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One in four Indian births is now by caesarean section: a state-level analysis of public–private sector differences and ecological drivers using NFHS-6 (2023– 24)

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Abstract

Background

India's caesarean section (CS) rate rose from 21.5% (NFHS-5, 2019–21) to 27.2% (NFHS-6, 2023–24), now 82% above the WHO optimal ceiling of 15%. No published study has used NFHS-6 data to map the private–public sector gap across all 36 states and union territories (UTs), or identified its ecological determinants.

Methods

Ecological cross-sectional study using publicly available NFHS-6 state fact sheets (n = 35 states/UTs; national aggregate excluded from regression). A market-driven care index (MDCI = private-sector CS rate ÷ public-sector CS rate) was computed per state. Spearman rank correlations (Bonferroni-adjusted threshold $p < 0.0125$ for four simultaneous tests) and OLS multiple regression (HC3 robust standard errors) examined associations between state CS rates and four predictors: health insurance coverage (I.7), women's educational attainment (I.12), proportion of institutional births at public facilities (I.36), and total fertility rate (I.18). Analyses performed in Python 3.12.

Results

State CS rates ranged from 6.4% (Meghalaya) to 62.2% (Telangana). The national private-sector CS rate was 54.1% versus 16.9% in government hospitals (national MDCI = 3.20). Bihar had the highest MDCI (18.26). Women's education was the strongest predictor (Spearman $\rho = +0.532$, 95% CI + 0.241 to + 0.735, $p = 0.001$). TFR was inversely correlated ($\rho = -0.428$, 95% CI − 0.666 to − 0.110, $p = 0.010$). The proportion of births at public facilities was not significantly correlated with CS rates ($\rho = +0.026$, $p = 0.883$). In OLS regression (Model 2), education ($\beta = +0.377$, 95% CI 0.185–0.569, $p = 0.0001$) and TFR ($\beta = -12.101$, 95% CI − 23.330 to − 0.873, $p = 0.035$) together explained 30.7% of state-level CS rate variance ($R^2 = 0.307$).

Conclusions

Women's educational attainment is the dominant ecological predictor of India's state-level CS rates, reflecting demand-side medicalisation. Mandatory CS audits using the Robson classification in private hospitals, PMJAY reimbursement conditioned on clinical indication records, LaQshya scale-up with CS-reduction targets, and pre-natal education campaigns targeting high-CS states are urgent priorities.

INTRODUCTION

Globally, the caesarean section (CS) rate nearly doubled from 12.1% in 2000 to 21.1% in 2015, and is projected to reach 28.5% by 2030.[1] The World Health Organization (WHO) concluded from systematic review evidence that CS rates above 10–15% at the population level confer no additional benefit for maternal or neonatal survival, and excess CS carries real risks of morbidity.[2,3]

India's NFHS-5 (2019–21) documented a national CS rate of 21.5%, already 43% above the WHO upper threshold. Private hospitals performed CS in 47.4% of births versus 14.3% in government hospitals.[4] Research links this private-sector excess to physician financial incentives, provider convenience and weak facility regulation.[5–8] Despite the LaQshya Labour Room Quality Improvement Initiative[9] (2017) and expansion of PMJAY health insurance[10], the NFHS-6 (2023–24) suggests continued deterioration.

No published study has used NFHS-6 data to map CS rates across all 36 Indian states and UTs or introduced a composite measure of the private–public gap. We introduce the market-driven care index (MDCI = private-sector CS rate ÷ public-sector CS rate). This study: (1) documents NFHS-6 CS rates for all 35 states/UTs; (2) computes MDCI and describes sector divergence; (3) quantifies temporal change from NFHS-5; and (4) identifies ecological predictors of state-level CS rates.

METHODS

Study design and data source

Ecological cross-sectional study. Data: publicly available NFHS-6 (2023–24) state fact sheets (Ministry of Health and Family Welfare/IIPS, Mumbai; https://rchiips.org).[11] The ecological unit was the state or UT (n = 35; India national aggregate excluded from regression). NFHS-6 used stratified multi-stage cluster sampling; all values were taken from the 'Total' (Urban + Rural combined) column. STROBE reporting guidelines were followed (Supplementary File 2).

Variables

Primary outcome: overall state CS rate (I.38, % of institutional births delivered by CS). Secondary outcomes: private-sector CS rate (I.39) and public-sector CS rate (I.40). MDCI = I.39 ÷ I.40. The market-driven care index (MDCI) was used as a descriptive measure of private-public sector divergence in caesarean delivery rates. Because MDCI is a ratio, it is sensitive to very low values in the public-sector denominator and may therefore appear inflated in states where public-sector caesarean delivery rates are extremely low. Accordingly, MDCI should be interpreted alongside the absolute private-sector and public-sector rates rather than as a standalone measure of access or quality.

MDCI was not computed for Andaman and Nicobar Islands or Ladakh (I.39 fully suppressed). Predictors: health insurance coverage (I.7); women with ≥ 10 years of schooling (I.12); proportion of institutional births at a public facility (I.36); and total fertility rate or TFR (I.18). Indicator definitions in Supplementary File 1.

Statistical analysis

States were classified: very high (> 50%), high (30–50%), moderate (15–30%), or low (< 15%). We first examined pairwise associations using Spearman rank correlation because the ecological variables were percentages or rates and were not assumed to be normally distributed. To control the family-wise error rate across the four predictor–outcome correlation tests, we applied a Bonferroni-adjusted significance threshold of $p < 0.0125$. Because four predictor correlations were tested simultaneously, a Bonferroni correction was used to reduce the likelihood of false-positive findings arising from multiple testing. This correction was applied to the family of predictor correlations and not to the regression coefficients, which were evaluated within pre-specified multivariable models. The corrected threshold was intentionally conservative and may have reduced sensitivity, but it improves confidence that the statistically significant correlations represent more robust ecological associations.

