RESEARCH PAPER

Drug Availability, Out-of-Pocket Costs, and the Urban–Non-Urban Patient Satisfaction Gap: A Mediation Analysis from Public Healthcare Units in West Bengal

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Abstract
Stock outs and out of pocket (OOP) spending are chronic issues in the Indian public health care system, especially in the non-urban areas, but their mediating effect in the urban non-urban gap in patient satisfaction has not been thoroughly studied (Sharma and Narang, 2019; Das et al., 2021). This was a six district cross sectional study in West Bengal which enrolled 1,182 patients (591 urban, 591 non-urban) across 12 public healthcare units. We tested the relationship between the type of location (urban vs. non-urban) and patient satisfaction mediated by the availability of medicine and OOP expenditure using parallel mediation analysis (Baron and Kenny, 1986; Preacher and Hayes, 2008). Location had a total impact on satisfaction of 16.40 points (0 -100 scale, $p < 0.001$). The overall indirect impact through the two intermediaries was 9.52 points (58% of the total gap, 95% BCa CI: 8.5810.46), and it is not rejected by the null hypothesis of no mediation. The most prominent mediator (indirect effect = 8.04 points) was medicine availability (49% of total gap), then, OOP expenditure (indirect effect = 1.48 points, 9% of total gap). One important direct impact had (c 6.88, 42 percent of total gap, $p = 0.001$) which implies some mediation (Baron and Kenny, 1986). These findings show that the disparity in satisfaction could be decreased by almost half with the availability of medicine in non-urban facilities, and providing free drugs would reduce OOP spending as well (Patel et al., 2022; Brinda et al., 2016). The focus of policy makers should be to strengthen the pharmaceutical supply chain in the non-urban areas and accompaniment with interventions of the remaining direct effect, reduction of waiting time and increase of staff courtesy (Mukherjee & Banerjee, 2018; Bhattacharyya & Roy, 2020).

Keywords: Satisfaction of a patient; the availability of medicine; out of pocket expenditure; mediation analysis; urban rural disparity; West Bengal; public healthcare

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1. Introduction

The urban rural gap in healthcare access in India has been thoroughly reported, as the non-urban (rural and peri urban) populations experience more medicine stock outs and increased OOP costs regardless of government subsidisation (Sharma & Narang, 2019; Gupta and Singh, 2020). West Bengal is a state with a checkered history of delivering public health, and has had a consistent history of shortages of essential drugs in non-urban primary health centres: patients had to buy medicines in private pharmacies at high prices in up to 40 percent of months (Das et al., 2021). These unpredictable costs directly undermine satisfaction, when the patients feel that the state facility is not doing its job of offering free treatment (Mukherjee and Banerjee, 2018).

Nevertheless, the existing comparative research has mostly regarded both medicine availability and OOP expenditure as independent correlates of satisfaction, without considering their mediating effect on the urban-non-urban satisfaction gap (Patel et al., 2022). In particular, there is also no information on whether the decreased level of satisfaction in non-urban patients could be directly attributed to location or it was indirectly caused by decreased drug access and higher OOP expenditure. The policy implications of this mediation are fundamental: in case the satisfaction gap is completely accounted by drug supply and OOP prices, the gap might be bridged only by supply chain

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and financial protection interventions. On the other hand, when there is a direct effect, additional unmeasured variables (e.g., staff behaviour, infrastructure) also need to be addressed (Bhattacharyya and Roy, 2020).

To fill this gap, the current research will use mediation analysis (Baron and Kenny, 1986; Preacher and Hayes, 2008) on primary data of six sampled districts of West Bengal. In particular, it is a test of the mediation of the relationship between location type (urban vs. non-urban) and patient satisfaction by the variables of medicine availability and OOP expenditure. The research will: (1) measure the total, direct and indirect impacts of location on satisfaction, (2) estimate the extent to which satisfaction gap is mediated by drug availability and OOP costs, and (3) recommend evidence-based interventions in pharmaceutical and financial terms to address issues in the non-urban healthcare facilities.

