

TRENDS AND DETERMINANTS OF SEX RATIO AT BIRTH IN NORTHERN AND WESTERN STATES OF INDIA FROM AN SDG 3 PERSPECTIVE:

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Abstract

"The neglect of girl children is one of the greatest failures of our societies."

Amartya Sen- Nobel Prize in Economist.

The Child Sex Ratio (CSR) is an important demographic indicator reflecting the social status of the girl child and the level of gender equality in a society. In recent decades, India has experienced noticeable changes in the child sex ratio, raising concerns about gender imbalance and discrimination against female children. This paper examines the trends and determinants of child sex ratio in India during the period 2001–2021. The study relies mainly on secondary data obtained from the Office of the Registrar General & Census Commissioner, India, National Family Health Survey, and Sample Registration System reports. Statistical tools such as percentage analysis, trend analysis, and correlation techniques are used to understand the relationship between socio-economic variables and child sex ratio. The findings indicate that factors such as female literacy, urbanization, and health awareness significantly influence the child sex ratio. The paper concludes by suggesting policy measures aimed at improving gender equality and ensuring the survival and well-being of girl children.

Keywords: Child Sex Ratio, IMR, MMR and U5MR.

Introduction

Sustainable Development Goal 3 (SDG-3): Good Health and Well-Being aims to ensure healthy lives and promote well-being for all at all ages. Maternal and child health indicators such as Infant Mortality Rate (IMR), Under-Five Mortality Rate (U5MR), Maternal Mortality Ratio (MMR), and Adolescent Childbirth Rate (ACBR) are widely recognized as key measures of population health and health-care system performance.

Despite significant progress in recent decades, maternal and child mortality remain major public health challenges, particularly in developing countries like India. High levels of IMR and U5MR indicate inadequate child health services, poor nutrition, and limited access to timely medical care, while elevated MMR reflects gaps in maternal health services, including

antenatal care, institutional delivery, and postnatal care. Additionally, adolescent childbirth continues to be a concern due to early marriage, limited reproductive health awareness, and socio-economic inequalities, which increase health risks for both mothers and infants.

Under SDG-3, global and national targets emphasize reducing maternal mortality, ending preventable deaths of newborns and children under five years of age, and reducing adolescent birth rates. Monitoring trends and disparities in IMR, U5MR, MMR, and Adolescent Childbirth Rate is therefore essential for evaluating progress toward these targets and identifying areas requiring focused policy interventions.

This study focuses on examining the patterns and progress of key maternal and child health indicators in the context of SDG-3, with the aim of understanding trends, identifying disparities, and assessing the effectiveness of health initiatives in improving maternal and child health outcomes.

Review of Literature

Several scholars and institutions have contributed significantly to the understanding of gender imbalance and child sex ratio trends. Amartya Sen introduced the concept of “Missing Women,” highlighting the demographic consequences of gender discrimination and unequal survival rates among female children. His work emphasized the importance of recognizing gender inequality as a major developmental challenge.

Similarly, Ashish Bose analyzed regional variations in demographic indicators and highlighted disparities in sex ratio across Indian states. Reports by institutions such as UNICEF and International Institute for Population Sciences have provided extensive data on child health, gender inequality, and fertility patterns. These studies indicate that socio-economic factors such as literacy, income, and healthcare availability play a significant role in determining child sex ratio trends.

Objectives of the Study

1. To study trends in IMR, U5MR, MMR, and Adolescent Childbirth Rate under SDG-3 (Good Health and Well-Being).
2. To identify disparities in maternal and child health indicators across regions and population groups.
3. To evaluate progress toward achieving SDG-3 targets related to maternal and child health.

Research Methodology

This study adopts a descriptive and analytical research design based on secondary data sources. Data for the study have been collected from official publications and national surveys conducted by the Office of the Registrar General & Census Commissioner, India, National Family Health Survey, and Sample Registration System.