For multivariable analysis, we used ordinary least squares regression because the outcome, state-level caesarean section rate, was a continuous proportion expressed as a percentage. Given the small sample size and the possibility of unequal residual variance across states, we report heteroscedasticity-robust HC3 standard errors. We also assessed model assumptions using residual diagnostics and the Breusch–Pagan test. Homoscedasticity was confirmed by Breusch–Pagan test (Model 1: $p = 0.157$; Model 2: $p = 0.823$). Two bivariate models: Model 1 (I.36 + I.7); Model 2 (I.12 + I.18). Maximum two predictors per model (events per variable ≥ 17, adequate for $n = 35$). Sensitivity analysis excluding small union territories was undertaken to assess robustness of the main findings. Python 3.12 code in Supplementary File 3.

The use of two parsimonious multivariable models was deliberate. With only 35 ecological units, models with a large number of predictors would have been unstable and vulnerable to overfitting. We therefore grouped predictors into conceptually related pairs and limited each model to two covariates, which preserved interpretability while maintaining an acceptable events-per-variable ratio for small-sample ecological regression.

Ethics

This study used publicly available, aggregated, de-identified state-level data only. No individual participants were involved. Institutional ethics approval was not required.

RESULTS

State-level CS rates and temporal change

The national CS rate rose from 21.5% (NFHS-5) to 27.2% (NFHS-6): absolute rise of 5.7 percentage points, relative increase 26.5% in approximately five years. Among 35 states and UTs, the median CS rate

was 29.4% (IQR 19.8–43.9%), mean 31.4% (SD 14.0%). Rates ranged from 6.4% (Meghalaya) to 62.2% (Telangana). Full data are in Table 1 and Fig. 1.

Four states exceeded 50%: Telangana (62.2%), Andhra Pradesh (52.2%), Sikkim (51.1%), and Jammu and Kashmir (51.0%). Only three states, Nagaland (9.9%), Mizoram (13.5%), and Meghalaya (6.4%) fell within the WHO optimal range of 10–15%. Among large states, Tamil Nadu (46.9%), Punjab (46.6%), Karnataka (45.7%), and West Bengal (44.5%) all exceeded the national rate. EAG states including Bihar (13.2%), Madhya Pradesh (16.0%), Rajasthan (15.6%), Jharkhand (15.7%), and Uttar Pradesh (19.5%) remained below the national average. CS rates increased in 32 of 33 states with NFHS-5 comparisons, with the largest rises in Sikkim (+ 18.3 pp), Karnataka (+ 14.2 pp), and Jammu and Kashmir (+ 9.3 pp) (Fig. 3).

Table 1

State-level caesarean section rates (%), private-sector rate, public-sector rate, market-driven care index (MDCI), and NFHS-5 comparison-NFHS-6 (2023–24), n = 35 states/UTs ranked by overall CS rate. National reference row shown at bottom.

State / UT	Overall CS% (NFHS-6)	Private CS% (I.39)	Public CS% (I.40)	MDCI (I.39 ÷ I.40)	NFHS-5 CS%	Category
Telangana	62.2	83.9	48.1	1.74	60.7	Very high (> 50%)
Andhra Pradesh	52.2	66.2	38.0	1.74	42.4	Very high (> 50%)
Sikkim	51.1	67.8	46.7	1.45	32.8	Very high (> 50%)
Jammu & Kashmir	51.0	90.0	48.6	1.85	41.7	Very high (> 50%)
Tamil Nadu	46.9	60.3	39.6	1.52	44.9	High (30–50%)
Punjab	46.6	63.3	34.2	1.85	38.5	High (30–50%)
Goa	46.2	69.7	31.4	2.22	39.5	High (30–50%)
Karnataka	45.7	63.8	34.0	1.88	31.5	High (30–50%)
West Bengal	44.5	87.7	28.8	3.05	32.6	High (30–50%)
Puducherry	43.2	62.4	37.4	1.67	36.3	High (30–50%)
Kerala	41.3	42.5	39.3	1.08	38.9	High (30–50%)
Lakshadweep	39.9	75.0	33.4	2.25	31.3	High (30–50%)
Chandigarh	36.1	65.0	32.3	2.01	—	High (30–50%)
A&N Islands	35.0	—	28.5	—	29.9	High (30–50%)
Maharashtra	33.6	48.5	23.8	2.04	25.4	High (30–50%)
Tripura	30.1	78.3	25.1	3.12	25.1	High (30–50%)

