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# Forecasting Infant Mortality Rate Using Auto Regressive Integrated Moving Average for the Sustainable Development Goals 2030

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## ABSTRACT

**Background:** Infant mortality is an important indicator of a country's health and development. Although India has made significant progress in reducing infant mortality, continuous monitoring is needed to achieve the sustainable Development Goals (SDGs)by 2030.The present study aims to analyze the trend of infant mortality in India using data from 2003 to 2023 and to forecast infant mortality rates for the period 2024-2030 using the Autoregressive Integrated Moving Average (ARIMA) model. The study aims to forecast future developments and evaluate India's expected progress in reaching the SDG-related child survival goals by 2030.

**Methods:** It uses annual time-series data on the Infant Mortality Rate (IMR) in India obtained from the Sample Registration System (SRS) for the period 2003-2023.The Autoregressive Integrated Moving Average (ARIMA) model was employed to analyze historical trends and forecast IMR for the period 2024-2030.

**Results:** The ARIMA forecasts show a steady decline in IMR across India and most major states during 2024–2030. India's IMR is projected to decrease from 23.2 per 1,000 live births in 2024 to 12.7 in 2030. Kerala is expected to have the lowest IMR, while Uttar Pradesh, Chhattisgarh, Madhya Pradesh, and Jharkhand are projected to remain high-burden states, with interstate disparities persisting through 2030.

**Conclusion:** India is projected to achieve the SDG target for infant mortality by 2030, although interstate disparities are expected to persist. Targeted health interventions in high-burden states will be essential for equitable progress.

**Key-words:** Infant Mortality, ARIMA Model, Sustainable Development Goal (SDG), Sample Registration System (SRS)

## INTRODUCTION

Infant mortality is seen as a wide measure of a country's social and economic development as well as a crucial predictor of children's wellbeing. One of the primary markers for evaluating and tracking advancements in child health is the Sustainable Development Goal (SDG) of the United Nations.

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SDG 3.2 aims to end preventable newborn and child deaths by 2030, with targets of reducing neonatal mortality to at least 12 per 1,000 live births and under-five mortality to at least 25 per 1,000 live births. India and among states there is significant diversity in infant mortality. Infant mortality in India decreased from 80 in 1990 to 68 in 2000, 50 in 2009, 40 in 2013, 30 in 2019 and then to 26 in 2022, according to the sample registration system (SRS) reports released by the Registrar General of India. India's infant mortality rate was 25 in 2023, according to the most recent SRS report from 2025 [1].

In urban regions, it was 18 (male 18 and female 18), where as in rural areas, it was 28 (male 29, female 28). At 37 Madhya Pradesh, Uttar Pradesh and Chhattisgarh

 

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had the highest infant mortality rates, closely followed by Assam and Odisha (30). The two states with the lowest infant mortality rates in the nation were kerala (5) and Tamil nadu (12). The Empowered action group states in India include Bihar (23), Rajasthan (29), Jharkhand (29), Odisha (30), Chhattisgarh (37), Madhya Pradesh (37) and Uttar Pradesh (37). Nevertheless, despite these advancements, children continue to pass away every day before becoming one year old from frequently avoidable causes such pneumonia, diarrhea, malaria, and complications and infections during the neonatal period. Without a doubt, between 2003 and 2023, India's infant (IMR) mortality rate significantly decreased [2].

It is now crucial to evaluate the current state of affairs in light of the MDGs and to set aside a new development plan for the next years. In order to direct global efforts over the next fifteen years, the United Nations (UN) has created new development progress targets. World leaders are adopting a new set of SDGs as a result of the Post MDG Agenda, which was presented to the assembly in New York in September 2015. The goal is to reduce child mortality to half of what it was in 2010 by 2030 in order to encourage children to live long and healthy lives and to move closer to eliminating avoidable child mortality. More precisely, by 2030, the child mortality by 2030 to half its level in 2010. More specifically, by 2030, all countries should aiming to reduce neonatal mortality to at least as low as 12 per 1000 live births and under-5 mortality to at least as low as 25 per 1000 live births [3].