2. Literature Review and Research Gap

2.1 Medicine Availability and Patient Satisfaction:

Healthcare quality comes with access to basic medicines (World Health Organization, 2000). Lack of availability of prescribed drugs at public facilities leads to frustration, loss of trust and lower satisfaction in patients (Rao et al., 2016). In India, surveys of the whole country have indicated recurrently that the stock outs of medicine are more common in rural and non-urban health centres (Sharma & Narang, 2019; Gupta and Singh, 2020). A multi state study conducted by Patel et al. (2022) revealed that 42 per cent of rural primary health centres (PHCs) had at least one of the essential drugs out of stock on the day of visit as opposed to 18 per cent in urban PHCs. This difference directly influences patient satisfaction: Kaur and Singh (2018) found that every 10% of the medicine availability also led to a 4.5-point decrease in the satisfaction scores (0-100 scale) in rural Punjab.

Das et al. (2021) recorded that the PHCs, which were not urban, had shortages of essential drugs in 37 percent of months, with antibiotics, antihypertensives, and analgesics being most commonly out of stock in West Bengal, particularly, the PHCs. Sometimes, patients in such facilities were forced to travel to privately owned pharmacies, which cost them more time and money (Mukherjee & Banerjee, 2018). The qualitative interviews demonstrated that patients considered unavailability of medicine as a failure of the collective system, resulting in their dissatisfaction even when the clinical staff members were polite (Bhattacharyya & Roy, 2020).

2.2 Out of Pocket and Patient Satisfaction

Direct payments by patients at the point of care– out of pocket (OOP) spending- is a significant obstacle to health care access and a source of patient dissatisfaction in India (Balarajan et al., 2011). Although the government boasts of free primary care, patients often pay the cost of diagnostics, medicines, transportation, and informal costs (Rao et al., 2016). According to the National Sample Survey Office (NSSO, 2019), the average spending of rural households in West Bengal on outpatient visits was ₹1,847, of which 68% was on medicines.

A number of studies have determined that there is a negative correlation between OOP expenditure and patient satisfaction. According to Brinda et al. (2016), an increase of 100 in the OIP spending lowered the chances of satisfaction by 12 percent amongst the rural elderly in Tamil Nadu. On the same note, Ahmad and Khan (2019) have found that patients who incurred unexpected OOP expenses (e.g., purchasing medications in independent shops) were 2.3 times more likely to be dissatisfied than those who obtained all medications free. Notably, the adverse impact of OOP is compounded by the fact that in the case of patients who are supposed to receive free care and service, which is a frequent occurrence in the state-run facilities (Prakash and Chandrashekaran, 2017).

2.3 The Urban Non-Urban Satisfaction Gap Direct and Indirect Pathways

The gap between urban and non-urban satisfaction is solid and the mechanisms that contribute to this gap are still controversial (Sharma & Narang, 2019). One school of thought believes that the gap is directly due to location specific factors like rural culture, lower expectations or alternative care priorities (Bhattacharyya & Roy, 2020). The other view is that the gap is indirectly explained by the quantifiable intermediary variables, especially medicine availability and OOP expenditure (Patel et al., 2022).

Formalised by Baron and Kenny (1986) and generalised by Preacher and Hayes (2008), mediation analysis is a statistical framework that gives the opportunity to separate direct and indirect effects. Mediation has also been employed to clarify the differences in treatment adherence (Hayes and Rockwood, 2017), healthcare utilisation (Tram et al., 2018), and patient satisfaction (Ahmad and Khan, 2019) in health services research. Its use with the urban non-urban gap of satisfaction with Indian public health is however scant.

2.4 Empirical Support of the Satisfaction Gap Mediation

There are very few studies that have tested mediation specifically in this regard. A mediation analysis was carried out in Kenya by Chuma et al. (2019), which established that the drug availability and OOP costs mediate 68% of the urban-rural satisfaction gap with drug availability as a stronger mediator (48 percent of total effect). In India, Ahmad and Khan (2019) compared the differences between the satisfaction of private and public hospitals and discovered that OOP expenditure mediated a third of the disparity. Nonetheless, none of the published studies have used mediation analysis in the urban non-urban satisfaction gap in the public healthcare units in the state of West Bengal.

A similar article by Patel et al. (2022) in Madhya Pradesh employed path analysis and found that the medicine availability mediated 41 percent of the gap in rural urban satisfaction, and OOP costs mediated 22 percent. They determined that enhancement of drug supply chains would make a greater difference in minimizing the satisfaction gap than financial protection programs alone. Their analysis, however, failed to consider the facility level clustering and employed single mediator model instead of parallel mediation.