State / UT	Overall CS% (NFHS-6)	Private CS% (I.39)	Public CS% (I.40)	MDCI (I.39 ÷ I.40)	NFHS-5 CS%	Category
Himachal Pradesh	29.9	63.7	23.3	2.73	21.0	Moderate (15–30%)
Odisha	29.4	76.8	19.9	3.86	21.6	Moderate (15–30%)
Gujarat	29.0	39.8	15.6	2.56	21.0	Moderate (15–30%)
D&NH & D&D	28.6	43.6	24.9	1.75	22.9	Moderate (15–30%)
Ladakh	27.8	—	27.0	—	37.6	Moderate (15–30%)
NCT of Delhi	27.4	50.9	19.6	2.60	23.6	Moderate (15–30%)
Uttarakhand	25.9	47.7	14.7	3.24	20.4	Moderate (15–30%)
Haryana	25.6	40.2	15.2	2.64	19.4	Moderate (15–30%)
Assam	22.9	81.4	17.4	4.68	18.1	Moderate (15–30%)
Chhattisgarh	20.0	64.9	12.2	5.32	15.2	Moderate (15–30%)
Uttar Pradesh	19.5	47.3	6.5	7.28	13.7	Moderate (15–30%)
Arunachal Pradesh	17.4	62.1	16.7	3.72	14.8	Moderate (15–30%)
Madhya Pradesh	16.0	61.7	10.4	5.93	12.1	Low (< 15%)
Jharkhand	15.7	54.1	6.1	8.87	12.8	Low (< 15%)
Rajasthan	15.6	35.0	10.5	3.33	10.4	Low (< 15%)
Bihar	13.2	49.3	2.7	18.26	9.7	Low (< 15%)
Mizoram	13.5	35.2	10.3	3.42	10.8	Low (< 15%)
Nagaland	9.9	32.5	9.4	3.46	5.2	Low (< 15%)
Meghalaya	6.4	36.2	5.0	7.24	8.2	Low (< 15%)
India (National-reference)	**27.2**	**54.1**	**16.9**	**3.20**	**21.5**	**Reference**

CS = caesarean section; MDCI = market-driven care index (I.39 ÷ I.40); — = estimate suppressed in NFHS-6 (< 25 unweighted cases). Row colours: red = very high (> 50%), yellow = high (30–50%), blue = moderate (15–30%), green = low (< 15%). Yellow state-name highlight = EAG/high-burden state. Blue row = national reference (excluded from regression). Sikkim I.39 = 67.8% (NFHS-6 total; urban suppressed). MDCI not computed for A&N Islands and Ladakh. Chandigarh I.39 = 65.0% and Lakshadweep I.39 = 75.0% are small-sample parenthetical estimates. All values verified against NFHS-6 state fact sheets (MoHFW/IIPS, 2024). WHO optimal CS range: 10–15%.

Colour: red > 50%; orange 30–50%; blue 15–30%; green < 15%. Green band = WHO target (10–15%). Dashed line = national average (27.2%). Percentage values to right of each bar.

Private-sector versus public-sector CS rates and the MDCI

Nationally, private hospitals performed CS in 54.1% of births versus 16.9% in government hospitals (national MDCI = 3.20). State MDCI ranged from 1.08 (Kerala) to 18.26 (Bihar) (Table 1, Fig. 2). The highest MDCIs occurred paradoxically in states with the lowest overall CS rates. In Bihar (MDCI 18.26), government hospitals perform CS in only 2.7% of births while private hospitals do so in 49.3%: access to CS is effectively a private commodity. In Jharkhand (MDCI 8.87), Uttar Pradesh (7.28), Meghalaya (7.24), and Madhya Pradesh (5.93), government CS rates range from 2.7% to 10.5%.

Three epidemiological patterns emerge: (1) Private-monopoly states (EAG): very high MDCI, low overall CS-CS is privatised but not yet medicalised. (2) System-wide medicalisation (Telangana, Andhra Pradesh): high CS in both sectors; MDCI 1.74 despite the highest overall rates. (3) Equity-in-excess (Kerala): MDCI 1.08; public-sector rate (39.3%) nearly equal to private (42.5%) - high CS equally distributed. Each pattern requires a different policy response (Fig. 2).

Upper panel: grouped bars (red = private, blue = public, green = overall). Purple dashed line = WHO limit (15%). Dark dashed line = national overall (27.2%). Lower panel: lollipop chart; dot colour = MDCI level (red > 8×, orange 4–8×, blue < 4×). National MDCI (3.20) as dashed reference line.

Temporal change: NFHS-5 to NFHS-6

Figure 3 shows the change in state CS rates between NFHS-5 and NFHS-6 for all 33 states with available trend data. Seven states recorded increases exceeding 10 percentage points. EAG states showed consistent upward trends: Bihar rose from 9.7% to 13.2% (+ 3.5 pp), Uttar Pradesh from 13.7% to 19.5% (+ 5.8 pp). Telangana rose only 1.5 pp from its already extreme NFHS-5 baseline (60.7%), suggesting plateau near saturation. Ladakh showed an apparent decrease (− 9.8 pp) based on a small sample and should be interpreted with caution.

Circles = NFHS-5 rate; diamonds = NFHS-6 rate. Segment colour: red = increase > 5 pp; blue = 0–5 pp; green = decrease. Number at right = absolute pp change. Dashed line = NFHS-6 national (27.2%); dotted = NFHS-5

national (21.5%).

Ecological predictors of state-level CS rates

Table 2 and Fig. 4 summarise results. Women's educational attainment (I.12) was the strongest predictor of state CS rates (Spearman ρ = +0.532, 95% CI + 0.241 to + 0.735, p = 0.001, n = 35). TFR (I.18) was inversely correlated (ρ = −0.428, 95% CI − 0.666 to − 0.110, p = 0.010). Both remained significant after Bonferroni correction. The MDCI showed a strong inverse correlation with overall CS rates (ρ = −0.846, 95% CI − 0.922 to − 0.709, p < 0.001, n = 33): states with the highest private–public divergence had the lowest overall CS rates, consistent with marked private-public divergence in low-resource settings. The proportion of institutional births in public facilities (I.36) was not significantly correlated with CS rates (ρ = +0.026, 95% CI − 0.310 to + 0.356, p = 0.883), nor was health insurance coverage (ρ = +0.015, p = 0.934).