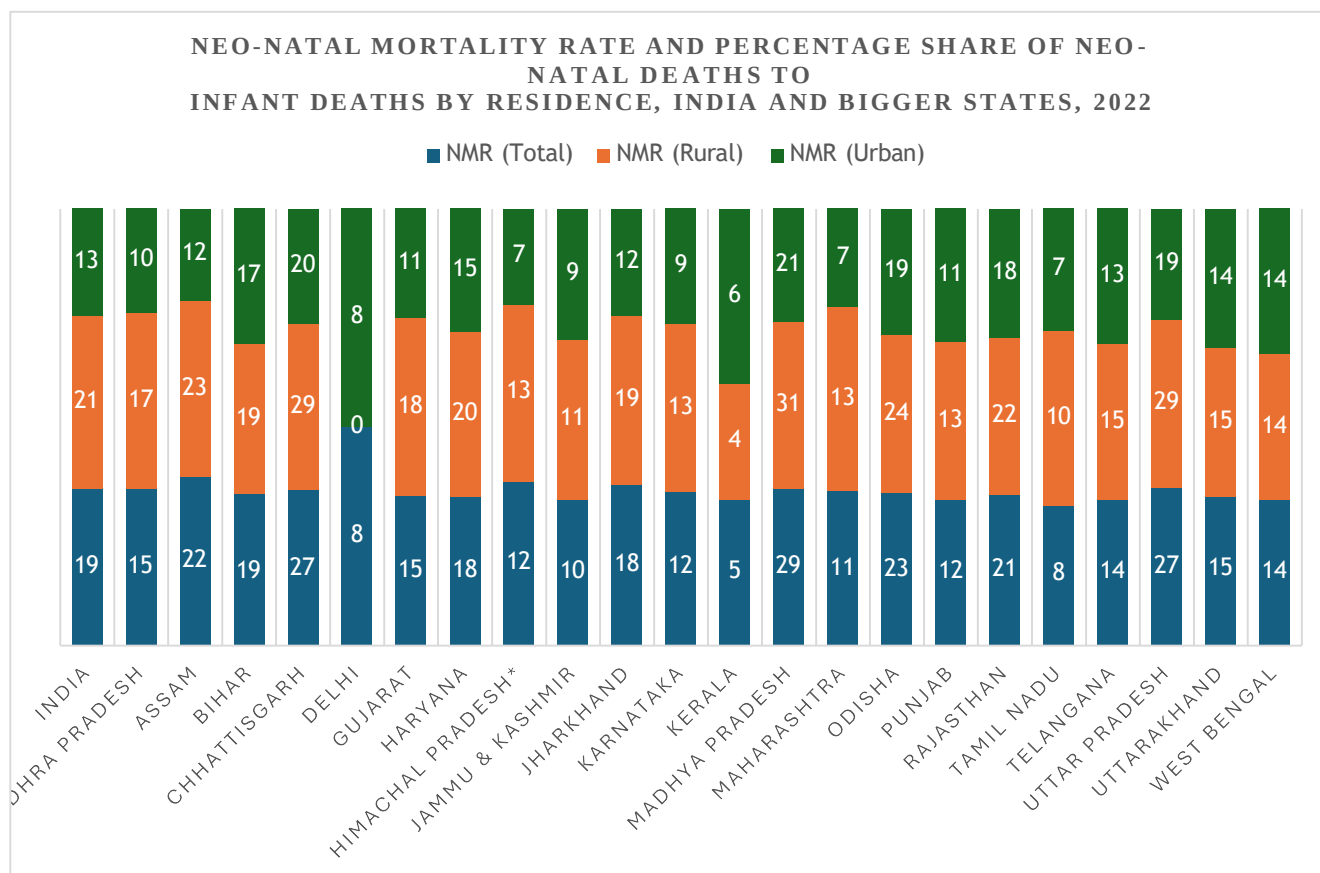
Statistical tools such as percentage analysis, trend analysis, and correlation techniques are used to analyze the data. Graphical representation and tabular methods are employed to illustrate trends and variations. Software applications such as Microsoft Excel.

Table: 1: Neo-natal Mortality Rate and percentage share of Neo-natal Deaths to Infant Deaths by Residence, India and bigger States, 2022

India and Bigger States/UTs	NMR (Total)	NMR (Rural)	NMR (Urban)	% Share (Total)	% Share (Rural)	% Share (Urban)
India	19	21	13	72.4	72.2	72.9
Andhra Pradesh	15	17	10	75	76.5	70
Assam	22	23	12	70.1	69.6	81.8
Bihar	19	19	17	72.2	72.8	66.9
Chhattisgarh	27	29	20	71.9	71.9	72
Delhi	8	0	8	67.8	0	67.8
Gujarat	15	18	11	74.2	76.5	69.1
Haryana	18	20	15	69.2	67.2	74.7
Himachal Pradesh*	12	13	7	74.3	74.6	67.2
Jammu & Kashmir	10	11	9	72.8	72.6	73.9
Jharkhand	18	19	12	69.8	71.4	60.7
Karnataka	12	13	9	75.7	75.9	75.2
Kerala	5	4	6	70.9	69.7	71.5
Madhya Pradesh	29	31	21	73.2	72.6	77
Maharashtra	11	13	7	78.6	79.9	75.8
Odisha	23	24	19	72.9	72.8	73.3
Punjab	12	13	11	74.6	75.2	73.6
Rajasthan	21	22	18	69.9	68.5	76.2
Tamil Nadu	8	10	7	74.4	70.4	80.2
Telangana	14	15	13	76.2	72.3	83.9
Uttar Pradesh	27	29	19	70.9	70.9	70.8
Uttarakhand	15	15	14	68.8	68.9	68.5
West Bengal	14	14	14	79.5	80.4	77.2