2.5 The West Bengal Background

The case of West Bengal is special. Its network of public health facilities is rather dense, with more than 2,000 PHCs and 200 block primary health centres (Das et al., 2021). Swasthya Sathi scheme by the state government covers health insurance but medicine stock outs and OOP payments are still prevalent (Mukherjee & Banerjee, 2018). Sen and Chatterjee (2022) carried out a recent district level survey which revealed that availability of drugs was very uneven, ranging between 92% in Kolkata urban facilities and 54% in Purulia rural blocks. Likewise, the OOP spending per outpatient visit was 2.4 times in the non-urban districts (₹356) than in the urban districts (₹148) (NSSO, 2019).

Even with this recorded difference, no research has examined the mediation of medicine availability and OOP expenditure between urban/non-urban location and patient satisfaction in West Bengal. This gap is especially problematic to policymakers who must be aware of whether to invest in supply chains (targeting the mediator) or other interventions (targeting direct effects).

2.6 Research Gap

Following the review above, the following gaps remain:

1. Absence of mediation analysis: No research has been done to quantify the indirect impacts of medicine availability and OOP expenditure on the urban non-urban satisfaction gap of the West Bengal public healthcare units.
2. Individual treatment of mediators: The majority of the studies are investigating drug availability and OOP costs as independent predictors rather than causal sequential or parallel mediators in a causal pathway.
3. Geographic specificity: No studies have dealt with West Bengal among existing studies of Indian mediation that have concentrated on other states (Madhya Pradesh, Tamil Nadu).
4. Methodology weaknesses: Previous research frequently does not provide proper clustering adjustments (by facility) and direct tests of indirect effects (e.g. bootstrapped confidence intervals).

2.7 Study Contribution

The current research fills these gaps by using the parallel mediation analysis (Preacher and Hayes, 2008) on primary data of six districts, which were selected in West Bengal. Specifically, it will:

Primarily test the direct influence of location type (urban vs. non-urban) on the satisfaction of patients.

The indirect impacts of location on satisfaction on medicine availability and OOP expenditure as parallel mediators should be tested.

• Estimate the share of the overall satisfaction gap that is mediated by each variable.

• Give policy suggestions based on the West Bengal pharmaceutical and financial protection systems.

3. Research Methodology

3.1 Research Questions (RQs)

RQ1: Does the location type (urban vs. non-urban) have a significant overall impact on patient satisfaction?

RQ2: Is medicine availability and/or out of pocket (OOP) spending the mediating variable between the location type and patient satisfaction?

RQ3: Does location type have a significant direct effect on patient satisfaction when mediators are taken into account?

3.2 Objectives

Primary Objective:

To test whether medicine availability and OOP expenditure mediate the urban–non-urban patient satisfaction gap using parallel mediation analysis.

Secondary Objectives:

1. To estimate the total effect (c) of location type on satisfaction.
2. To estimate the indirect effects ($a_1 \times b_1$ and $a_2 \times b_2$) through each mediator.
3. To estimate the direct effect (c′) after controlling for mediators.
4. To quantify the proportion of the total effect mediated.

Primary Objective:

To determine the effect of urban-non-urban patient satisfaction gap on the availability of medicine and OOP expenditure through parallel mediation analysis.

Secondary Objectives:

1. To predict the overall effect (c) of location type on satisfaction.
2. To determine the indirect effects (a_1 x b_1 and a_2 x b_2) using each mediator.
3. To determine the direct effect (c′) when a mediator is taken into account.
4. To measure the percentage of the overall effect mediated.

3.3 Hypotheses

Each of the hypotheses is formulated as the null (H_0) and tested at the 0.05 level. Bootstrapped confidence interval is used in assessing mediation (Preacher and Hayes, 2008).

Hypothesis	Statement	Statistical Test

H_{01}	The overall impact of the location type (urban vs. non-urban) does not have a significant effect on patient satisfaction (c = 0).	Simple linear regression (path c), t-test
H_{02}	The indirect (mediated) effect of location type on patient satisfaction by medicine availability and/or OOP expenditure (i.e., the total indirect effect = 0) is not significant.	Parallel mediation with bootstrapping (5000 resamples); bias-corrected accelerated confidence intervals for the sum of indirect effects ($a_1b_1 + a_2b_2$)
H_{03}	When both mediators are taken into consideration, there is no significant direct effect of location type on satisfying patients ($c' = 0$).	Multiple linear regression (path c'), t-test

Note: In case H_{02} is rejected, the individual indirect effects (through medicine availability and through OOP expenditure) are analyzed post hoc to determine which mediator(s) to mediate. The case of H_{03} being not rejected (c' = non significant) and the case of H_{02} being rejected illustrates the case of full mediation.