In OLS regression Model 1 (I.36 + I.7, n = 35, R^2 = 0.005, F-p = 0.931), neither predictor was significant. Model 2 (I.12 + I.18, n = 35) explained 30.7% of the variance in state CS rates (R^2 = 0.307, adjusted R^2 = 0.264, F-p < 0.001). Women's education was positively associated with CS rates (β = +0.377, 95% CI 0.185 to 0.569, p = 0.0001): each 1 percentage-point increase in women with ≥ 10 years of schooling was associated with a 0.377 pp higher state CS rate, after adjusting for TFR. TFR was inversely associated (β = −12.101, 95% CI − 23.330 to − 0.873, p = 0.035): each additional child per woman was associated with a 12.1 pp lower state CS rate, after adjusting for education. Sensitivity analysis (n = 30) confirmed stronger associations for both predictors (I.12 β = +0.351, p = 0.003; I.18 β = −19.121, p = 0.003; Supplementary File 1, Table S1).

Table 2

Spearman rank correlations and OLS regression results for ecological predictors of state-level overall CS rate (%), NFHS-6 (2023–24), n = 35 states/UTs. Replicate in Jamovi: Regression → Correlation Matrix (Spearman); Regression → Linear Regression (OLS).

Predictor (NFHS-6 indicator)	**n**	**Spearman ρ (95% CI)**	**p value**	**Significant (p < 0.0125)***	**Model**	**β (95% CI)**	**p (OLS)**
I.36: % institutional births at public facility	35	+ 0.026 (− 0.310 to + 0.356)	0.883	No	1	−0.022 (− 0.336 to + 0.292)	0.892
I.7: Health insurance coverage (% households)	35	+ 0.015 (− 0.320 to + 0.346)	0.934	No	1	+ 0.044 (− 0.192 to + 0.280)	0.714
I.12: Women with ≥ 10 years of schooling (% aged 15–49)	35	+ 0.532 (+ 0.241 to + 0.735)	0.001	**YES**	2	+ 0.377 (0.185 to 0.569)	0.0001
I.18: Total fertility rate (children per woman)	35	−0.428 (− 0.666 to − 0.110)	0.010	**YES**	2	−12.101 (− 23.330 to − 0.873)	0.035
MDCI: Private÷public CS rate ratio	33	−0.846 (− 0.922 to − 0.709)	< 0.001	**YES**	—	—	—

*β = unstandardised OLS coefficient; CI = 95% confidence interval; ρ = Spearman rank correlation. *Significant after Bonferroni correction for four predictor correlations (adjusted α = 0.0125). Model 1 (I.36 + I.7): n = 35, R^2 = 0.005, adj-R^2 = −0.057, F-p = 0.931. Model 2 (I.12 + I.18): n = 35, R^2 = 0.307, adj-R^2 = 0.264, F-p < 0.001. Homoscedasticity confirmed (Breusch–Pagan: Model 1 p = 0.157, Model 2 p = 0.823); HC3 robust SEs used as conservative choice. β interpretation for I.12: each 1 pp increase in women's education is associated with + 0.377 pp higher state CS rate, adjusting for TFR. Sensitivity analysis (n = 30, excluding five small UTs) in Supplementary File 1, Table S1. MDCI correlation is a separate test (not part of Bonferroni family).*

Red dots = EAG states; blue = other states. Dashed lines = OLS trend. Panel A: strong inverse MDCI–CS relationship — high-MDCI states (Bihar, Jharkhand) have low overall CS rates, consistent with marked private-public divergence over surgical obstetric access. Panel B: near-zero, non-significant correlation (ρ = +0.026) — public-facility birth share does NOT predict overall CS rates because some high-public-sector states (e.g. Telangana, West Bengal) also have very high public-sector CS rates.

The Breusch–Pagan test did not indicate strong evidence of heteroscedasticity in either model, supporting the use of OLS for point estimation. Nonetheless, HC3 robust standard errors were retained as a conservative approach because small-sample ecological regression can be sensitive to variance instability and influential observations. Sensitivity analysis excluding small union territories produced materially similar associations, suggesting that the main findings were not driven by a few small units.

DISCUSSION

Three major findings emerge from this first state-level ecological analysis of NFHS-6 data. First, India's national CS rate of 27.2% has risen 26.5% relative to NFHS-5 in five years and now exceeds the WHO upper limit by 82%. Private hospitals operate at 54.1% nationally, surpassing the Latin American regional average of 44.3%, itself the world's highest.[1] Research consistently links this excess to financial incentives,[5] provider convenience,[12] and weak regulatory oversight of private facilities.[13]

Second, the MDCI reveals an equity crisis hidden by aggregate statistics. Bihar's MDCI of 18.26 means private hospitals perform CS at 18 times the government-hospital rate.[14] In EAG states, CS access is effectively a private commodity: government hospitals deliver most births but perform almost no CS, while private hospitals operate with near-clinical freedom. PMJAY was expected to bridge this gap, but Garg et al. found no reduction in out-of-pocket expenditure or private-sector CS rates associated with PMJAY enrolment using NFHS-5 data.[15] Our ecological finding that health insurance coverage (I.7) was not correlated with state CS rates ($\rho = +0.015$, $p = 0.934$) provides corroboration.

