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Socioeconomic Inequalities in Out-of-Pocket Expenditure on Antenatal and Postnatal Care in India: A National Cross-Sectional Study

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ABSTRACT

Background: Socioeconomic determinants significantly influence maternal healthcare spending in India. Differences in Out-of-Pocket Expenditures (OOPE) for Antenatal care (ANC) and Postnatal care (PNC) pose challenges in achieving equitable maternal healthcare. The objective was to examine socioeconomic inequality in ANC and PNC expenditures in India.

Methods: This study used cross-sectional secondary data from the 75th round of the National Sample Survey (NSS) during 2017-18. The sample included 31,422 women (ANC) and 25,971 women (PNC). Inequality was measured using the Percentile, Gini coefficient, Atkinson index, Generalised Entropy Index (2), and Concentration Index (CI). A survey-weighted Generalised Linear Model (GLM) identified key socioeconomic factors of inequality.

Results: Gini coefficients indicated high inequality (ANC: 0.661; PNC: 0.647) with CIs confirming pro-rich inequality (ANC: CI = 0.154; PNC: CI = 0.117; $p < 0.001$). GLM results showed general caste women had higher OOPE than Scheduled Tribes (STs) (ANC: IRR = 1.950; PNC: IRR = 1.764). The richest quintile spent more than the poorest (ANC: IRR = 1.320; PNC: IRR = 1.341). Other factors included education, urban residency, southern region, and divergent insurance effects. Uninsured women had lower OOPE for ANC (IRR = 0.853) but higher for PNC (IRR = 1.148).

Conclusions: OOPE for ANC and PNC shows significant socioeconomic inequalities with pro-rich distribution. Divergent insurance effects highlight coverage gaps, warranting redesigned insurance schemes and equity-oriented financial protection for rural, poor, STs, and underserved regions.

Key-words: Maternal Healthcare Services, Health Expenditures, Socioeconomic Factors, Health Equity, Out-of-Pocket Expenditure, India

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INTRODUCTION

According to the World Health Organisation (WHO), maternal healthcare comprises three stages, including Antenatal Care (ANC), Delivery Care, and Postnatal Care (PNC), which are important for enhancing maternal and neonatal outcomes.[1] The global Maternal Mortality Ratio (MMR) has declined by nearly 40% between 2000 and 2023. Notably, more than 90% of these maternal deaths occur in Low- and Lower-Middle-Income Countries (LMICs), which is alarmingly high compared to developed countries.[2] India has achieved a significant decline in MMR over the past two decades.[3] However, substantial gaps persist in ensuring equitable access to maternal healthcare services and in the distribution of financial burdens across socioeconomic groups.[4]

Financial protection is a crucial aspect of maternal healthcare. Out-of-Pocket Expenditures (OOPE) constitute a significant component of healthcare financing.[5] According to the National Health Accounts (2021-2022) report, OOPE are expenditures directly paid by households while receiving healthcare services. OOPE accounted for approximately 39.4% of India's total healthcare expenditure. High OOPE intensifies financial hardship and delays seeking medical care. This perpetuates socioeconomic disparities in healthcare access and utilisation.[6] Direct costs of maternal healthcare, including ANC visits, diagnostic tests, medicines, and consultations, disproportionately affect socioeconomically disadvantaged households. This is particularly the case when services are accessed through private providers.[7,8] Studies on maternal healthcare expenditures highlight the persistence of socioeconomic inequalities in healthcare spending. High expenditure on maternal healthcare among wealthier households is associated with greater access to quality services and private facilities. Lower health spending among economically vulnerable groups indicates financial constraints, restricted access, and exclusion from high-quality care.[9,10] Urban, higher-educated and wealthier women are more likely to access and utilise ANC, institutional delivery, and PNC.

Most studies explored differences in access to and utilisation of maternal healthcare services.[11,12] Existing research has predominantly focused on maternal healthcare utilisation and catastrophic spending, with particular emphasis on delivery care. Consequently, the inequality in expenditures related to ANC and PNC remains underexplored. These studies have largely relied on a singular inequality metric, such as the Concentration Index (CI).[5,9,13,14] To address this gap, the present study employed multiple inequality metrics, including the percentile ratios, Gini coefficient, Generalised Entropy Index [GE(2)], Atkinson index, and CI, specifically in relation to OOPE on ANC and PNC. This study is grounded in the Social Determinants of Health (SDH) framework, which identifies socioeconomic position, social stratification, geographic factors, and financial protection as key factors of inequality in healthcare expenditure, contextualising independent variable selection.[15] Furthermore, a Generalised Linear Model (GLM) is used to identify the socioeconomic factors influencing inequality among Indian women, using National Sample Survey Organisation (NSSO) 75th round data (2017-18).

