest and poorer wealth quantiles of the household; this is a statistically established fact supported by the studies, which show that children from higher-income households have a higher child survival rate (Lartey et al., 2016). The difference in

IMR and CMR between the richest and the poorest households is due to poorer families' lack of access to adequate nutrition, basic sanitation, educational opportunities, and timely maternal and child health care services (Khadka et al., 2015). Earlier surveys showed noticeable differences in infant and child mortality rates by sex, while recent survey data showed an improvement and a narrowing of the gap. This differential may also reflect improvements in gender equity, access to child health services, and a decline in discriminatory care-seeking practices. There have been similar decreases in the child survival gender gap in Nepal and neighboring countries over time (Bango, & Ghosh, 2023; Jain et al., 2025).

Conclusions

From 1996 to 2022, Nepal has achieved remarkable, sustained success in reducing infant and child mortality rates, reflecting significant progress in maternal and child health programs, socio-economic development, and a better health care system. National surveys over the past years show that child survival rates have improved, with IMR and CMR consistently decreasing over time. However, significant disparities were observed regarding maternal, residential, geographical, and socio-economic factors. Children of low-aged mothers, those with short birth intervals, high birth order or parity, those residing in remote or underserved regions or areas, low-educated mothers, and socio-economically disadvantaged households continue to face a higher risk of infant and child mortality. These findings provide a clear indication that policy and program efforts should target equity-driven strategies, including strong maternal and newborn care, that achieve above-average health outcomes.

Declarations

Ethical Approval

We used secondary data for analysis; publicly available DHS data were collected without any personal identification from all samples included in the analysis. The respective survey agencies received prior permission to perform the original surveys, and no additional ethical approval was required for this analysis.

Consent to Participate

As this study was based on a nationally representative report from 1996 to 2022 of Nepal, no additional consent from participants was required.

Consent for Publication

Not applicable.

Competing Interests

Each author confirms that we have no competing interests.

Data Availability

The data for this study were obtained from the Nepal Family Health Survey, 1996, and the Nepal Demographic and Health Surveys conducted at different times, such as 2001, 2006, 2011, 2016, and 2022, all of which are publicly available reports from the DHS Program.

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