Third, and most important for policy, women's educational attainment (I.12) was the dominant ecological predictor ($\rho = +0.532$, $p = 0.001$; OLS $\beta = +0.377$, $p = 0.0001$). States with more educated women have higher CS rates. This reflects demand-side medicalisation: education is associated with state-level CS rates and receptivity to medical recommendations.[16–18] The finding that public-sector birth share (I.36) was not correlated with CS rates ($\rho = +0.026$, $p = 0.883$) reinforces this: routing births toward government facilities alone is unlikely to reduce CS rates if the public sector itself operates at high CS rates (as in Telangana, where the public CS rate is 48.1%). The policy target must be clinical culture within sectors, not only which sector women use.

The inverse association between TFR and state-level CS rates ($\rho = -0.428$, 95% CI − 0.666 to − 0.110, $p = 0.010$; OLS $\beta = -12.101$, 95% CI − 23.330 to − 0.873, $p = 0.035$) is ecologically coherent but demands cautious interpretation. Higher parity, the individual correlate of high population-level TFR is consistently associated with lower likelihood of CS delivery, and this biological gradient plausibly aggregates to an inverse ecological association at the state level.[19] EAG states with persistently high TFR, including Bihar (CS 13.2%), Uttar Pradesh (CS 19.5%), and Rajasthan (CS 15.6%), record low aggregate CS rates partly because the numerically dominant vaginal delivery norm suppresses the state average. However, the MDCI data caution against interpreting these low rates as appropriate care. Bihar's MDCI of 18.26 reveals that government hospitals which absorb the majority of births in this high-fertility state perform CS in only 2.7% of deliveries, indicating severe public-sector under-provision rather than genuinely low clinical burden. This finding corroborates district-level analyses from Bihar[20] and Madhya Pradesh[21] documenting marked geographical and socioeconomic inequities in CS access, with rural and lowest-wealth-quintile women at disproportionate risk of unmet need for emergency CS. Conversely, low-TFR southern states, Telangana (62.2%), Andhra Pradesh (52.2%), and Tamil Nadu (46.9%) have undergone fertility transitions accompanied by urbanisation and expansion of private maternity care, consistent with global evidence that CS rates respond strongly to structural and socioeconomic determinants

beyond clinical need.[21,22] Notably, TFR retained independent inverse association after adjustment for women's educational attainment (p = 0.035), suggesting it captures dimensions of development including private-sector dependence and demand-side medicalisation that are partially distinct from education alone. These findings should be interpreted at the ecological level only; unmeasured confounders including obstetrician density, private hospital concentration, and case-mix may contribute to the observed associations.

These findings should be interpreted at the ecological level and not as individual-level causal relationships. The positive association between women's education and state caesarean section rates reflects state-level correlation and may partly capture broader development, urbanization, private-sector dependence, and health-system capacity rather than education alone.[18,23] Likewise, the absence of association with public-facility birth share does not imply that facility mix is irrelevant; instead, it suggests that sector of delivery alone is insufficient to explain state-level variation in caesarean rates. Important unmeasured factors such as obstetrician density, private hospital concentration, referral patterns, case-mix, and local medical practice norms may also contribute to the observed associations.[4,22,24]

LaQshya has improved structural quality in government labour rooms but lacks binding CS-indication protocols.[9] Mandatory Robson Ten-Group Classification System audits, already piloted at tertiary centres in Mumbai[25] and Bihar,[20] could be considered for scale-up and linked to PMJAY reimbursement in empanelled private hospitals. Pre-natal education programmes in high-CS states must explicitly address misconceptions about elective CS safety.

Limitations include the ecological design, which precludes individual-level causal inference. With n = 35 units and two predictors per model, statistical power is adequate but limited. CS status is self-reported. State averages mask district-level variation. Medical indications cannot be assessed from NFHS data. Two UTs (A&N Islands, Ladakh) had fully suppressed I.39, limiting MDCI computation to 33 states. Unmeasured confounders such as provider density, private hospital concentration, referral patterns, urbanization, and cultural factors may explain residual associations. The MDCI is a descriptive indicator rather than a validated causal metric of marketisation or quality, and its interpretation is limited when public-sector rates are very low.

CONCLUSIONS

One in four Indian births now occurs by CS, with private hospitals operating at three to eighteen times the rate of government facilities. Women's educational attainment reflecting demand for private maternity care is the strongest ecological predictor of state-level CS rates; public-sector birth share is not. The MDCI provides a replicable monitoring tool for future NFHS rounds. Four priorities follow: (1) mandatory Robson-classification CS audits in all PMJAY-empanelled hospitals; (2) PMJAY reimbursement conditioned on Robson-group-appropriate CS indication documentation; (3) LaQshya

scale-up with explicit CS-reduction targets and independent monitoring; and (4) structured pre-natal counselling on CS risks in high-CS and high-education states.

Overall, the findings should be viewed as a state-level descriptive and hypothesis-generating analysis rather than evidence of individual-level causation. The principal value of the study lies in identifying marked interstate inequality, sectoral divergence, and plausible ecological correlates that merit confirmation using facility-level data, multilevel analyses, and Robson-classified audit systems.

Declarations

Conflicts of interest:

None declared.

Ethics approval:

Not required. This study used publicly available, aggregated, de-identified state-level data from NFHS-6 state fact sheets (MoHFW/IIPS, 2024). No individual participants were involved.

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Author Contribution

All authors contributed equally to this work and share equal credit.