This study aims to examine the socioeconomic disparities in ANC and PNC expenditures in India and identify the various socioeconomic factors influencing these inequalities.

METHODOLOGY

Study Design and Data Source: This study utilised a cross-sectional secondary data analysis approach, employing publicly accessible anonymised data. The data were derived from the 75th round of the National Sample Survey (NSS) conducted by the Ministry of Statistics and Programme Implementation (MoSPI), Government of India. The survey was conducted between July 2017 and June 2018.[16] The NSS 75th round, titled "Social Consumption in India: Health." The survey evaluated household healthcare utilisation and expenditure. Data were collected from rural and urban households across all states and union territories. However, villages in the Andaman and Nicobar Islands presented exceptions due to their challenging accessibility. The survey included data from 113,823 households, including 555,115 individuals. The dataset comprised 64,552 households from rural areas and 49,271 households from urban areas. The 75th round of the survey employed a stratified, multistage sampling design. Data were collected through personal interviews with a sample of randomly selected households and their members. This study adhered to the STROBE reporting guidelines for cross-sectional observational studies.

Study Population and Sampling: The survey generated estimates of the sources, nature, and expenditure data associated with ANC and PNC among women who were pregnant in the year preceding the survey. The study included a total sample of 32,151 women aged 15-49 years who were pregnant during the 365-day reference period. Of these, 31,422 women received ANC, and 25,971 received PNC, with corresponding expenditure data available. To control for selection bias, the sampling weights employed by the NSSO were applied to ensure representativeness at the population level. The study sample was determined based on the availability of data for pregnant women aged 15-49 years. Women with missing expenditure data were excluded from the analyses.

Outcome Variables: The outcome variables of this study were OOPE on ANC and PNC, measured in In-

dian Rupees (₹). Delivery expenditures were excluded because of structural limitations in the NSS 75th round Schedule 25.0. Specifically, expenditures on institutional deliveries are categorised as inpatient hospitalisations (Blocks 6 and 7), which are aggregated with other costs without disaggregation at the unit level. Conversely, expenditures on home deliveries, recorded in Block 11 (Column 14), account for only a small fraction of delivery cases and lack comparability across different facilities. In contrast, expenditures related to ANC and PNC, documented in Block 11 (Columns 10 and 17, respectively), are appropriate for conducting an inequality analysis. The original expenditure values were maintained for all analyses.

Independent Variables: The independent variables in this study were selected based on the SDH framework. To examine socioeconomic inequalities in ANC and PNC expenditures, this study considered a range of socioeconomic, demographic, geographical, and health insurance coverage characteristics of the study population. The independent variables included age group (15-24, 25-34, and 35-49 years), marital status (currently married and others), religion (Hindu, Muslim, Christian, and others), social group or caste (Scheduled Tribe [ST], Scheduled Caste [SC], Other Backward Class [OBC], and general category), educational attainment (no education, primary, secondary, and higher education), Monthly Per Capita Consumption Expenditure (MPCE) quintile as a proxy for household economic status (consumption-based welfare) (poorest, poor, middle, rich, and richest), place of residence (rural and urban), geographic region (North, Central, East, North-East, West, and South), and health insurance status (covered and not covered).