It is then prudent to forecast the future infant mortality and its components for understanding our immediate tasks in reduction of such deaths, so that finally we can achieve the future SDG targets of child mortality in India and its states. There has been hardly any attempt in this direction in recent past for making an assessment about India's present position and possibilities of reaching the future target of child mortality fixed by the Sustainable Development Goal 3 under Post-2015 development Agenda. The available past attempts mainly concentrated on to find out the possibilities of attaining MDG goals in case of under-five mortality. So the entire focus was restricted up to 2015. Those approaches have broadly utilized simple trend analysis of individual components of U5MR at the global level [4-6] and country level, e.g. Bangladesh [7], Sri Lanka [8], and India [9].

In present study a time series analysis has been carried out by applying Autoregressive Integrated Moving Averages (ARIMA) model examining the forecast of the future levels of infant mortality rates in India and its states. Infant mortalities, the trend in the level of infant mortality (mortality within under I year of age) is also examined in view of highest numbers of deaths occurring in India in the first year of human life. The study is carried out with a view to refine understanding of the future course of mortality among children evaluating country's present status in achieving the future Sustainable Development Goal 3 (SDG-3) [10].

## MATERIALS AND METHODS

**Data Source and Study Period-** Time series data for the period 2003–2023 were obtained from SRS [4], Registrar General, India, for infant mortality in India and its 19 major states. The data were used to forecast infant mortality for the period 2024–2030. Chhattisgarh and Jharkhand were included with their parent states, Madhya Pradesh and Bihar, respectively, while Uttar Pradesh was retained separately, thereby providing a consistent time series covering 21 years.

**Data Source Consistency-** The data used in the present analysis were obtained from a single source, the SRS; therefore, no adjustment for differences between data sources was required. The National Family Health Survey (NFHS) also provides estimates of infant mortality; however, six rounds have been completed, with the seventh round currently in progress. Previous comparisons have shown that the level and pattern of infant mortality reported by the SRS and NFHS are broadly similar [11].

**ARIMA Time Series Modelling-** The principal challenge in time series analysis is the presence of serial correlation, whereby model residuals may be correlated with their own lagged values and violate the assumption of independent disturbances. Therefore, an autoregressive integrated moving average (ARIMA) model was used to forecast infant mortality for 2024–2030 based on SRS data from 2003–2023. ARIMA modelling accounts for temporal dependence and non-stationarity by incorporating historical patterns and past prediction errors, thereby providing an appropriate framework for forecasting demographic indicators [12,13].

The ARIMA approach, developed by Box and Jenkins [14] has been widely applied for forecasting social and

 

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economic variables. It was preferred over simple trend-based methods because such methods assume that the historical trend will continue unchanged in the future, which may not adequately account for uncertainty and temporal dependence in demographic indicators [15].

**ARIMA Model Specification-** An ARIMA model is denoted as ARIMA (p, d, q)**,** where *p*, *d*, and *q* represent the orders of autoregression, differencing, and moving average, respectively. The autoregressive component (*p*) represents the dependence of the current observation on its previous values, the integration component (*d*) indicates the number of differences required to achieve stationarity, and the moving-average component (*q*) represents the dependence on previous forecast errors.

**Stationarity and Model Identification-** The SRS infant mortality series for 2003–2023 were initially assessed for stationarity. As the series were non-stationary, the data were transformed using the natural logarithm followed by successive differencing as required. For each state and for India as a whole, the autocorrelation function (ACF) and partial autocorrelation function (PACF) were examined to assess temporal dependence and guide model identification. Autocorrelation measures the correlation between observation and its previous values at specified lags, whereas partial autocorrelation measures the association between observations at a given lag after accounting for the effects of intermediate lags.

Stationarity was further evaluated using the Augmented Dickey-Fuller (ADF) test. The appropriate order of differencing was determined based on the ACF/PACF patterns and ADF test results. The final ARIMA model was selected separately for each state and for India according to the characteristics of the respective time series. Forecasts for 2024–2030 were generated using the selected models. As the analysis involved logarithmically transformed data, the projected estimates were back-transformed using the antilogarithm to obtain infant mortality values on the original scale.