Source: SRS Statistical Report : 2022 (ORGI)

Chart-1



The Neonatal Mortality Rate (NMR) remains a crucial indicator under Sustainable Development Goal (SDG) 3, which aims to reduce neonatal deaths to less than 12 per 1,000 live births by 2030. The data for 2022 reveals a stark contrast in neonatal health across Northern and Western India, with the national average of 19 serving as a critical benchmark above the SDG target. In the Northern and Central belts, states such as Madhya Pradesh (29) and Uttar Pradesh (27) recorded the highest mortality levels, indicating a substantial gap from the SDG goal. These higher rates are largely influenced by rural–urban disparities; for example, rural Uttar Pradesh reported an NMR of 29, while urban areas performed better at 19, reflecting differences in healthcare accessibility and quality. Similarly, Rajasthan (21) and Haryana (18) reported values around or above the national average, highlighting the continued need for strengthened maternal and newborn healthcare interventions in these densely populated regions. In contrast, Western states and certain Northern Union Territories demonstrate comparatively better outcomes, reflecting stronger healthcare infrastructure. Maharashtra (11)

stands out as a top performer, achieving levels below the SDG target, supported by an impressive urban NMR of 7. Gujarat (15) remains below the national average but still above the SDG threshold, with its rural rate of 18 indicating persistent geographic inequalities. Delhi recorded the lowest NMR at 8, demonstrating the benefits of concentrated urban healthcare facilities. Overall, these findings emphasize that while several urban regions are approaching single-digit neonatal mortality levels, achieving the national SDG target will depend largely on reducing rural–urban disparities and strengthening neonatal healthcare services in high-burden Northern states.

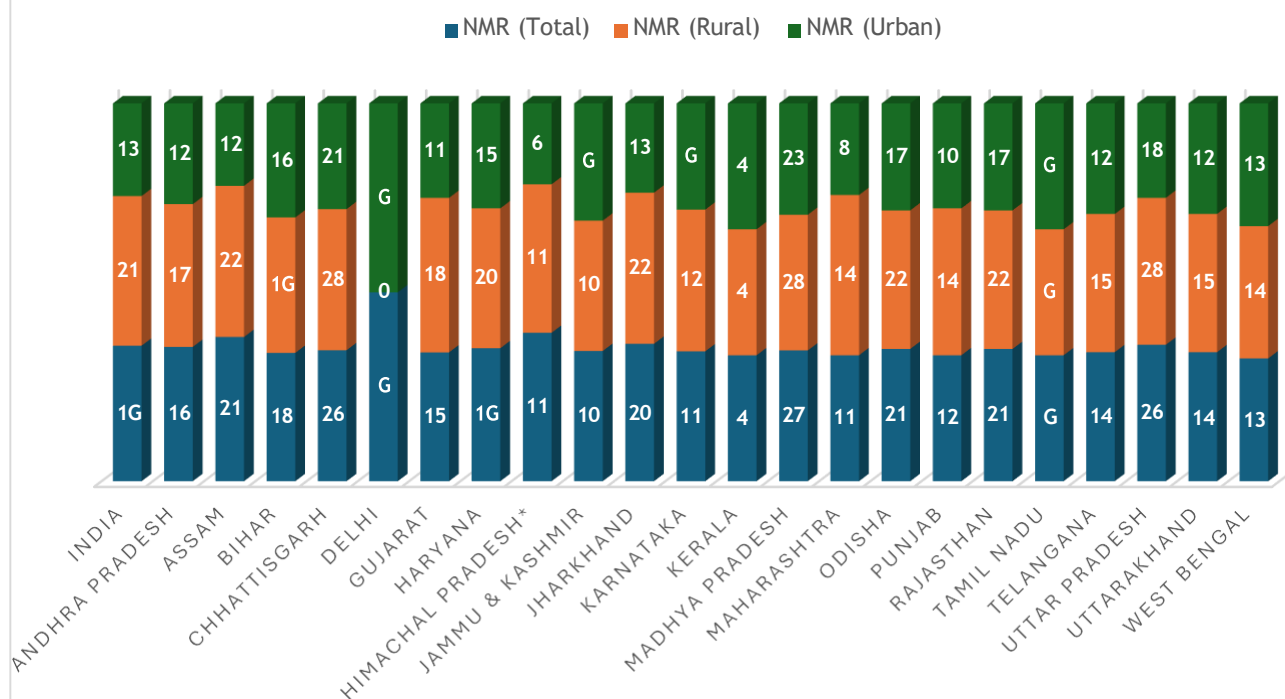
Table: 2: Neo-natal Mortality Rate and percentage share of Neo-natal Deaths to Infant Deaths by Residence, India and bigger States, 2023:

State and Bigger States/UTs	NMR (Total)	NMR (Rural)	NMR (Urban)	% Share (Total)	% Share (Rural)	% Share (Urban)
India	19	21	13	73.2	73.3	72.6
Andhra Pradesh	16	17	12	83.7	82.3	87.9
Assam	21	22	12	70.2	69.5	83.6
Bihar	18	19	16	78.8	80.1	67.6
Chhattisgarh	26	28	21	71.3	71.3	71.3
Delhi	9	0	9	63.1	0	63.6
Gujarat	15	18	11	77.1	79.9	71
Haryana	19	20	15	71.3	68.8	78.3
Himachal Pradesh*	11	11	6	76.3	77.3	56.3
Jammu & Kashmir	10	10	9	71.2	71.7	69.6
Jharkhand	20	22	13	68.9	69.8	64.1
Karnataka	11	12	9	76.1	74.6	79.4
Kerala	4	4	4	71.1	66.9	75.1
Madhya Pradesh	27	28	23	73.3	72.8	75.8
Maharashtra	11	14	8	81.7	80.6	84.1
Odisha	21	22	17	72	72.1	71.5
Punjab	12	14	10	71.5	71.6	71.3
Rajasthan	21	22	17	71.6	71	74
Tamil Nadu	9	9	9	74.6	67.7	81.8
Telangana	14	15	12	75.8	73.6	79.9
Uttar Pradesh	26	28	18	70.6	71.5	66.1
Uttarakhand	14	15	12	69.7	70.5	67.1
West Bengal	13	14	13	79.8	80.3	78.3

Source: SRS Statistical Report: 2023 (ORGI)

Chart-2

NEO-NATAL MORTALITY RATE AND PERCENTAGE SHARE OF NEO-NATAL DEATHS TO INFANT DEATHS BY RESIDENCE, INDIA AND BIGGER STATES, 2023



The Neonatal Mortality Rate (NMR) remains a crucial indicator under United Nations Sustainable Development Goals (SDG) 3, which aims to reduce neonatal mortality to less than 12 deaths per 1,000 live births by 2030. The national average NMR of India stands at 19, which is still above the SDG threshold, indicating the need for sustained public health interventions. A regional analysis of Northern and Western states reveals mixed progress toward achieving the SDG target. Among the Northern states, Himachal Pradesh (11) and Jammu & Kashmir (10) have successfully achieved the SDG benchmark, reflecting relatively better maternal and neonatal healthcare systems. However, large Northern states such as Uttar Pradesh (26), Rajasthan (21), Haryana (19), and Punjab (12) continue to record higher NMR levels, particularly in rural areas where healthcare accessibility and institutional delivery coverage remain challenges. In the Western region, significant progress is visible in states such as Maharashtra (11) and Gujarat (15), although Gujarat still remains above the SDG threshold.

Notably, Kerala (4), though located in the southern region, demonstrates exemplary performance with one of the lowest NMR levels in the country, serving as a benchmark for other states. The rural–urban gap further highlights disparities, with rural NMR consistently