Statistical Analysis: The study's analysis was performed by utilising STATA version 17, employing a multistep analytical methodology. Descriptive statistics, such as the mean, median, standard deviation (SD), and percentiles (25th, 75th, and 90th), were estimated for total expenditures (ANC and PNC) based on the socioeconomic characteristics. Maternal healthcare expenditure inequality was measured using five complementary metrics. The Percentile ratios (P90/P10 and P75/P25) were computed among women with positive expenditures only to capture the spread of expenditure across the distribution.[17] The Gini coefficient was used as the primary measure of overall expenditure inequality, ranging from 0 (perfect equality) to 1 (perfect inequality).[18] The Generalised Entropy Index GE(2) was used to capture inequality concentration in the upper tail of the expenditure distribution.[19] The Atkinson Index with inequality aversion parameters (ε=1.0 and ε=2.0) was calculated to measure inequality with greater sensitivity to expenditure among lower-spending groups.[20] The Concentration Index (CI) was used to assess economic inequality in maternal healthcare expenditure, capturing the degree to which health spending is concentrated among individuals ranked by their economic status.[21] The Gini coefficient and CI were estimated for the full sample, including zero expenditure. The Percentile ratios, GE(2) Index, and Atkinson Index were computed among women with positive expenditures only. Women reporting zero OOPE (ANC: 15.46%; PNC: 11.30%) were excluded due to the mathematical constraints of these indices. The bootstrap methodology with 1,000 replications was used to estimate 95% confidence intervals for the CI.[22] For other inequality measures, confidence intervals were not computed because of the software constraints of inequality estimation packages with NSSO sampling weights.

Socioeconomic factors influencing inequality in maternal healthcare expenditure were analysed using a survey-weighted Generalised Linear Model (GLM) with a gamma distribution and log-link function. This model is adept at capturing right-skewed non-negative expenditure distributions, including mass points at zero spending.[23] Given that 11%-15% of the data had zero expenditure observations, a single-equation GLM was deemed suitable for estimating socioeconomic differentials. Prior evidence suggests that excess zeros pose minimal challenges when fitting a one-part GLM at a comparable proportion of zero expenditures.[24] Nevertheless, no formal statistical test was conducted to compare the model specifications, which is acknowledged as a methodological limitation of this study. Exponentiated coefficients were reported as Incidence Rate Ratios (IRR) with 95% confidence intervals. The IRR was calculated as (IRR-1) × 100 to facilitate the interpretation of the socioeconomic gradients in ANC and PNC expenditures. Analyses incorporated NSSO sampling weights for national representativeness.[16] Statistical significance was set at $P < 0.05$.

Ethical Consideration: This study used secondary data from the 75th round of the NSSO 2017-18. The data were publicly accessible and fully anonymised. As the dataset did not contain any personally identifiable information, ethical approval or informed consent was not necessary. The use of this data adheres to the data access and dissemination policies of the MoSPI, Government of India.[16]

RESULTS

Table 1 presents the descriptive statistics for the OOPE for ANC and PNC. Both ANC and PNC expenditure data showed a right-skewed distribution with extremely high maximum and large standard deviation (SD) values. There was a significant gap between the mean and median for both ANC and PNC, revealing that a small proportion of individuals incurred high expenditure. The interquartile ranges for ANC (₹300-₹3,500) and PNC (₹230-₹2,000) indicate substantial variations in maternal healthcare expenditures. A substantial proportion of women reported zero expenditure.

Table 1. Descriptive Statistics of Out-of-Pocket Expenditure (OOPE) on Antenatal Care (ANC) and Postnatal Care (PNC), India, 2017-18

Statistic	ANC (₹)	PNC (₹)
Mean	2951.33	1629.85
Median	1250	800
SD	5100.19	3329.07
25th Percentile	300	230
75th Percentile	3500	2000
90th Percentile	8000	3500
Zero Expenditure (%)	15.46	11.3
Sample size (n)	31422	25971
Minimum	0	0
Maximum	199780	100000

Note: *OOPE: Out-of-pocket expenditure (Indian Rupees); SD: Standard deviation ₹: Indian Rupees
||Source: Estimated by authors based on NSSO 75th Round Survey on Household Social Consumption: Health, 2017-18

Tables 2a and 2b show the disparities in maternal healthcare expenditures across socioeconomic characteristics. A clear social gradient is evident, with women from the general category incurring over twice the expenditure of ST women for ANC and PNC. Women with higher education spent double that of illiterate women on maternal healthcare. The wealthiest quintile spent over twice as much as the poorest quintile. Urban households spent nearly double that of rural households. The southern region had the highest ANC and PNC expenditures.

