

State-Level and Regional Variation in Maternal Healthcare Utilization in India: An Ecological Analysis of NFHS-6 (2023–24)

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Abstract:

Background: Maternal healthcare utilization is a key determinant of maternal and child health outcomes. Despite substantial improvements in maternal health indicators in India, disparities persist across States and Union Territories (UTs). The study aimed to assess State-Level and Regional Variation in Maternal Healthcare Utilization in India. **Materials and Methods:** An ecological study was conducted using National Family Health Survey-6 (NFHS-6) data. Four nationally recommended maternal healthcare indicators such as first trimester antenatal care (ANC) registration, four or more ANC visits, institutional delivery, and iron and folic acid (IFA) consumption for at least 180 days during pregnancy were combined to calculate Composite Maternal Healthcare Score. **Results:** Considerable inter-state variation in maternal healthcare utilization was observed. Kerala achieved the highest Composite Maternal Healthcare Score (89.38), while substantial disparities were noted across regions. Southern (81.60 ± 7.18) and Western (80.89 ± 3.47) regions demonstrated significantly higher scores than other regions (p=0.001). **Conclusion:** Significant geographical disparities in maternal healthcare utilization persist across India. Policies aimed at reducing regional inequities may contribute to enhanced maternal healthcare utilization.

Keywords: Maternal healthcare utilization, NFHS-6, Ecological study, India, Antenatal care

Introduction:

Maternal health remains a major public health challenge in developing countries and is central to achieving the Sustainable Development Goals.^[1] Antenatal care (ANC) services are primary function of the primary health care delivery system of a country, which aims a healthy society and is a component of continuum of care for controlling maternal morbidity and mortality. One of the important components of Safe Motherhood Initiative is the provision of good ANC to all pregnant women.^[2] Timely and adequate utilization of maternal healthcare services including antenatal care, nutritional supplementation during pregnancy, and

institutional delivery, plays a critical role in reducing maternal and neonatal morbidity and mortality.^[3,4] Previous studies revealed that countries which have improved their maternal health care services are successful in dropping the maternal morbidity or mortality rate.^[5,6,7] Globally, 260,000 women died in 2023 due to pregnancy and childbirth related causes. These deaths are disproportionately concentrated in certain regions. For instance, Sub-Saharan Africa and Southern Asia together account for 87% of global maternal deaths, with Southern Asias contribution of 17%, indicating greater regional disparities.^[8]

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Over the past two decades, India has initiated several efforts to reduce MMR due to preventable causes related to pregnancy and childbirth. In 2005, the Government of India launched the National Rural Health Mission (NRHM) in which they focused on maternal and child health through the Reproductive Maternal Neonatal Child and Adolescent Health (RMNCH+A) programme which has changed to RMNCHA+N adding nutritional component to it. The *Janani Suraksha Yojana (JSY)* or Safe Motherhood Scheme was launched in 2005 under the NRHM to reduce maternal and child mortality by promoting institutional delivery through cash incentives to poor and marginalized women. Also, the Maternal and Child Protection (MCP) card was introduced under NRHM, and the Integrated Child Development Scheme (ICDS), was launched as an instrument to ensure that pregnant mothers have access to maternal healthcare services. Despite these efforts, there exists an inter-regional disparity in the utilization of maternal healthcare services and resultant maternal deaths in India.^[8,9] Understanding the geographical distribution of maternal healthcare utilization is essential for identifying underserved regions and guiding evidence-based policy decisions.

The National Family Health Survey-6 (NFHS-6) provides recent state-level estimates of maternal health indicators.^[9] Analysis of these data offers an opportunity to examine geographical patterns in maternal healthcare utilization. The objectives of the study were: (i) to assess inter-state variation in maternal healthcare utilization across India, (ii) to compare maternal healthcare utilization across different geographical regions of India, (iii) to rank States and Union Territories based on a Composite Maternal Healthcare Score.