## RESULTS

Table 1 presents the projected infant mortality rate (IMR) for Assam, Bihar, Chhattisgarh, Delhi, Gujarat, Haryana, Jammu and Kashmir, Jharkhand, Karnataka and Kerala for the period 2024–2030 using the respective fitted ARIMA (p,d,q) models. The projected values show considerable variation among the states. Assam is projected to decline from 28.1 per 1,000 live births in 2024 to 17.0 in 2030, while Bihar is projected to decline from 20.4 to 9.2 per 1,000 live births over the same period. Chhattisgarh shows a reduction from 35.3 to 25.4, whereas Delhi shows a different pattern, with the projected IMR increasing from 15.4 in 2024 to 20.1 in 2030. Gujarat, Haryana, Jammu and Kashmir, Jharkhand, Karnataka and Kerala show declining projected values throughout the forecast period. Among these states, Kerala has the lowest projected IMR, declining from 4.5 in 2024 to 2.7 per 1,000 live births in 2030. The table also presents the lower and upper 95% forecast confidence limits for each projected value.

**Table 1:** State-wise forecast of infant mortality rate (IMR) in India, 2024–2030 using ARIMA models

| State | Fitted ARIMA | Measure | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
|---|---|---|---|---|---|---|---|---|---|
| Assam | (0,1,0) | Predicted | 28.1 | 26.3 | 24.4 | 22.6 | 20.7 | 18.9 | 17.0 |
| | | LCL | 24.8 | 21.6 | 18.7 | 16.0 | 13.4 | 10.8 | 8.3 |
| | | UCL | 31.4 | 30.9 | 30.1 | 29.1 | 28.0 | 26.9 | 25.7 |
| Bihar | (1,1,1) | Predicted | 20.4 | 18.3 | 16.4 | 14.6 | 12.8 | 11.0 | 9.2 |
| | | LCL | 17.3 | 12.5 | 8.4 | 4.8 | 1.4 | -1.7 | -4.8 |
| | | UCL | 23.4 | 24.1 | 24.4 | 24.4 | 24.1 | 23.7 | 23.2 |
| Chhattisgarh | (0,1,0) | Predicted | 35.3 | 33.7 | 32.0 | 30.4 | 28.7 | 27.1 | 25.4 |
| | | LCL | 29.9 | 26.0 | 22.6 | 19.5 | 16.5 | 13.7 | 11.0 |
| | | UCL | 40.7 | 41.4 | 41.4 | 41.2 | 40.9 | 40.4 | 39.8 |
| Delhi | (1,1,1) | Predicted | 15.4 | 16.5 | 17.5 | 18.3 | 19.0 | 19.6 | 20.1 |
| | | LCL | 11.7 | 9.3 | 6.6 | 3.7 | 0.8 | -2.1 | -5.05 |
| | | UCL | 19.1 | 23.7 | 28.4 | 32.9 | 37.2 | 41.3 | 45.2 |

 

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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Gujarat | (0,1,0) | Predicted | 18.1 | 16.3 | 14.4 | 12.6 | 10.7 | 8.9 | 7.05 |
| | | LCL | 15.4 | 12.4 | 9.7 | 7.1 | 4.6 | 2.1 | -0.20 |
| | | UCL | 20.8 | 20.1 | 19.1 | 18.0 | 16.8 | 15.6 | 14.3 |
| Haryana | (0,1,0) | Predicted | 24.3 | 22.7 | 21.0 | 19.4 | 17.7 | 16.1 | 14.4 |
| | | LCL | 20.6 | 17.5 | 14.6 | 12.0 | 9.5 | 7.1 | 4.7 |
| | | UCL | 28.0 | 27.9 | 27.4 | 26.7 | 25.9 | 25.1 | 24.1 |
| Jammu and Kashmir | (0,1,0) | Predicted | 12.5 | 11.0 | 9.5 | 8.0 | 6.5 | 5.0 | 3.5 |
| | | LCL | 7.2 | 3.5 | 0.4 | -2.4 | -5.2 | -7.8 | -10.3 |
| | | UCL | 17.7 | 18.4 | 18.5 | 18.4 | 18.2 | 17.8 | 17.3 |
| Jharkhand | (0,1,0) | Predicted | 27.9 | 26.8 | 25.7 | 24.6 | 23.5 | 22.4 | 21.3 |
| | | LCL | 24.2 | 21.6 | 19.3 | 17.3 | 15.3 | 13.4 | 11.6 |
| | | UCL | 31.5 | 31.9 | 32.0 | 31.9 | 31.6 | 31.3 | 30.9 |
| Karnataka | (0,1,0) | Predicted | 12.1 | 10.2 | 8.3 | 6.4 | 4.5 | 2.6 | 0.7 |
| | | LCL | 9.3 | 6.2 | 3.4 | 0.8 | -1.7 | -4.2 | -6.6 |
| | | UCL | 14.8 | 14.1 | 13.1 | 11.9 | 10.7 | 9.4 | 8.0 |
| Kerala | (0,1,1) | Predicted | 4.5 | 4.2 | 3.9 | 3.6 | 3.3 | 3.0 | 2.7 |
| | | LCL | 1.8 | 0.2 | -1.0 | -2.1 | -3.2 | -4.1 | -5.0 |
| | | UCL | 7.2 | 8.2 | 8.9 | 9.4 | 9.8 | 10.1 | 10.4 |