Table 2a. Mean (SD) Out-of-Pocket Expenditure (OOPE INR) on Antenatal Care (ANC) and Postnatal Care (PNC) by Socio-demographic Characteristics, India, 2017-18

Variables	ANC Mean (SD)	PNC Mean (SD)
Age group (years)		
15-24	2681.35 (4275.23)	1485.02 (2981.32)
25-34	3182.03 (5547.22)	1701.20 (3222.68)
35-49	3036.17 (6694.65)	1971.29 (5700.75)
Marital status		
Currently married	2942.28 (5129.86)	1605.82 (3335.69)
Others	2983.97 (4992.03)	1717.76 (3303.55)
Religion		
Hindu	2914.62 (5023.71)	1586.17 (3041.76)
Muslim	2930.03 (5160.42)	1720.15 (3749.41)
Christian	3861.93 (6259.42)	2300.57 (7323.27)
Others	3578.94 (5968.38)	1904.27 (3862.38)
Social group		
ST†	1523.76 (2826.36)	888.73 (1454.74)
SC‡	2587.44 (5097.04)	1560.45 (3360.76)
OBC§	2965.51 (4987.44)	1631.04 (3039.67)
General	3758.77 (5765.65)	1948.34 (4137.30)
Education		
No education	2234.63 (4804.46)	1274.27 (2346.69)
Primary	2554.16 (4702.23)	1464.51 (2952.54)
Secondary	3142.87 (4893.52)	1709.78 (3590.82)
Higher	5349.79 (6759.93)	2725.56 (4884.45)

Note: OOPE: Out-of-pocket expenditure (Indian Rupees); SD: Standard deviation
†ST: Scheduled Tribe ‡SC: Scheduled Caste §OBC: Other Backward Classes
||Source: Estimated by authors based on NSSO 75th Round Survey on Household Social Consumption: Health, 2017-18

The central and northeastern regions had the lowest ANC expenditure. The eastern region had the lowest PNC expenditure. Women with health insurance had higher ANC expenditures than uninsured women; however, insurance status showed minimal differences in PNC expenditure. Large standard deviation values indicate significant expenditure dispersion within the same socioeconomic group, showing extensive variation in OOPE in maternal healthcare.

Table 3 presents various measures of inequality in ANC and PNC expenditures. The P90/P10 and P75/P25 ratios revealed that a small proportion of women incurred significantly higher expenditures than the majority. The positive Gini coefficients for both ANC and PNC revealed significant inequalities in OOPE distributions, indicating that maternal healthcare expenditure is highly unequally distributed across women. The GE(2) index was higher for PNC than for ANC, suggesting a more pronounced concentration of expenditure in the upper tail for PNC than for ANC. The Atkinson indices (ε=1.0 and ε=2.0) reveal considerable normative inequality for both ANC and PNC across varying degrees of inequality aversion, with ANC demonstrating greater inequality under both parameters. Positive and statistically significant values of CIs ($p < 0.001$) for both ANC and PNC suggest that women from rich quintiles incur disproportionately higher expenditures than women from poor quintiles, with ANC showing a greater socioeconomic concentration of expenditure than PNC.

Table 4 shows the survey-weighted GLM estimates for ANC expenditures.

Table 2b. Mean (SD) Out-of-Pocket Expenditure (OOPE) (INR) on Antenatal Care (ANC) and Postnatal Care (PNC) by Economic Characteristics, India, 2017-18

Variables	ANC Mean (SD)*	PNC Mean (SD)*
MPCE quintile		
Poorest	2082.12 (3381.17)	1347.61 (2815.82)
Poor	2587.85 (5313.13)	1376.54 (2552.75)
Middle	2931.01 (4912.66)	1565.38 (3021.70)
Rich	3186.03 (5206.39)	1749.39 (3390.09)
Richest	4839.18 (6563.14)	2479.99 (5025.91)
Residence		
Rural	2407.90 (4366.59)	1431.42 (3066.92)
Urban	4633.13 (6615.56)	2207.36 (3939.00)
Region		
North	3087.57 (6028.97)	1646.19 (3020.32)
Central	1853.34 (3973.30)	1473.08 (2776.82)
East	2735.67 (3932.94)	1002.92 (1680.99)
North-East	1848.89 (2798.74)	1745.04 (4662.48)
West	3633.48 (5245.99)	1636.79 (3118.10)
South	5462.89 (6498.15)	2325.82 (4846.99)
Health insurance		
Covered	4248.31 (6551.37)	1657.69 (3235.42)
Not covered	2657.47 (4690.58)	1597.76 (3307.85)

Note: OOPE: Out-of-pocket expenditure (Indian Rupees); SD: Standard deviation ¶MPCE: Monthly Per Capita Consumption Expenditure
||Source: Estimated by authors based on NSSO 75th Round Survey on Household Social Consumption: Health, 2017-18