MATERIALS AND METHODS

An ecological study was conducted using publicly available State and Union Territory fact sheets from the National Family Health Survey-6 (NFHS-6), 202324. NFHS-6 is a nationally representative household survey conducted under the stewardship of the Ministry of Health and Family Welfare, Government of India. The unit of analysis was the State/Union Territory. A total of 35 States and Union Territories for which complete data

were available were included in the study. Study variables included maternal healthcare utilization indicators such as: women who received antenatal care during the first trimester of pregnancy (%), women who had four or more antenatal care visits (%), institutional deliveries (%), women who consumed iron-folic acid tablets for at least 180 days during pregnancy (%). use

A Composite Maternal Healthcare Score was developed as a descriptive summary measure using nationally recognized maternal healthcare indicators reported in NFHS-6. The score was not intended to represent a psychometrically validated index but rather an aggregate measure to facilitate comparison across States and Union Territories. The score was derived using four indicators from the NFHS-6 fact sheets such as first-trimester antenatal care (ANC) registration, receipt of four or more ANC visits, institutional delivery, and consumption of iron-folic acid (IFA) tablets for at least 180 days during pregnancy. Composite Score = (First trimester ANC + Four or more ANC visits + Institutional delivery + IFA consumption e"180 days) ÷ 4. These indicators represent complementary dimensions of the maternal continuum of care, representing timely initiation of antenatal services, adequacy of antenatal care, safe childbirth, and adherence to recommended nutritional supplementation. Equal weighting was given for each indicator because each indicator represents an essential and complementary dimension of maternal healthcare utilization, and no empirical basis existed for assigning differential weights. These indicators are routinely used in NFHS reports and national maternal health monitoring frameworks. This approach was chosen because no validated or empirically established weighting scheme exists for combining these indicators at the state level, and assigning differential weights without a robust empirical basis could introduce subjectivity. Equal weighting is a commonly used and transparent method in composite index construction when individual indicators are considered equally important contributors to the underlying construct. Although recall bias may influence self-reported IFA consumption, this indicator is routinely collected and reported in NFHS surveys and remains an integral

component of national maternal health monitoring frameworks. Therefore, its inclusion enhances the comprehensiveness and policy relevance of the composite measure.

Adopted

States and Union Territories were categorized into six geographical regions: North, South, East, West, Central, and Northeast following classifications commonly used in national demographic and health research in India

Statistical analysis: Data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics version 26. Descriptive statistics including mean, standard deviation, minimum, and maximum values were calculated. Regional differences were also assessed using one-way ANOVA however, given the unequal number of States and Union Territories across regions, these analyses were considered exploratory and were interpreted with caution. Tukey's post-hoc test was used for pairwise comparisons. A p-value less than 0.05 was considered statistically significant.

Ethical considerations: The study utilized publicly available aggregate data from NFHS-6 fact sheets and did not involve human participants or identifiable information. Therefore, ethical approval was not required.

Results

Among the maternal healthcare indicators, institutional delivery demonstrated the highest mean coverage (92.10%; SD: 8.95), with several States and UTs achieving universal institutional delivery. In contrast, iron-folic acid (IFA) consumption for at least 180 days during pregnancy had the lowest mean coverage (44.85%; SD: 19.62), reflecting considerable

gaps in adherence to recommended antenatal nutritional supplementation.

The mean proportion of women receiving antenatal care during the first trimester was 78.28% (SD: 9.50), while the mean proportion completing four or more antenatal care visits was 70.87% (SD: 17.07). The wider standard deviation observed for four or more ANC visits and IFA consumption suggests greater inter-state variability in these indicators compared to institutional delivery and first trimester ANC registration.