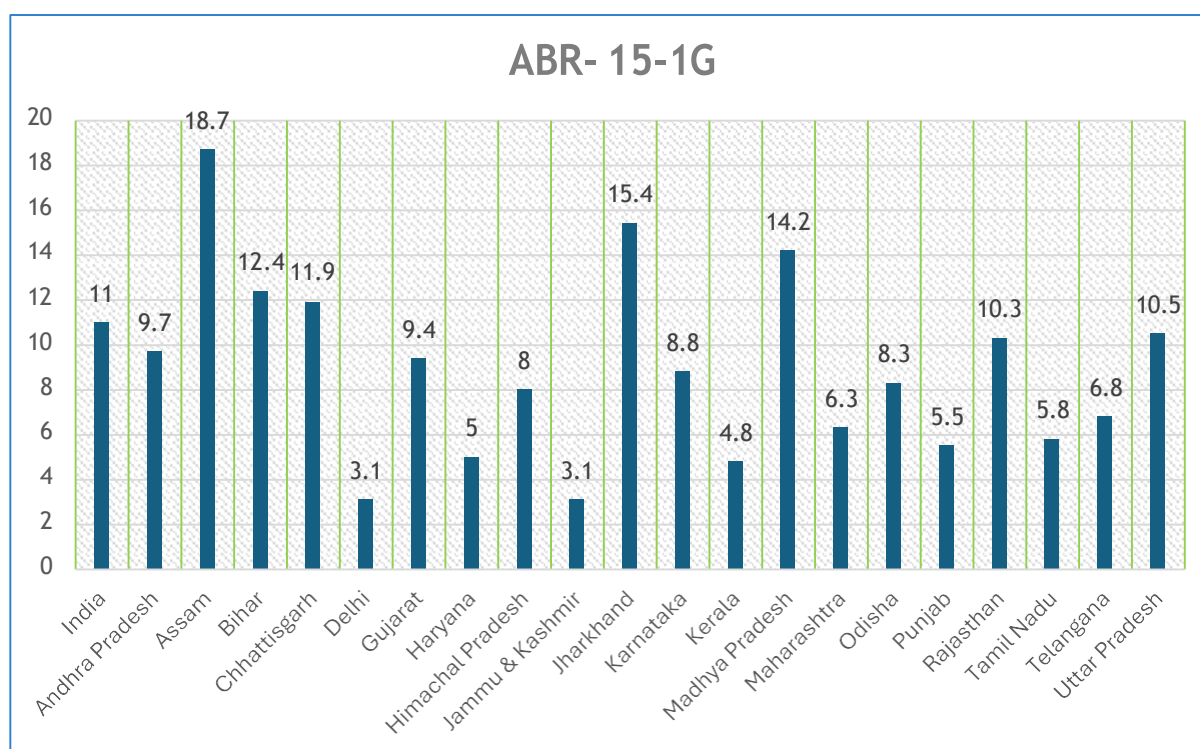
higher than urban rates across most states, underscoring inequalities in healthcare infrastructure, neonatal care services, and skilled birth attendance. Overall, while a few Northern states have achieved the SDG target of reducing NMR below 12, the majority of Northern and Western states still lag behind, emphasizing the urgent need for focused policy interventions, improved neonatal healthcare services, and strengthened rural health systems to meet the SDG 3 target by 2030.

Table: 3 ASFRs (Age Specific Fertility Rates), India and bigger States/UTs, 2023

State/UT	15-19	20-24	25-29	30-34	35-39	40-44	45-49
India	11	107.5	136.8	78.4	32.5	11.5	3.9
Andhra Pradesh	9.7	105.1	125.5	41.9	12.8	4.6	2.2
Assam	18.7	102.7	120.5	86	44.1	15.5	6.2
Bihar	12.4	147.7	215	115.7	49.1	19	8.5
Chhattisgarh	11.9	141.3	154.8	89.7	32.7	13.9	4.6
Delhi	3.1	59.2	94.9	55.6	21.5	8.1	2.9
Gujarat	9.4	111.2	135.8	69.7	26.8	8.9	3
Haryana	5	112.3	155	72.4	23.9	9.8	3.9
Himachal Pradesh	8	70.5	121.7	73.4	26.6	8.2	1.7
Jammu & Kashmir	3.1	38.6	82.9	88.3	44.7	25.5	11.8
Jharkhand	15.4	123.6	140.1	75.4	42.8	15.5	9.8
Karnataka	8.8	83.3	116.8	63.9	26	6.2	2.2
Kerala	4.8	76.2	113.8	70.5	27.6	5.2	0.8
Madhya Pradesh	14.2	142.8	174	92.2	39.2	13.9	3.5
Maharashtra	6.3	89	107.2	57	18.6	6.7	2.3
Odisha	8.3	94.5	116.6	76.4	26.3	7.8	2.7
Punjab	5.5	68.9	105.5	75.7	25.9	8.3	1.5
Rajasthan	10.3	132.6	169.1	97.5	38	12.2	6.4
Tamil Nadu	5.8	83.8	106	48.3	13.6	4.1	0.9
Telangana	6.8	82	127.2	61.9	19.9	7.5	3.3
Uttar Pradesh	10.5	112.9	171.5	121.4	62.5	25.2	7.1
Uttarakhand	4.8	70.3	139.2	86.8	34.9	10	3.2
West Bengal	23.3	96.9	75.4	44.4	13.7	4.3	1.6

Source: SRS Statistical Report: 2023 (ORGI)