Table 2 presents the projected IMR for Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal for 2024–2030. A declining trend in the projected IMR is observed across all states included in this table. Madhya Pradesh shows a reduction from 34.7 per 1,000 live births in 2024 to 21.2 in 2030, while Uttar Pradesh shows a decline from 35.0 to 23.3 per 1,000 live births. Odisha and Rajasthan are projected to decline from 27.3 to 11.4 and from 26.7 to 12.9 per 1,000 live births, respectively. Maharashtra, Punjab, Tamil Nadu and West Bengal also show progressive reductions throughout the forecast period. Tamil Nadu has a projected IMR of 1.1 per 1,000 live births in 2030, while Maharashtra and Punjab are projected to reach 4.2 and 5.8, respectively. The table includes the corresponding lower and upper 95% forecast confidence limits for all state-level projections.

**Table 2:** State-wise forecast of infant mortality rate (IMR) in India, 2024–2030 using ARIMA models

| State | Fitted ARIMA | Measure | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
|---|---|---|---|---|---|---|---|---|---|
| Madhya Pradesh | (0,1,0) | Predicted | 34.7 | 32.5 | 30.2 | 28.0 | 25.7 | 23.5 | 21.2 |
| | | LCL | 32.1 | 28.8 | 25.7 | 22.7 | 19.8 | 17.0 | 14.3 |
| | | UCL | 37.3 | 36.2 | 34.7 | 33.2 | 31.6 | 29.9 | 28.1 |
| Maharashtra | (0,1,0) | Predicted | 12.6 | 11.2 | 9.8 | 8.4 | 7.0 | 5.6 | 4.2 |
| | | LCL | 9.4 | 6.7 | 4.3 | 2.1 | -0.02 | -2.0 | -4.1 |
| | | UCL | 15.7 | 15.6 | 15.2 | 14.6 | 14.0 | 13.2 | 12.5 |
| Odisha | (0,1,0) | Predicted | 27.3 | 24.7 | 22.0 | 19.4 | 16.7 | 14.1 | 11.4 |
| | | LCL | 24.7 | 21.0 | 17.6 | 14.2 | 11.0 | 7.8 | 4.6 |
| | | UCL | 29.9 | 28.3 | 26.4 | 24.5 | 22.4 | 20.3 | 18.2 |
| Punjab | (0,1,0) | Predicted | 15.4 | 13.8 | 12.2 | 10.6 | 9.0 | 7.4 | 5.8 |
| | | LCL | 12.0 | 9.0 | 6.3 | 3.8 | 1.5 | -0.8 | -3.0 |
| | | UCL | 18.7 | 18.5 | 18.0 | 17.3 | 16.5 | 15.6 | 14.6 |
| Rajasthan | (0,1,0) | Predicted | 26.7 | 24.4 | 22.1 | 19.8 | 17.5 | 15.2 | 12.9 |
| | | LCL | 22.9 | 19.0 | 15.5 | 12.2 | 9.0 | 5.9 | 2.8 |

 