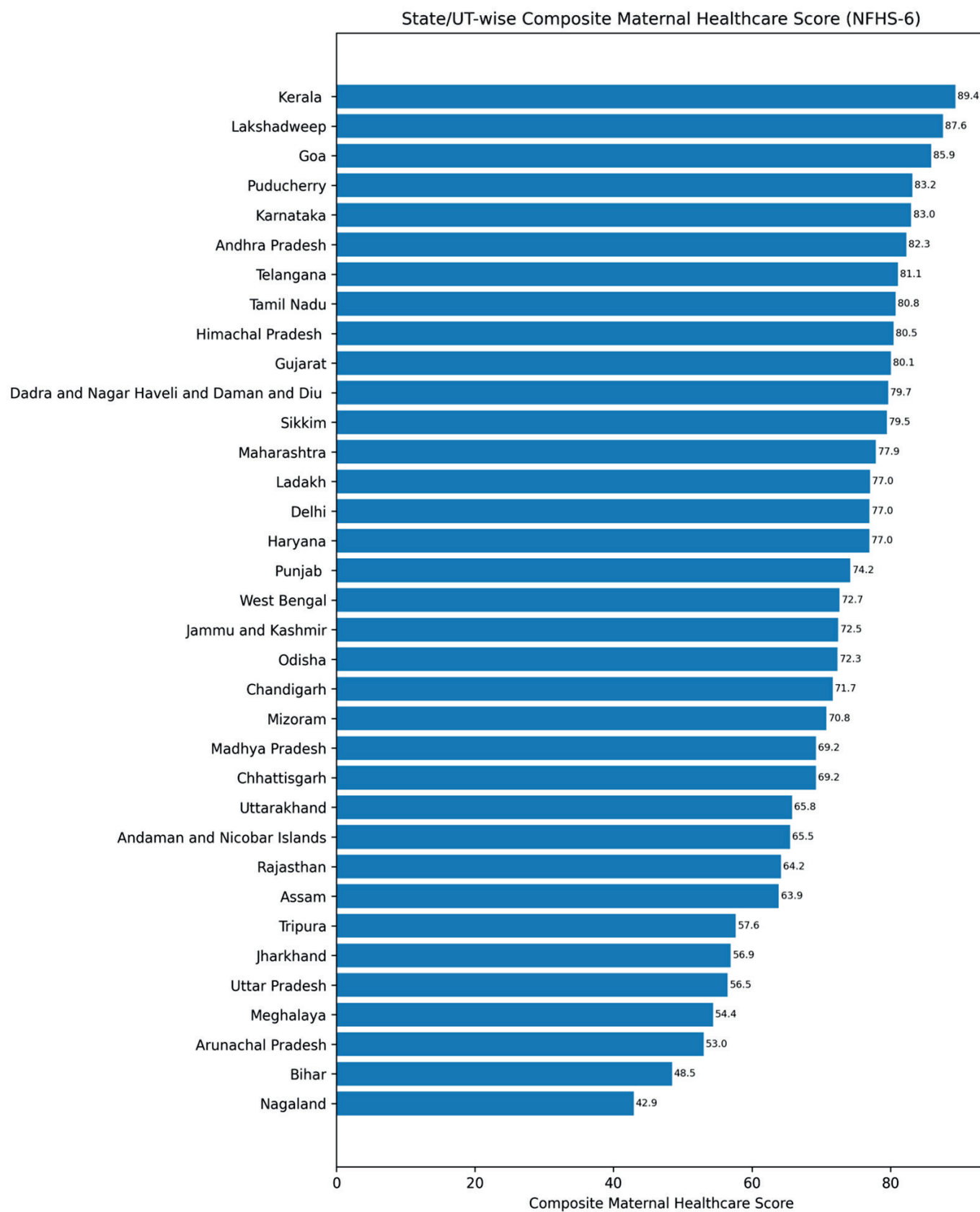
The Composite Maternal Healthcare Score had a mean value of 71.53 (SD: 11.60), with scores ranging from 42.93 to 89.38. This wide range highlights substantial geographical disparities in maternal healthcare utilization across India. The coefficient of variation (CV) indicated substantial interstate heterogeneity in maternal healthcare indicators. IFA consumption for at least 180 days exhibited the greatest variability (CV = 43.7%), followed by completion of four or more ANC visits (CV = 24.1%). In contrast, institutional delivery showed relatively low variability (CV = 9.7%), suggesting more uniform coverage across States and Union Territories. These findings indicate that adherence to antenatal care recommendations and nutritional supplementation remains considerably more uneven across India than institutional delivery services. (Table 1)

The Composite Maternal Healthcare Score ranged widely across States and Union Territories, indicating substantial geographical disparities in maternal healthcare utilization. Kerala achieved the highest score (89.38), followed by Lakshadweep (87.58), Goa (85.90), Puducherry (83.18), and Karnataka (83.00). Other high-performing States included Andhra Pradesh, Telangana, Tamil Nadu, Himachal Pradesh, and Gujarat.

Table 1: Descriptive statistics of maternal healthcare indicators

Indicator	Mean	SD	CV	Minimum	Maximum
First trimester ANC	78.28	9.5	12.1	57.6	96.3
≥4 ANC visits	70.87	17.07	24.1	32.5	95.1
Institutional delivery	92.1	8.95	9.7	62.2	100
IFA ≥180 days	44.85	19.62	43.7	11.2	83.7
Composite Maternal Healthcare Score	71.53	11.6	16.2	42.93	89.38

Figure 1. State/UT wise Composite Maternal Healthcare Score(NFHS-6)



In contrast, several States demonstrated comparatively lower composite scores, highlighting areas requiring greater programmatic attention and strengthening of maternal health services. (Figure 1)

Source: Authors’ analysis of NFHS-6 (202324) State and Union Territory Fact Sheets.