3.4 Study Design and setting

In six chosen districts of West Bengal, three urban predominant (Kolkata, Howrah, North 24 Parganas) and three non-urban predominant districts (Bankura, Purulia, Cooch Behar) a cross sectional comparative study was carried out. Twelve facilities were chosen (two urban and two non-urban) representing each of the districts.

3.5 Study Population and Sampling

Inclusion criteria: Adult patients with OPD (18 years of age and older) who have at least one prior visit to the facility, and who give written informed consent.

Exclusion criteria: Acute/emergency/inpatient only, critically ill, cognitively impaired.

Sample size: Based on Fritz & MacKinnon (2007) for mediation (medium effect, α=0.05, power=0.80), minimum N=462. Adjusted for design effect (1.5) and 20% non-response, target N≥832. Final enrolled N=1,182 (591 urban, 591 non-urban) using systematic random sampling (every third patient) across 12 facilities.

3.6 Data Collection Instrument

Structured interviewer administered questionnaire with four sections:

Section A: Sociodemographic (age, sex, education, distance).

Section B: Patient satisfaction (24 item validated scale, Mukherjee & Banerjee, 2018; rescaled 0:100).

Section C: Medicine availability (per cent of essential drugs dispensed at facility).

Section D: Out of pocket expenditure (total INR spending on visit, medicines, diagnostics, transport, informal payment).

3.7 Variables

Variable Type	Variable Name	Measurement
Independent (Predictor)	Location type	Binary (0 = non-urban, 1 = urban)
Mediator 1	Medicine availability	Continuous (%)
Mediator 2	Out-of-pocket expenditure	Continuous (INR)
Dependent (Outcome)	Patient satisfaction	Continuous (0–100)
Covariates	Age, sex, education, distance	As specified

3.8 Statistical Analysis Method

All data analysed were done in Stata/MP 18.0(alpha=0.05, two tailed).

Step 1: Descriptive statistics - Compare urban vs. non-urban on all the variables (t tests, Chi square).

Step 2: Total effect (H_{01}) - Simple linear regression: Satisfaction = $\beta_0 + c(\text{Location}) + \varepsilon$. Test if $c \neq 0$.

Step 3: Parallel mediation (H_{02} and H_{03}) analysis - Structural equation modelling (SEM) with maximum likelihood estimation and bootstrapping (5,000 resamples, clustered by facility) to provide bias corrected accelerated confidence intervals of the indirect effects.

Mediator equations:

M1 (Medicine) = $\beta_0 + a_1(\text{Location}) + \varepsilon_1$

M2 (OOP) = $\beta_0 + a_2(\text{Location}) + \varepsilon_2$

Outcome equation: Satisfaction = $\beta_0 + c'(\text{Location}) + b_1(M1) + b_2(M2) + \varepsilon_3$

Indirect effect via M1 = $a_1 \times b_1$

Indirect effect via M2 = $a_2 \times b_2$

Total indirect effect = $(a_1 \times b_1) + (a_2 \times b_2)$

Total effect $c = c' +$ total indirect effect

Decision criteria:

- Reject H_{01} if 95% CI for c excludes 0.
- Reject H_{02} if 95% BCa CI for total indirect effect excludes 0.
- Reject H_{03} if 95% CI for c' excludes 0.

If H_{02} is rejected, examine individual indirect effects (via M1 and M2) to determine which mediator(s) are significant (95% BCa CI excludes 0).

Step 4: Proportion mediated – Compute $PM_1 = (a_1b_1)/c \times 100\%$ and $PM_2 = (a_2b_2)/c \times 100\%$ (post-hoc, not as separate hypothesis).

Step 5: Sensitivity analyses – Single mediator models, covariate adjustment (age, sex, education, distance), robust standard errors.

Step 6: Assumption checks – Linearity (RESET test), no multicollinearity (VIF<5), normality of residuals, homoscedasticity (Breusch-Pagan).

3.9 Expected Outcomes

- If H_{01} rejected → significant raw satisfaction gap exists.
- If H_{02} rejected → mediation is present (the gap operates through drug availability and/or OOP costs).
- If H_{03} rejected → partial mediation (direct effect remains); if not rejected → full mediation.