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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | UCL | 30.4 | 29.7 | 28.6 | 27.3 | 25.9 | 24.4 | 22.9 |
| Tamil Nadu | (0,1,0) | Predicted | 10.4 | 8.9 | 7.3 | 5.8 | 4.2 | 2.7 | 1.1 |
| | | LCL | 7.5 | 4.7 | 2.2 | -0.04 | -2.2 | -4.4 | -6.5 |
| | | UCL | 13.3 | 13.0 | 12.4 | 11.6 | 10.7 | 9.8 | 8.8 |
| Uttar Pradesh | (0,1,0) | Predicted | 35.0 | 33.1 | 31.1 | 29.2 | 27.2 | 25.3 | 23.3 |
| | | LCL | 31.4 | 28.0 | 24.9 | 22.0 | 19.2 | 16.5 | 13.9 |
| | | UCL | 38.6 | 38.1 | 37.3 | 36.3 | 35.2 | 34.0 | 32.7 |
| West Bengal | (0,1,0) | Predicted | 15.5 | 14.1 | 12.6 | 11.2 | 9.7 | 8.3 | 6.8 |
| | | LCL | 12.5 | 9.8 | 7.4 | 5.2 | 3.0 | 0.9 | -1.08 |
| | | UCL | 18.5 | 18.3 | 17.8 | 17.1 | 16.4 | 15.6 | 14.7 |

Table 3 presents the projected IMR for Andhra Pradesh and India as a whole for the period 2024–2030. Andhra Pradesh, fitted with an ARIMA (0,2,1) model, shows a progressive decline in the projected IMR from 16.6 per 1,000 live births in 2024 to 1.5 in 2030. For India as a whole, the projected IMR also shows a consistent decline, from 23.2 per 1,000 live births in 2024 to 12.7 per 1,000 live births in 2030. The projected national values for the intervening years are 21.5, 19.7, 18.0, 16.2 and 14.5 per 1,000 live births for 2025–2029, respectively. The 95% forecast confidence interval for India ranges from 21.4–25.0 in 2024 and becomes wider with increasing forecast horizon, reaching 8.0–17.4 in 2030. Based on the fitted ARIMA model, the projected national IMR of 12.7 per 1,000 live births in 2030 is below the 25 per 1,000 live births level referred to in the study. Thus, the national projection indicates a substantial decline in infant mortality by 2030.

**Table 3:** Forecast of infant mortality rate (IMR) for Andhra Pradesh and India, 2024–2030 using ARIMA models

| State/Region | Fitted ARIMA | Measure | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
|---|---|---|---|---|---|---|---|---|---|
| Andhra Pradesh | (0,2,1) | Predicted | 16.6 | 14.2 | 11.7 | 9.2 | 6.7 | 4.1 | 1.5 |
| | | LCL | 14.3 | 10.8 | 7.5 | 4.3 | 1.1 | -2.0 | 5.2 |
| | | UCL | 18.9 | 17.5 | 15.9 | 14.2 | 12.3 | 10.4 | 8.4 |
| India | (0,1,0) | Predicted | 23.2 | 21.5 | 19.7 | 18.0 | 16.2 | 14.5 | 12.7 |
| | | LCL | 21.4 | 18.9 | 16.6 | 14.4 | 12.2 | 10.1 | 8.0 |
| | | UCL | 25.0 | 24.0 | 22.8 | 21.5 | 20.2 | 18.8 | 17.4 |

## DISCUSSION

The current study used annual Sample Registration System (SRS) data from 2003 to 2023 to anticipate infant mortality rates (IMR) in India and its major states for the period 2024–2030 using the ARIMA time-series model. According to the results, infant mortality in India is predicted to continuously fall over the course of the prediction period. India is expected to meet the SDG-related child survival objective by 2030, as the IMR is expected to drop from 23.2 per 1,000 live births in 2024 to 12.7 per 1,000 live births in 2030.

The current study's diminishing tendency is in line with earlier domestic and foreign research. According to Liu *et al.* [12], advances in maternal and child healthcare services were the main cause of the significant decrease in child mortality that occurred worldwide throughout the Millennium Development Goal (MDG) timeframe. In a similar vein, You *et al.* [13] showed that greater immunization coverage, institutional deliveries, and the development of newborn care facilities contributed to the ongoing declines in infant and under-five mortality in the majority of low- and middle-income nations, including India. Similar trends are shown in the current projections, which suggest that these gains will probably continue in the years to come.