Chart-3: ASFRs (Age Specific Fertility Rates), India and bigger States/UTs, 2023



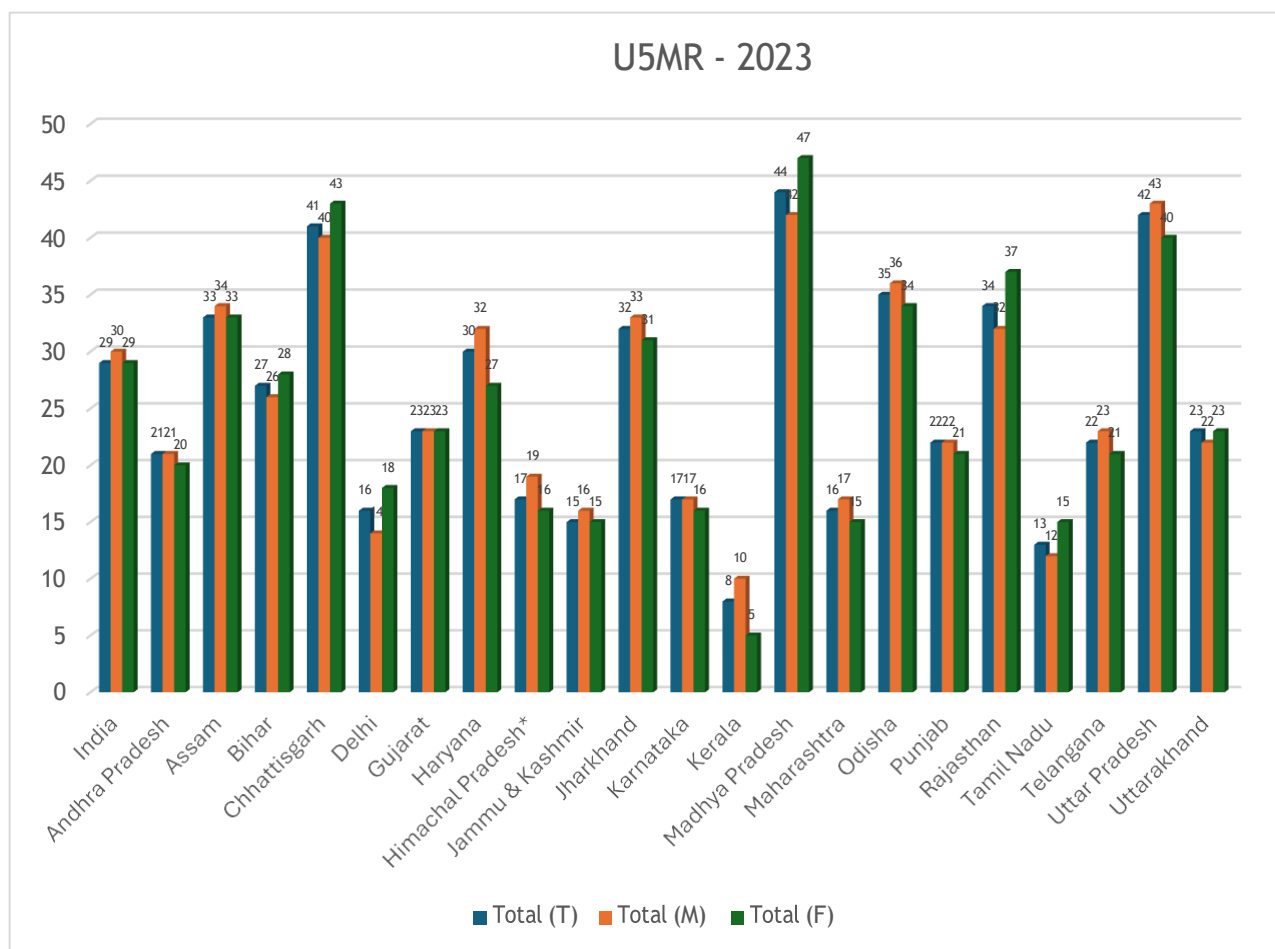
Adolescent Birth Rate (ABR) for ages 15–19 years is a key indicator under United Nations Sustainable Development Goals (SDG) 3, particularly Target 3.7, which emphasizes universal access to reproductive health services and the reduction of early childbearing. At the national level, India records an ABR of 11.0 births per 1,000 women aged 15–19, reflecting moderate progress but still indicating the persistence of adolescent pregnancies in several regions. In the Northern states, notable variation is observed. States such as Delhi (3.1), Jammu & Kashmir (3.1), Haryana (5.0), Punjab (5.5), Himachal Pradesh (8.0), and Uttarakhand (4.8) show relatively lower adolescent fertility levels, suggesting improved access to education, delayed marriage, and better reproductive health awareness. However, higher ABR levels in states like Rajasthan (10.3) and Uttar Pradesh (10.5) indicate continued prevalence of early marriage and limited reproductive health outreach in certain rural and socio-economically disadvantaged communities. In the Western region, states such as Maharashtra (6.3) and Gujarat (9.4) demonstrate comparatively better performance, remaining below the national average and reflecting steady improvements in maternal health interventions and adolescent education programs. Overall, while several Northern and Western states are progressing toward SDG goals by maintaining relatively low adolescent birth rates, disparities persist across states,

particularly in regions with entrenched socio-cultural practices supporting early marriage. Continued investment in female education, adolescent health services, and awareness programs is essential to further reduce adolescent fertility and achieve the broader reproductive health objectives outlined under SDG 3.