Table 3. Inequality Measurements in Out-of-Pocket Expenditure for Antenatal Care (ANC) and Postnatal Care (PNC), India, 2017-18

Inequality Measures	ANC	PNC
P90/P10 Ratio*	30.71	20.00
P75/P25 Ratio*	6.00	4.00
Gini Coefficient†	0.661	0.647
GE(2) Index*	1.185	1.682
Atkinson Index (ε = 1)*	0.540	0.490
Atkinson Index (ε = 2)*	0.890	0.845
Concentration Index†	0.154***	0.117***
	(0.143, 0.165)	(0.103, 0.131)

Note: 95% bootstrap confidence intervals based on 1,000 replications are shown in parentheses for the Concentration Index only. *Computed among women with positive expenditure only; women with zero out-of-pocket expenditure (ANC: 15.46%; PNC: 11.30%) were excluded due to the mathematical constraints of these indices. †Computed for the full sample, including zero expenditure. GE: Generalised Entropy; ε: inequality aversion parameter. ***P < 0.001.

||Source: Estimated by authors based on NSSO 75th Round Survey on Household Social Consumption: Health, 2017-18.

The age group 25-34 (15% higher) and other than currently married women (13% higher) showed statistically significant associations with ANC expenditure. Religion did not emerge as a significant predictor in any category (Appendix Table A1). Social groups were significant predictors of ANC expenditure inequality. Compared with women from the ST, SC (55% higher), OBC (76% higher), and general categories (95% higher) had considerably higher spending. Educational attainment plays an important role in determining inequality in maternal healthcare spending. Women with higher levels of education were more likely to spend on ANC (62% higher) than women with no formal education. Women in the richest MPCE quintile incurred substantially higher ANC expenditures (32% higher) than those in the poorest. Women from urban households incurred significantly higher ANC expenditures than rural women (36% higher). Women from the central region had 30% lower ANC spending than those from the north. In contrast, women from the southern region had 72% higher spending than those from the northern region. Women without insurance coverage incurred significantly lower ANC spending (15% lower) than insured women. Significant differences in ANC expenditure were evident across socioeconomic, regional, and health insurance variables (see Appendix Table A1 for the complete results).

Table 5 presents the GLM estimates of the OOPE for PNC. Women aged 35-49 years incurred higher (32%) PNC expenditures than those aged 15-24. Other than currently married women, PNC expenditures were 18% higher than those of married women. Religion showed no significance in any category, similar to the ANC findings (Appendix, Table A2). PNC expenditures were higher among SC (69%), OBC (57%), and general category women (76%) than among ST women. Therefore, similar to ANC, social groups significantly impact PNC expenditures. Women with higher levels of education had higher PNC spending (74% higher) than those with no formal education did. The richest MPCE quintile had higher PNC expenditures (34% higher) than the poorest quintile, whereas the intermediate quintiles showed no significant differences. Urban women were 17% more likely to spend on PNC than rural women. Among the regions, the south recorded higher PNC expenditures (43% higher). The East recorded lower expenditures (29% lower)—a pattern that differed from ANC, where the Eastern region was not significant. The Central, North-Eastern, and Western regions showed no differences from the northern region. In contrast to ANC, uninsured women had higher PNC spending (15% higher) than insured women. PNC expenditures showed notable differences from those of ANC concerning different socioeconomic gradients, regional patterns, and insurance impact.

Table 4. Significant Predictors from Survey-Weighted GLM (Gamma, Log Link) for ANC Expenditure, India, 2017-18

Variable/Category	IRR	SE	P>|t|	95% CI
35-49 yr Age group (Ref: 15-24)	1.152	0.053	0.002**	[1.053, 1.260]
Other Marital status (Ref: Currently married)	1.134	0.052	0.007**	[1.035, 1.241]
Social group: (ref: ST)				
SC	1.547	0.116	<0.001***	[1.336, 1.792]
OBC	1.761	0.118	<0.001***	[1.544, 2.009]
General	1.95	0.135	<0.001***	[1.703, 2.233]
Higher Education: (ref: No education)	1.62	0.129	<0.001***	[1.386, 1.893]
Richest MPCE quintile: (ref: Poorest)	1.32	0.084	<0.001***	[1.166, 1.496]
Urban Residence: (ref: Rural)	1.363	0.055	<0.001***	[1.259, 1.475]
Region: (ref: North)				
Region: Central	0.701	0.054	<0.001***	[0.602, 0.815]
Region: South	1.72	0.128	<0.001***	[1.487, 1.990]
Health insurance not covered: (ref: Covered)	0.853	0.055	0.014*	[0.752, 0.968]