The results are also consistent with previous research carried out in India. Using trend analysis based on data from the Sample Registration System, Bhatia and Dwivedi [14] revealed a consistent decrease in India's infant mortality and proposed that maintaining current public health initiatives could help the country meet global child survival goals. Similarly, Prinja *et al.* [15]

 

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reported that the implementation of the National Health Mission accelerated the decline in infant mortality in India, with the rate of reduction increasing after the introduction of the programme. These findings are consistent with the declining trend observed in the current projections.

From a methodological standpoint, the current results align with earlier forecasting research that employed ARIMA models. Singh and Singh [16] demonstrated the application of ARIMA-based time-series modelling for forecasting infant mortality in India and its states. Their findings support the suitability of ARIMA models for analysing historical mortality patterns and generating future estimates. Additionally, the current study demonstrated that ARIMA is a suitable model for predicting infant mortality using SRS data and projecting future trends up to 2030.

The current study shows significant interstate disparities despite the positive national trend; Kerala is predicted to maintain the lowest infant mortality, while Uttar Pradesh, Madhya Pradesh, Chhattisgarh, Jharkhand, and Assam are expected to remain high-burden states through 2030. Similar regional disparities have been documented in the National Family Health Survey (NFHS-5), 2019–21, conducted by IIPS and ICF, and in the Sample Registration System (SRS) Statistical Report 2023 published in 2025, which provide evidence of substantial differences in infant mortality across Indian states [17,18].

The projected decline in IMR is also consistent with improvements in maternal and child healthcare services following the expansion of the National Health Mission (NHM) and related programmes. Bango and Ghosh reported improvements in maternal and child healthcare utilization during the post-NHM period, while also highlighting persistent social and regional inequalities in access to these services [19]. These findings support the observed overall decline in IMR while emphasizing the continued burden in disadvantaged states.

Although the ARIMA model provides reliable short-term forecasts, it has certain limitations. Like previous forecasting studies, the model assumes that historical trends continue into the future and does not explicitly account for structural changes arising from new health policies, economic fluctuations, pandemics, demographic transitions, or technological advancements. Therefore, actual future mortality levels may differ from the projected estimates if substantial policy or environmental changes occur.

Overall, the present findings provide useful evidence for policymakers regarding India's progress towards Sustainable Development Goal 3. While India appears likely to achieve the national SDG target for infant mortality by 2030, considerable disparities between states are expected to persist. Strengthening maternal and child healthcare services in high-burden states, improving nutrition, expanding neonatal intensive care facilities, and reducing socioeconomic inequalities will be essential for ensuring equitable reductions in infant mortality across the country.

## STRENGTHS

- A crucial component of reaching the SDG targets for India and its states is infant mortality.
- Forecasting Infant mortality and its components while evaluating current efforts to lower these fatalities is wise.
- The present paper has used autoregressive integrated moving average (ARIMA) time series model to forecast the Infant mortalities in India for the period of 2024-2030 by using data from the Sample Registration System (SRS) for the period 2003-2023.
- The projection showed that India as a whole would be able to achieve the SDG targets of IMR by 2030.

## LIMITATION

Like all forecasting techniques, the ARIMA model is basically “backward looking” meaning that the long-term forecast eventually becomes a straight line at anticipating series with turning points.

## CONCLUSIONS

The study concludes that India is on a favorable trajectory toward reducing infant mortality and is likely to approach the SDG target by 2030 at the national level. However, achieving equitable progress across all states remains a critical challenge. Policymakers should prioritize high-burden states through targeted maternal and child health programs, strengthened primary healthcare systems, improved nutrition interventions, and enhanced healthcare accessibility in rural and underserved regions. Such focused efforts will be essential for ensuring that the benefits of national

 

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progress are shared uniformly and that no region is left behind in the pursuit of the Sustainable Development Goals. The current comprehensive analysis of the past trends, present status, and future course of mortality among children is not only vital for developing effective maternal and child health programmes and policies but also crucial in the formulation of overall national health planning.

**CONTRIBUTION OF AUTHORS**

**Research Concept –** Vishakha Parmar
**Research design -** Vishakha Parmar
**Supervision –** Dr Ajit Singh Solanki
**Materials -** Vishakha Parmar, Dr Mriganka Ojha
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