Table: 4 Under-5 Mortality Rate (U5MR) by Sex and Residence, 2023

India & bigger states/UTs	Total (T)	Total (M)	Total (F)	Rural (T)	Rural (M)	Rural (F)	Urban (T)	Urban (M)	Urban (F)
India	29	30	29	33	33	32	20	20	20
Andhra Pradesh	21	21	20	23	23	24	16	18	14
Assam	33	34	33	35	36	35	16	17	15
Bihar	27	26	28	27	26	28	26	26	26
Chhattisgarh	41	40	43	43	41	46	33	38	28
Delhi	16	14	18	9	16	0	16	14	18
Gujarat	23	23	23	27	28	26	17	17	18
Haryana	30	32	27	34	37	30	23	24	21
Himachal Pradesh*	17	19	16	18	20	16	13	9	17
Jammu & Kashmir	15	16	15	16	16	15	14	14	14
Jharkhand	32	33	31	34	35	33	23	21	24
Karnataka	17	17	16	20	22	18	12	10	14
Kerala	8	10	5	6	7	5	9	13	5
Madhya Pradesh	44	42	47	46	43	49	37	37	37
Maharashtra	16	17	15	20	23	18	12	11	13
Odisha	35	36	34	36	38	35	25	25	26
Punjab	22	22	21	23	24	23	19	20	18
Rajasthan	34	32	37	36	33	40	27	27	28
Tamil Nadu	13	12	15	14	14	15	13	10	16
Telangana	22	23	21	24	26	22	19	18	19
Uttar Pradesh	42	43	40	45	47	43	30	31	29
Uttarakhand	23	22	23	23	22	24	21	23	19
West Bengal	18	20	17	18	20	17	18	20	17

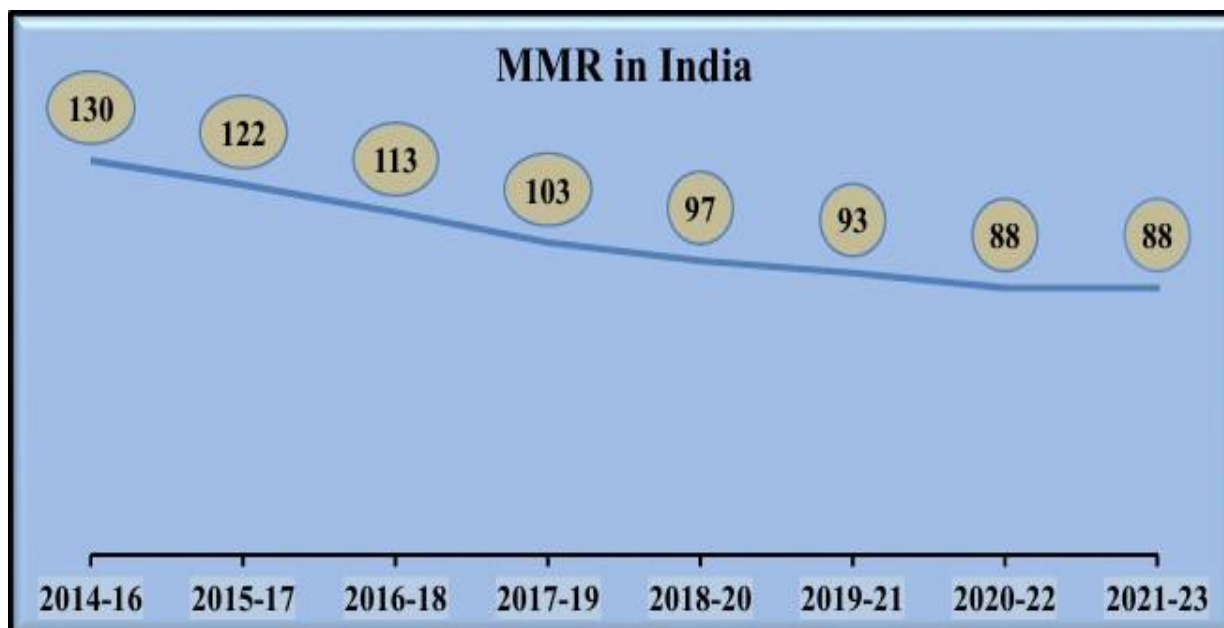
Source: SRS Statistical Report: 2023 (ORGI)