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Data availability:

Source data available at https://www.nfhsiips.in/nfhsuser/assets/National%20Family%20Health%20Survey%20(NFHS-6)%202023-2024%20Fact%20Sheets.pdf (NFHS-6 state fact sheets).

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26. SUPPLEMENTARY, FILES SUBMITTED.
27. Supplementary File 1. Data extraction procedure; indicator definitions, Breusch–Pagan test results, Supplementary Table S1 (n = 30 sensitivity).
28. Supplementary File 2. Completed STROBE 22-item checklist for observational ecological studies, with manuscript page/section location for each item.

Figures

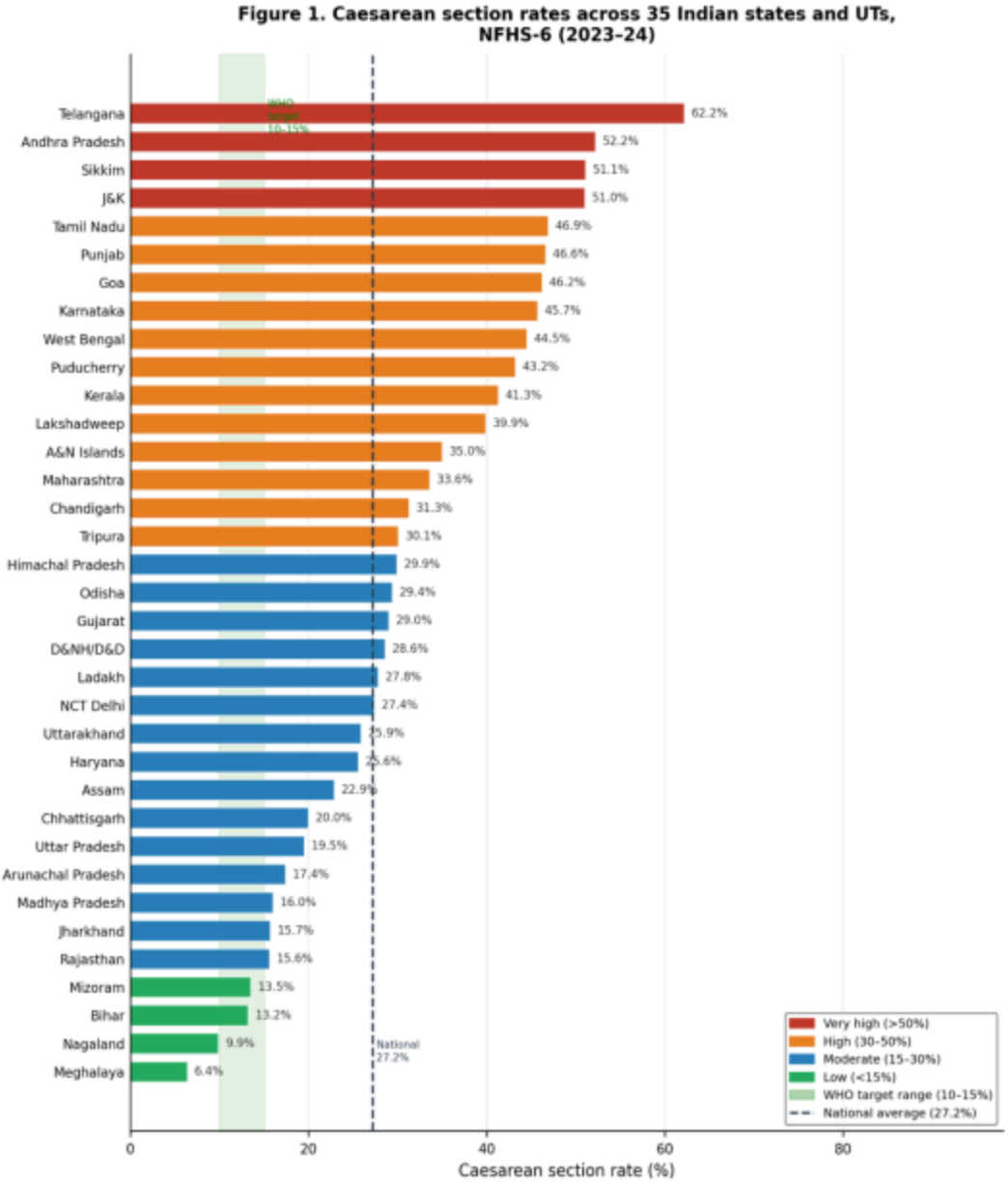


Figure 1

CS rates across 35 Indian states and UTs, NFHS-6 (2023–24), ranked lowest to highest.

Colour: red >50%; orange 30–50%; blue 15–30%; green <15%. Green band = WHO target (10–15%). Dashed line = national average (27.2%). Percentage values to right of each bar.