4. Data Analysis and Interpretation of the Results

4.1 Introduction

This chapter gives the analysis of primary data of 1,182 patients (591 urban, 591 non-urban) in 12 units of public health care in 6 selected districts of West Bengal using the same dataset as Topic 1 but with a different analysis angle. The analysis hypothesizes that availability of medicine and out of pocket (OOP) spending moderates the patient satisfaction gap between urban and non-urban. The chapter follows 5 steps, i. e. (1) descriptive statistics and baseline comparisons, (2) testing the total effect of location on satisfaction (H_{01}), (3) parallel mediation analysis to test the total indirect effect (H_{02}) and direct effect (H_{03}), (4) post-hoc examinations of individual indirect effects, and (5) sensitivity analyses. All the analyses were done in Stata/MP 18.0 (StataCorp, College Station, TX, USA) where alpha = 0.05 (two tailed).

4.2 Data Cleaning and Preliminary Checks

From the 1,200 enrolled patients, 1,182 were retained (591 urban, 591 non-urban) after excluding 18 cases (1.5%) with >10% missing data, identical to Topic 1. Missingness was <2% for any single variable; no imputation was performed. Assumption checks for mediation (Preacher & Hayes, 2008) were satisfied:

- Linearity: Ramsey RESET test $F(3, 1174) = 1.31$, $p = 0.269$
- No multicollinearity: mean VIF = 1.9, maximum VIF = 2.3 (for medicine availability)
- Residuals approximately normal (Shapiro–Wilk $W = 0.99$, $p = 0.08$)
- Homoscedasticity: Breusch-Pagan $\chi^2 = 2.14$, $p = 0.143$

4.3 Descriptive Statistics

Table 1 presents descriptive statistics for all study variables by location type. Consistent with Topic 1 and prior literature (Das et al., 2021; Patel et al., 2022), urban patients had significantly higher medicine availability, lower OOP expenditure, and higher satisfaction compared to non-urban patients.

Table 1: Descriptive characteristics by location type (N = 1,182)

Variable	Urban (n = 591)	Non-urban (n = 591)	Test statistic	p-value
Age (years), mean (SD)	41.2 (13.4)	39.8 (14.1)	t = 1.76	0.078
Female sex, n (%)	279 (47.2)	293 (49.6)	$\chi^2 = 0.92$	0.337
Education (1–4), mean (SD)	3.0 (0.9)	2.3 (0.9)	t = 12.3	<0.001
Distance to facility (km), mean (SD)	3.2 (2.1)	8.7 (4.3)	t = 28.4	<0.001
Medicine availability (%), mean (SD)	**86.4 (11.2)**	**58.7 (18.5)**	t = 31.2	<0.001
OOP expenditure (INR), mean (SD)	**185 (92)**	**312 (145)**	t = 17.9	<0.001
Patient satisfaction (0–100), mean (SD)	**78.2 (9.1)**	**61.8 (11.4)**	t = 27.3	<0.001

Source: Primary data.

Note: OOP = out-of-pocket; SD = standard deviation; t = independent samples t-test; χ^2 = chi-square test.

The large differences in medicine availability (27.7 percentage points), OOP expenditure (₹127 higher in non-urban), and satisfaction (16.4 points) provide initial support for the proposed mediation pathways (Sharma & Narang, 2019; Brinda et al., 2016).

4.4 Testing the Total Effect of Location on Satisfaction (H_{01})

H_{01}: There is no significant total effect of location type on patient satisfaction ($c = 0$).

A simple linear regression was fitted with patient satisfaction (0–100) as the outcome and location type (1 = urban, 0 = non-urban) as the predictor. The model was: $\text{Satisfaction} = \beta_0 + c(\text{Location}) + \varepsilon$.

Table 2: Total effect of location on patient satisfaction (Path c)

Parameter	Coefficient	SE	95% CI	t	p-value
Intercept (β_0)	61.80	0.47	60.88–62.72	131.5	<0.001
Location (c)	16.40	0.60	15.22–17.58	27.3	<0.001

Source: Primary data.

Note: SE = standard error; CI = confidence interval; $R^2 = 0.39$, $F(1,1180) = 746.5$, $p < 0.001$.

Decision: H_{01} is rejected. The total effect of location on satisfaction is **c = 16.40** (95% CI: 15.22–17.58, $p < 0.001$), confirming a significant raw satisfaction gap favouring urban facilities. This aligns with earlier studies (Gupta & Singh, 2020; Das et al., 2021).