The **Under-Five Mortality Rate (U5MR)** is a critical indicator under **United Nations Sustainable Development Goals (SDG) 3**, particularly Target 3.2, which aims to reduce under-five mortality to **less than 25 deaths per 1,000 live births** by 2030. At the national level, India records a U5MR of **29**, which remains above the SDG threshold, indicating that substantial efforts are still required to improve child survival outcomes. A regional assessment of Northern and Western states shows uneven progress toward achieving this target. In the Northern region, **Delhi (16)**, **Jammu & Kashmir (15)**, **Himachal Pradesh (17)**, **Punjab (22)**, and **Uttarakhand (23)** have already achieved the SDG benchmark, reflecting improved immunization coverage, institutional deliveries, and child healthcare services. However, major Northern states such as **Uttar Pradesh (42)**, **Rajasthan (34)**, and **Haryana (30)** continue to report significantly higher U5MR levels, particularly in rural areas where healthcare access and nutritional challenges persist. In the Western region, **Maharashtra (16)** has successfully met the SDG target, while **Gujarat (23)** is close to achieving it, remaining below the threshold level of 25. Despite this progress, disparities between rural and urban populations remain

evident, with rural U5MR consistently higher than urban rates across most states, highlighting persistent inequalities in healthcare availability, maternal education, and child nutrition. Overall, while several Northern and Western states have achieved the SDG target of reducing U5MR below 25, high-burden states such as Uttar Pradesh and Rajasthan continue to pose significant challenges, emphasizing the need for targeted interventions, strengthened rural health infrastructure, and enhanced maternal and child health programs to ensure uniform progress toward achieving SDG 3 goals by 2030.

India & Major States	MMR	95% CI	Maternal Mortality Rate	Lifetime risk
INDIA	88	(79,96)	5	0.18%
Assam	110	(53,167)	6	0.23%
Bihar	104	(68,140)	10	0.34%
Jharkhand	54	(10,98)	4	0.13%
Madhya Pradesh	142	(100,185)	12	0.41%
Chhattisgarh	146	(63,229)	10	0.37%
Odisha	153	(98,208)	9	0.31%
Rajasthan	86	(49,122)	7	0.25%
Uttar Pradesh	141	(104,177)	12	0.41%
Uttarakhand	91	(45,136)	5	0.19%
EAG AND ASSAM SUBTOTAL	118	(103,133)	9	0.31%
Andhra Pradesh	30	(3,56)	2	0.05%
Telangana	59	(14,105)	3	0.11%
Karnataka	68	(34,103)	3	0.12%
Kerala	30	(2,58)	1	0.05%
Tamil Nadu	35	(10,60)	2	0.05%
SOUTH SUBTOTAL	42	(29,56)	2	0.07%
Gujarat	51	(23,78)	3	0.12%
Haryana	89	(43,135)	6	0.22%
Maharashtra	36	(13,60)	2	0.06%
Punjab	90	(31,150)	5	0.16%
West Bengal	104	(64,143)	5	0.17%
Other states	86	(63,108)	4	0.15%
OTHER SUBTOTAL	75	(62,88)	4	0.14%



The Maternal Mortality Ratio (MMR) is a vital indicator under United Nations Sustainable Development Goals (SDG) 3, particularly Target 3.1, which aims to reduce maternal mortality to less than 70 deaths per 100,000 live births by 2030. At the national level, India records an MMR of 88, which remains above the SDG threshold, indicating that maternal health challenges persist despite recent progress. A closer examination of Northern states reveals considerable disparities in maternal health outcomes. States such as Uttar Pradesh (141), Madhya Pradesh (142), Bihar (104), Uttarakhand (91), Haryana (89), and Punjab (90) continue to report MMR levels above the SDG target, reflecting persistent gaps in maternal healthcare access, antenatal services, and emergency obstetric care. However, some progress is evident in Rajasthan (86), which, although still above the target, shows relatively improved outcomes compared to historically higher levels. In contrast, the Western region demonstrates comparatively better performance, with Gujarat (51) and Maharashtra (36) successfully achieving the SDG benchmark of less than 70 maternal deaths per 100,000 live births. These improvements are often associated with higher institutional delivery rates, improved maternal healthcare infrastructure, and enhanced public health interventions. Nevertheless, the continued high burden in several Northern states highlights the need for focused maternal health programs, strengthened rural healthcare systems, improved access to skilled birth attendants, and timely emergency obstetric services. Overall, while Western states show encouraging progress toward achieving the SDG MMR target, most Northern states still lag behind, underscoring the urgency of targeted policy measures to reduce maternal mortality and ensure safer motherhood across all regions by 2030.

Conclusion

The child sex ratio is a critical indicator reflecting the status of gender equality and the well-being of the girl child in society. The study highlights the importance of socio-economic development, female literacy, and healthcare infrastructure in improving child sex ratio trends. Achieving gender equality requires collective efforts from policymakers, communities, and institutions. Strengthening awareness programs and improving access to education and healthcare services will contribute significantly to the survival and empowerment of the girl child and support the achievement of sustainable development goals.

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