Darker shades indicate higher Composite Maternal Healthcare Scores.

Figure 2 illustrates the spatial distribution of Composite Maternal Healthcare Scores across India. Higher scores were predominantly concentrated in the southern and western regions, particularly Kerala, Karnataka, Tamil Nadu, Andhra Pradesh, Goa, and

Lakshadweep. In contrast, several states in the northeastern and eastern regions demonstrated comparatively lower scores, highlighting persistent geographical disparities in maternal healthcare utilization across the country.

Significant regional differences were observed in Composite Maternal Healthcare Scores across India. The highest mean score was observed in the Southern region (81.60 ± 7.18), followed closely by the Western region (80.89 ± 3.47). In contrast, the Northeast region demonstrated the lowest mean score (60.30 ± 12.16), followed by the Eastern region (64.48 ± 13.89).

Figure 2. Geographical Distribution of Composite Material Healthcare Scores Across Indian States and Union Territories, NFHS-6 (2023-24)

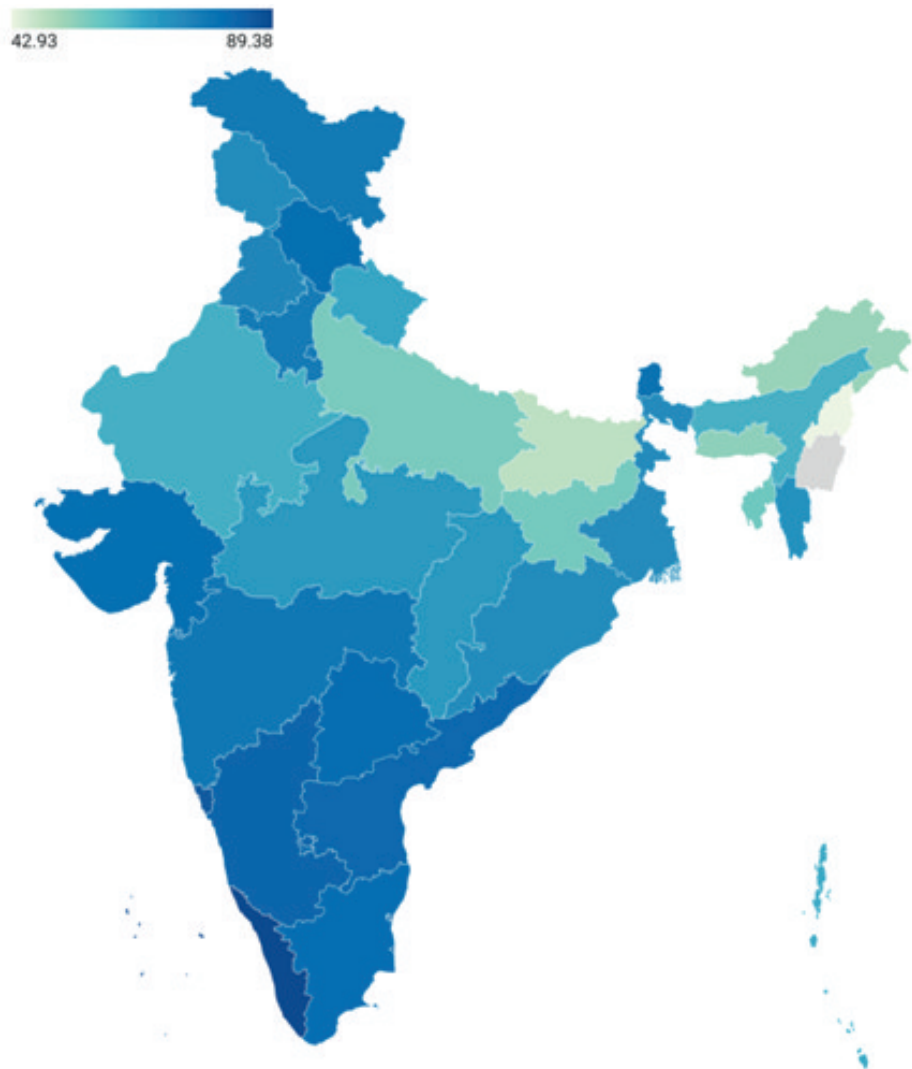


Table 2. Regional variation in maternal healthcare utilization

Region	Number of States/UT	Mean Composite Score $\pm$ SD
Northeast	7	60.30 $\pm$ 12.16
East	3	64.48 $\pm$ 13.89
Central	2	69.23 $\pm$ 0.00
North	11	70.29 $\pm$ 8.28
West	4	80.89 $\pm$ 3.47
South	8	81.60 $\pm$ 7.18
Total	35	71.53 $\pm$ 11.60