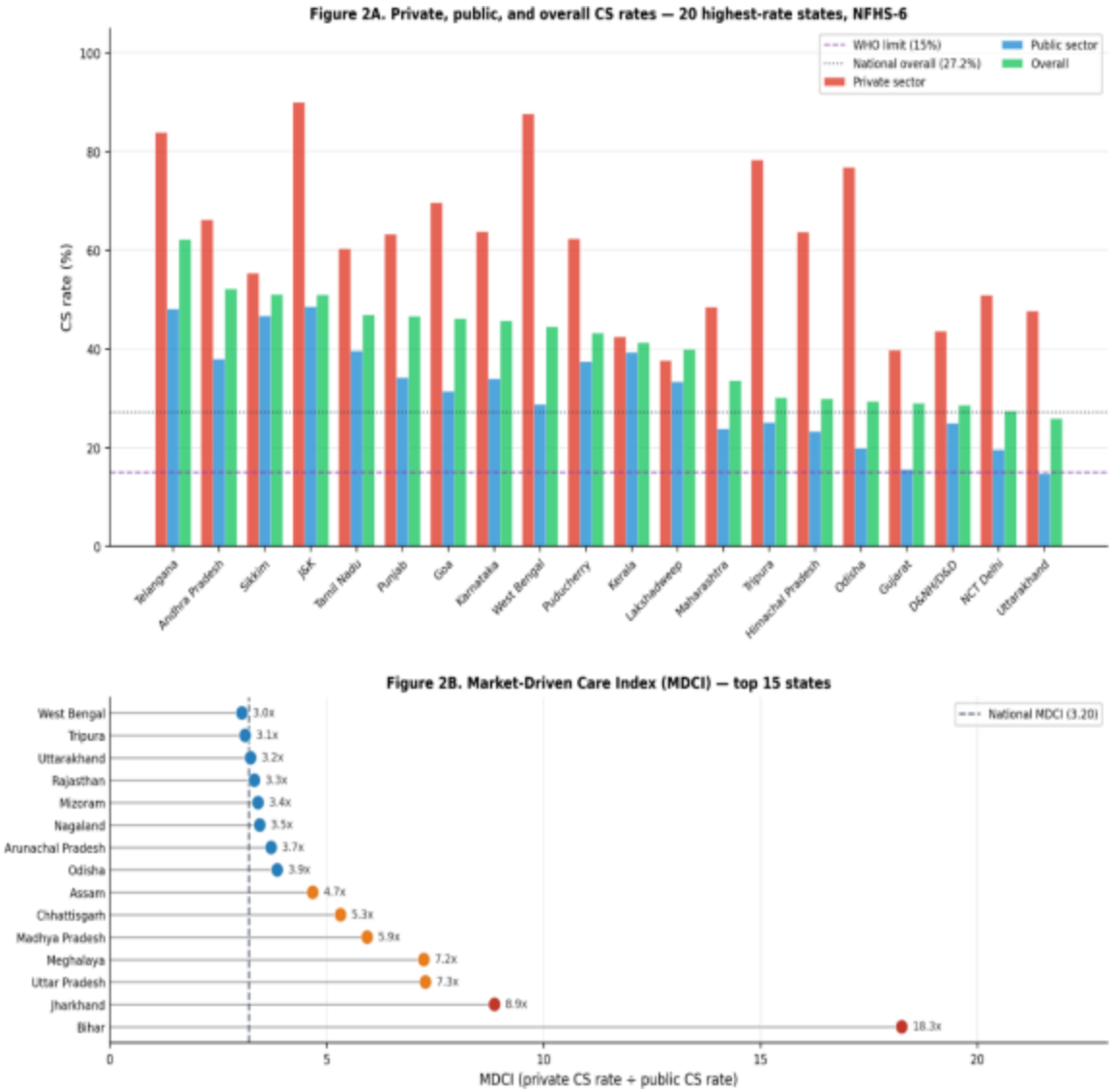


Figure 2

Upper panel: private-sector, public-sector, and overall CS rates for the 20 highest-rate states. Lower panel: MDCI for the 15 states with highest MDCI, NFHS-6 (2023–24).

Upper panel: grouped bars (red = private, blue = public, green = overall). Purple dashed line = WHO limit (15%). Dark dashed line = national overall (27.2%). Lower panel: lollipop chart; dot colour = MDCI level (red >8×, orange 4–8×, blue <4×). National MDCI (3.20) as dashed reference line.