Note: *P<0.05, **P<0.01, ***P<0.001; †IRR: Incidence Rate Ratio; SE: Standard Error; ST: Scheduled Tribe; SC: Scheduled Caste; OBC: Other Backward Classes; MPCE: Monthly Per Capita Consumption Expenditure.

||Full model results are presented in Appendix Table A1.

||Source: Estimated by the authors based on the NSSO 75th Round Survey on Household Social Consumption: Health, 2017-18.

Table 5. Significant Predictors from Survey-Weighted GLM (Gamma, Log Link) for PNC Expenditure, India, 2017-18

Variable / Category	IRR	SE	P-value	95% CI
35-49 yr Age group (Ref: 15-24)	1.317	0.133	0.006**	1.081 - 1.604
Other Marital status (Ref: Currently married)	1.183	0.066	0.003**	1.060 - 1.319
Social group (Ref: ST)				
SC	1.688	0.167	<0.001***	1.390 - 2.050
OBC	1.57	0.115	<0.001***	1.360 - 1.813
General	1.764	0.136	<0.001***	1.516 - 2.053
Education (Ref: No education)				
Secondary	1.188	0.064	0.001**	1.069 - 1.319
Higher	1.74	0.161	<0.001***	1.451 - 2.087
Richest MPCE quintile (Ref: Poorest)	1.341	0.118	0.001**	1.129 - 1.593
Urban Residence (Ref: Rural)	1.173	0.05	<0.001***	1.080 - 1.275
Region (Ref: North)				
East	0.709	0.051	<0.001***	0.615 - 0.817
South	1.433	0.098	<0.001***	1.253 - 1.639
Health insurance not covered (Ref: Covered)	1.148	0.056	0.004**	1.044 - 1.263

Note: *P<0.05, **P<0.01, ***P<0.001; †IRR: Incidence Rate Ratio; SE: Standard Error; ST: Scheduled Tribe; SC: Scheduled Caste; OBC: Other Backward Classes; MPCE: Monthly Per Capita Consumption Expenditure ||Full model results are presented in Appendix Table A2. ||Source: Estimated by authors based on NSSO 75th Round Survey on Household Social Consumption: Health, 2017-18.

DISCUSSION

This study shows significant socioeconomic inequalities in OOPE for ANC and PNC in India. ANC expenditure is higher than PNC expenditure across distributional measures. The disparities in ANC and PNC expenditures among socioeconomic groups indicate an association with socioeconomic status, consistent with previous studies.[5,7,9] Goli et al.[9] reported that expenditures on delivery and ANC exceeded PNC. This trend shows increased involvement of the private sector during the antenatal period. The substantial gap between the mean and median expenditures, along with the large SD values, indicates a highly skewed distribution. While most women incurred moderate costs, a small proportion experienced disproportionately high expenditures, which aligns with the findings of Mohanty and Kastor.[5] Many women reported zero expenditure, as similarly observed by Mohanty and Srivastava, possibly indicating the use of complementary government maternal healthcare services.[25]

Various analyses of inequality reveal disparities in maternal healthcare expenditures, particularly in ANC. The Percentile ratios indicate that a minority of women incur higher costs, with ANC exhibiting greater variability than PNC. This inequality in ANC is attributed to higher-income households utilising private-sector, and specialist services during the antenatal period.[5,9] The Gini coefficients for OOPE of ANC (0.661) and PNC (0.647) reveal significant inequality in the distribution of maternal healthcare. Notably, to the best of our knowledge, national-level Gini estimates specific to ANC and PNC for OOPE are absent from the published peer-reviewed literature. This underscores the novelty of these findings and their potential utility as baseline references for future investigations into maternal care expenditure inequality in India. Although the overall inequality, as measured by the Gini coefficient, is lower for PNC than for ANC, the GE(2) index indicates a more pronounced concentration in the upper tail for PNC (PNC 1.682 vs. ANC 1.185). This suggests that, although most women experience moderate PNC costs, a small minority incurs exceptionally high expenditures. This situation may potentially occur due to emergency postpartum complications that necessitate costly private care. The Atkinson index corroborates the normative inequality of ANC compared to that of PNC. Positive CI values indicate a pro-rich distribution of OOPE for ANC compared to PNC, with wealthier women incurring higher expenditure. This aligns with evidence that maternal healthcare utilisation in India is more concentrated among affluent women, with a higher CI for ANC (0.169) than for PNC (0.063).[12] The lower overall inequality in PNC, except for the GE(2) index, may be attributed to its shorter duration and fewer procedures, thereby reducing socioeconomic stratification in expenditure compared to ANC.