One-way analysis of variance revealed statistically significant differences in Composite Maternal Healthcare Scores among regions ($F = 5.469$, $p = 0.001$). The assumption of homogeneity of variances was satisfied (Levene's test $p = 0.052$).

Post-hoc Tukey analysis suggested that Southern and Western regions consistently demonstrated higher maternal healthcare utilization compared with the Northeast and Eastern regions. These findings highlight substantial geographical disparities in maternal healthcare utilization across India.

DISCUSSION

The present ecological analysis of NFHS-6 data revealed substantial inter-state and regional variations in maternal healthcare utilization across India. Southern and western regions demonstrated significantly higher Composite Maternal Healthcare Scores compared to eastern and northeastern regions.

The findings of this study indicate persistent geographical disparities in maternal healthcare utilization despite considerable improvements in maternal health indicators nationally. Southern states, particularly Kerala, Tamil Nadu, Karnataka, and Andhra Pradesh, consistently performed better across maternal healthcare indicators. Similar regional patterns have been reported in previous studies using NFHS data, where southern states demonstrated higher coverage of antenatal care services and institutional deliveries compared with several eastern and northeastern states.^[10,11] Similar findings were seen in study by Gajender Gupta *et al.* where North Eastern Region trails behind in maternal healthcare utilization.^[8] These differences may be attributable to variations in literacy

levels, female empowerment, healthcare infrastructure, health system performance, and socioeconomic development across regions. Among the maternal healthcare indicators, IFA consumption demonstrated the greatest interstate variability, suggesting that adherence to recommended antenatal nutritional supplementation remains a major challenge in several regions of India. Kerala's consistently high performance may reflect its higher female literacy, stronger primary healthcare system, better antenatal care coverage, and long-standing investments in maternal and child health services.

The significant regional variation observed in the present study ($p = 0.001$) suggests that improvements in maternal health services have not occurred uniformly throughout the country. States with lower composite scores may face challenges related to accessibility of healthcare facilities, shortage of skilled healthcare personnel, difficult geographical terrain, and sociocultural barriers to healthcare utilization.^[12,13] Targeted interventions focusing on underperforming regions are therefore essential to reduce inequalities in maternal health outcomes.

The present study has several strengths. First, it utilized the most recent nationally representative NFHS-6 data covering multiple States and Union Territories. Second, a Composite Maternal Healthcare Score was developed using key indicators representing different dimensions of maternal healthcare utilization. Third, the study provides a comprehensive comparison of maternal healthcare utilization across States, Union Territories, and geographical regions using a composite summary measure.

The present study has several limitations. The ecological design based on aggregate State and Union Territory data is subject to ecological fallacy; therefore, findings cannot be interpreted at the individual level. The Composite Maternal Healthcare Score was developed as a descriptive summary measure using equal weighting of four nationally recognized maternal healthcare indicators and has not undergone formal external validation. Although the indicator on iron-folic acid (IFA) tablet consumption for at least 180 days is routinely reported in NFHS surveys, it may be more susceptible to recall bias than the other indicators because it is based on self-reported information. Finally, the number of States and Union Territories within geographical regions was unequal, with some regions containing only a small number of observations. So the results of the regional comparisons using one-way ANOVA should be interpreted with caution, as the limited sample size in certain regions may have affected the robustness of the statistical comparisons.

States with lower maternal healthcare utilization require targeted strengthening of antenatal care services, improved nutritional supplementation programmes, and enhanced access to institutional delivery. Region-specific strategies should be prioritized to reduce interstate inequalities in maternal healthcare utilization. Continued monitoring using nationally representative surveys such as NFHS will be important for evaluating progress toward equitable maternal healthcare utilization.

Availability of data and materials

The data used in this study is publicly available and can be obtained for free by submitting an online request on the International Institute for Population Science (IIPS), Mumbai website (<https://www.iipsdata.ac.in/>).

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