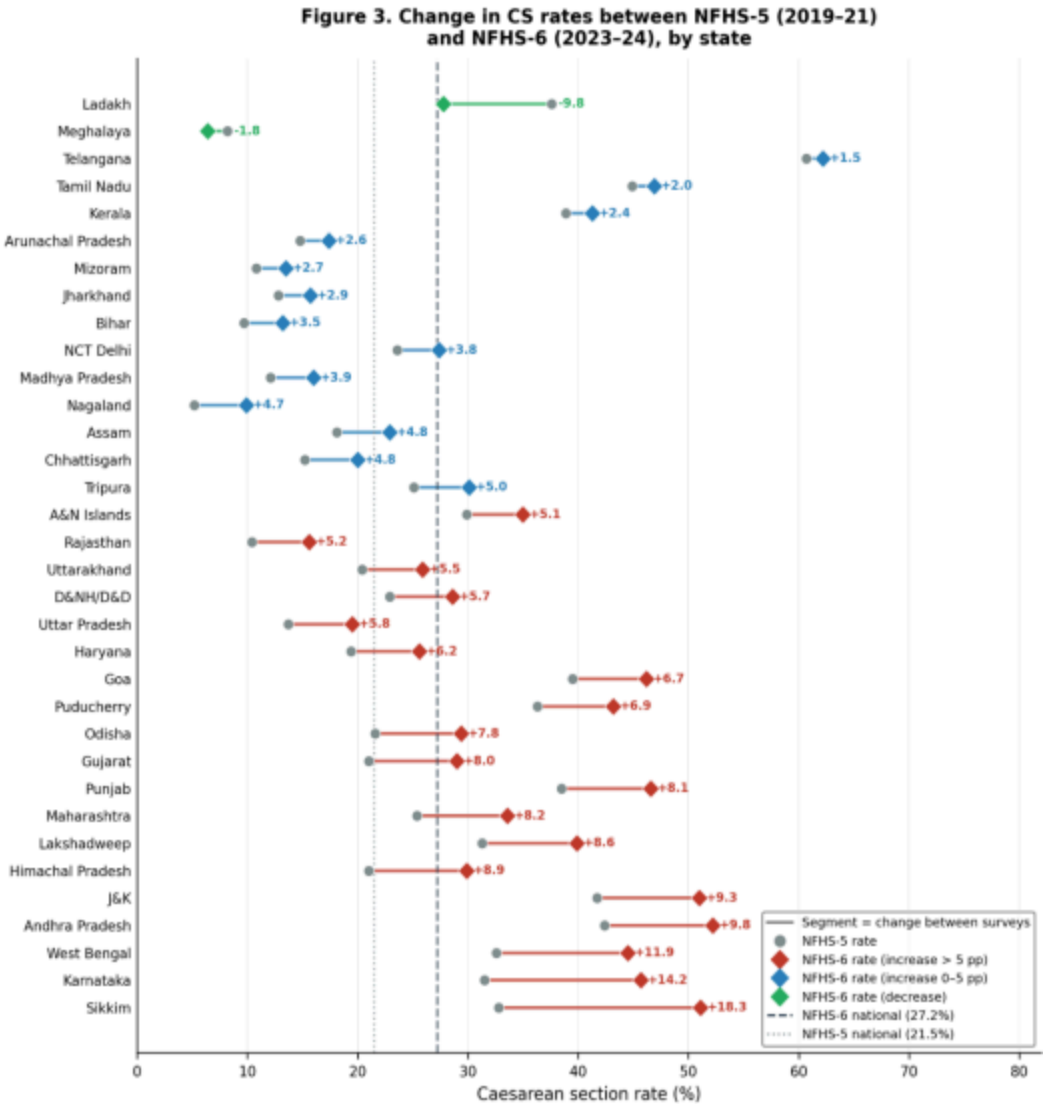


Figure 3

Change in state-level CS rates between NFHS-5 (2019–21) and NFHS-6 (2023–24), ordered by magnitude of change.

Circles = NFHS-5 rate; diamonds = NFHS-6 rate. Segment colour: red = increase >5 pp; blue = 0–5 pp; green = decrease. Number at right = absolute pp change. Dashed line = NFHS-6 national (27.2%); dotted = NFHS-5 national (21.5%).

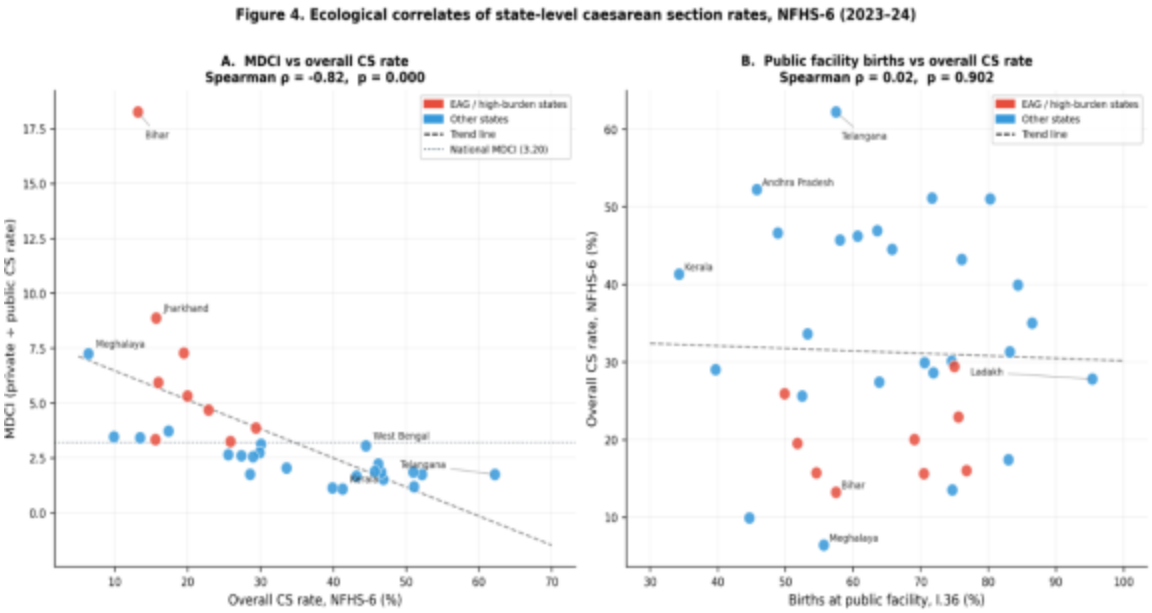


Figure 4

Ecological correlates of state-level CS rates, NFHS-6 (2023–24). Panel A: MDCI vs overall CS rate (Spearman ρ = −0.846, p < 0.001). Panel B: public facility birth share (I.36) vs overall CS rate (ρ = +0.026, p = 0.883).

Red dots = EAG states; blue = other states. Dashed lines = OLS trend. Panel A: strong inverse MDCI–CS relationship — high-MDCI states (Bihar, Jharkhand) have low overall CS rates, consistent with marked private-public divergence over surgical obstetric access. Panel B: near-zero, non-significant correlation (ρ = +0.026) — public-facility birth share does NOT predict overall CS rates because some high-public-sector states (e.g. Telangana, West Bengal) also have very high public-sector CS rates.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Supp1Methodsv6.docx
- Supp2STROBEv6.docx