Survey weighted GLM estimates revealed significant disparities in OOPE for maternal healthcare among socioeconomic groups. Women in the older age groups spent more on ANC and PNC than their younger counterparts. This suggests higher costs with increasing maternal age. This finding contrasts with Goli et al.[9], who reported that a decline in expenditures among women aged 30-49 years. Mukherjee et al.[26], also reported that younger women have higher catastrophic maternal healthcare payments. The study identified that OOPE was higher among non-married women (widowed, divorced, and separated) compared to currently married women for both ANC and PNC. Within the Indian sociocultural framework, spousal

and familial support plays a crucial role in determining maternal healthcare utilisation.[27] Lack of adequate support may compel non-married women to bear a disproportionate burden of maternal care expenses without the benefit of shared financial resources or assistance in seeking care. As marital status has received limited attention as a determinant of maternal healthcare expenditure inequality, this finding is a novel contribution to the literature, warranting further investigation.

Caste-based disparities are evident in maternal healthcare spending. The OOPE for both ANC and PNC increased from the ST to the general category. The lower spending among ST women indicates financial exclusion rather than enhanced protection. This reflects the inequalities within India's social hierarchy. These findings align with evidence showing lower utilisation of private maternal healthcare services among SC and ST in rural and urban India.[9,12,28] Differences in spending by various social groups confirming that caste act as a significant determinant of the inequality in maternal care expenditure in India.[9]

This study found a strong relationship between education and maternal healthcare expenditure. Women with higher levels of education incur greater spending, while those with lower educational attainment incur lower spending for both types of care. This trend reflects the greater propensity of women with higher education levels to access and spend on high-quality private care. Conversely, women with lower educational levels are often compelled to choose low-cost and low-quality healthcare due to limited options rather than personal preference, aligning with findings from previous studies.[5,9,10]

This study identified a strong association between MPCE and maternal healthcare expenditure. Increased expenditure is linked to improved access to quality services and private healthcare facilities. Remarkably, expenditure inequality is concentrated in the upper tail of the distribution. The richest quintile incurred higher OOPE than that of the poorest quintile. However, the intermediate quintiles did not show significant variations. This indicates a substantial gap between the richest and the rest, rather than a uniform income gradient. Conversely, lower spending among economically vulnerable groups reflects financial constraints and exclusion from high-quality care, consistent with previous evidences.[5,7,9,13,14]

Disparities in maternal healthcare expenditures between rural and urban areas were evident from this study. The high OOPE among urban women indicates greater private sector involvement with high-cost premiums rather than limitations in access. Goli et al.[9] and Mohanty and Kastor[5] have similarly reported that urban households are likely to spend more than rural households. In contrast, the lower OOPE among rural women suggests restricted access to quality care and financial barriers, indicating that rural women experience inequality through exclusion.[5,7,9] This rural-urban expenditure divide is similar to the utilisation gap in maternal healthcare in India.[12,28,29] The rural-urban divide indicates that financial and access barriers continue to perpetuate inequality across both types of care.

Another major finding of this study is the regional disparity in maternal healthcare expenditure across India. These findings are corroborated with previous utilisation studies, which documented a clear north-south divide in spending. The southern states display significantly higher utilisation of the continuum of maternal healthcare services than northern states.[30] The southern region recorded the highest expenditures for both ANC and PNC. The central and northeastern regions recorded lower ANC expenditure. These findings are similar to those noted by Chi et al.[27], who found comparatively lower inequalities in southern states than in northern and northeastern states. However, in this study, the eastern region recorded lower PNC expenditures than the north. Goli et al.[9] showed higher spending in the southern region with better performance in quality of care and greater healthcare spending. This signifies that the regional divide is evident in maternal healthcare spending in India.

The study found that health insurance coverage for maternal healthcare expenditures varies between ANC and PNC. This indicates a disparity in financial protection across the continuum of maternal care. Insured women incurred higher OOPE for ANC, whereas uninsured women incurred higher OOPE for PNC. The divergent insurance effect may have occurred due to adverse selection and moral hazards. Wealthier women and higher-risk women disproportionately enrolled in insurance and accessed more ANC services. Conversely, insurance demonstrated no consistent effect on PNC utilisation or financial protection.[31,32] India's publicly funded health insurance schemes such as Ayushman Bharat Pradhan Mantri Jan Arogya Yojana (AB-PMJAY), primarily cover institutional delivery but fail to reimburse outpatient ANC services, leaving significant ANC expenditures unprotected.[33] Additionally, insurance has similarly failed to improve PNC utilisation or reduce the financial burden, thereby perpetuating inequality in maternal healthcare expenditure among vulnerable women.[32]

NSSO 75th round data from June 2017 to July 2018 precede the full implementation of AB-PMJAY, launched in September 2018; therefore, the findings may not reflect the scheme's impact on maternal healthcare expenditure and insurance coverage. Garg et al.[34] found that enrolment in public health insurance schemes did not reduce OOPE for institutional deliveries. Similarly, post-National Health Mission (NHM) interventions appear to have provided limited financial protection across the continuum of maternal care.[5]

The findings of this study are consistent with the Social Determinants of Health (SDH) framework proposed by Dahlgren and Whitehead. According to this framework, socioeconomic status, geographic factors, and financial protection are key structural determinants of maternal healthcare expenditure inequalities.[15] Socioeconomic inequalities in OOPE for ANC and PNC, influenced by caste, education, wealth quintile, urban and southern regional residence, and insurance effects, highlight the structural determinants of maternal healthcare expenditure in India. Addressing these inequalities requires targeted policy interventions to tackle socioeconomic disparities and ensure universal access and affordability.

Strength and Limitations

The major strength of this study is the utilisation of an extensive national dataset at the unit level. The diverse sample size strengthens the validity and generalisability of the study's findings. The rigorous methodology and application of various methods to measure inequality in expenditure further strengthen the study's robustness. However, although several studies on maternal healthcare utilisation exist, research focusing on expenditure inequality, especially in ANC and PNC, is scarce, rendering this study distinctive. This study provides clear evidence of socioeconomic disparities in ANC and PNC spending, offering valuable insights for public health and policy development.

This study had some limitations. The study used self-reported data from the 75th round of the NSS, which may be subject to recall bias. The study may lead to an underestimation of indirect costs, and the cross-sectional study design restricts the causal inferences. Then, the scope of this study is restricted to ANC and PNC expenditures, excluding delivery expenditure data due to structural constraints within the NSS dataset. Furthermore, stratified analyses such as rural/urban residence and MPCE quintiles were beyond the scope of this study. However, these inequality gradients were assessed as covariates in the GLM model, and future research should examine subgroup-specific expenditure patterns in greater depth. Additionally, the use of MPCE as a proxy for economic status may underestimate inequality at the upper end of the income distribution. Moreover, the data collected before the introduction of AB-PMJAY, in September 2018 are unlikely to reflect the current insurance coverage and maternal healthcare financing landscape in India. Finally, the absence of quality-of-care data further limits interpretation.

Conclusion

An analysis of the NSSO 75th Round survey data revealed significant socioeconomic disparities in maternal healthcare expenditure in India. The OOPE for ANC exceeded that of PNC, with both showing pro-rich distributions. These inequalities were more evident among ST women, those with low education, low-income quintiles, non-married, rural residents, and individuals from the Central, Northeast, and Eastern regions, reinforcing the need for targeted healthcare infrastructure. The divergent effects of insurance coverage—where insured women incurred higher ANC costs but lower PNC costs—reveal deficiencies in outpatient services. This emphasises the need to redesign insurance coverage beyond institutional delivery. Overall, the findings highlight the need for equity-oriented policy reforms to address socioeconomic gradients in maternal healthcare expenditure inequality. Future research should use longitudinal data to establish causality and qualitative methods to understand decision-making related to maternal healthcare expenditure. Additionally, post-AB-PMJAY data should be used to assess the impact of insurance reforms on equity in maternal healthcare expenditure.

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Availability of Data: The data used in this study are publicly available. This is in an anonymised format and can be obtained from the MoSPI website to the corresponding author upon reasonable request.

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