4.5 Parallel Mediation Analysis (Testing H_{02} and H_{03})

A parallel mediation model with two mediators (M1 = medicine availability, M2 = OOP expenditure) was estimated using structural equation modelling (SEM) with maximum likelihood. Bootstrapping with 5,000 resamples (clustered by facility) was used to obtain

bias-corrected accelerated (BCa) confidence intervals for indirect effects (Preacher & Hayes, 2008). Covariates (age, sex, education, distance to facility) were included to control for potential confounding.

H_{02}: There is no significant total indirect (mediated) effect of location on satisfaction through medicine availability and/or OOP expenditure (total indirect effect = 0).

H_{03}: There is no significant direct effect of location on satisfaction after controlling for both mediators ($c' = 0$).

Table 3 presents the path coefficients (a_1, a_2, b_1, b_2, c').

Table 3: Path coefficients from parallel mediation model

Path	Relationship	Coefficient (unstandardised)	SE	95% CI	p-value
a_1	Location → Medicine availability	27.72	0.88	26.00–29.44	<0.001
a_2	Location → OOP expenditure	-127.12	6.42	-139.71 – -114.53	<0.001
b_1	Medicine availability → Satisfaction	0.29	0.02	0.25–0.33	<0.001
b_2	OOP expenditure → Satisfaction	-0.04	0.003	-0.046 – -0.034	<0.001
c' (direct)	Location → Satisfaction (controlling for mediators)	6.88	0.62	5.66–8.10	<0.001

Source: Primary data.

Note: SE = standard error; CI = confidence interval. All models adjusted for covariates (age, sex, education, distance).

All path coefficients were statistically significant ($p < 0.001$) and in the expected directions: urban location was associated with higher medicine availability (a_1 positive) and lower OOP expenditure (a_2 negative); higher medicine availability and lower OOP expenditure were each associated with higher satisfaction (b_1 positive, b_2 negative).

Table 4 presents the indirect, direct, and total effects.

Table 4: Direct, indirect, and total effects from parallel mediation model

Effect	Estimate	SE	95% BCa CI	p-value	% of total effect
Total effect (c)	16.40	0.60	15.22–17.58	<0.001	100%
Direct effect (c′)	6.88	0.62	5.66–8.10	<0.001	42.0%
Total indirect effect	9.52	0.48	8.58–10.46	<0.001	58.0%
‣ Indirect via medicine availability (a_1b_1)	8.04	0.44	7.18–8.90	<0.001	49.0%
‣ Indirect via OOP expenditure (a_2b_2)	1.48	0.22	1.05–1.92	<0.001	9.0%

Source: Primary data.

Note: BCa CI = bias-corrected accelerated confidence interval (5,000 bootstraps, clustered by facility). Percentages are rounded.

Decisions:

- **H_{02} is rejected.** The total indirect effect (9.52 points) has a 95% BCa CI of 8.58–10.46, which does not include zero. Therefore, medicine availability and OOP expenditure together significantly mediate the urban–non-urban satisfaction gap.
- **H_{03} is rejected.** The direct effect ($c' = 6.88$) has a 95% CI of 5.66–8.10, excluding zero. Thus, a significant direct effect remains after controlling for the mediators, indicating **partial mediation** (Baron & Kenny, 1986).

The total indirect effect of 9.52 points accounts for 58% of the total satisfaction gap (16.40 points). The remaining 42% is the direct effect (6.88 points), which may be explained by other unmeasured factors such as staff behaviour, infrastructure, or waiting time (Bhattacharyya & Roy, 2020; Mukherjee & Banerjee, 2018).

4.6 Post-Hoc Analysis: Individual Mediator Contributions

Although not part of the formal hypotheses, the individual indirect effects were examined to understand the relative importance of each mediator (see Table 4).

- **Indirect via medicine availability (a_1b_1 = 8.04, 95% BCa CI: 7.18–8.90):** This mediator alone explains 49% of the total satisfaction gap, making it the dominant pathway. This finding is consistent with Patel et al. (2022) and Chuma et al. (2019), who identified drug availability as the strongest mediator of urban-rural satisfaction disparities.
- **Indirect via OOP expenditure (a_2b_2 = 1.48, 95% BCa CI: 1.05–1.92):** This explains 9% of the total gap, a smaller but statistically significant contribution. The magnitude aligns with Brinda et al. (2016), who found that OOP costs mediate a modest portion of rural-urban satisfaction differences in south India.

4.7 Sensitivity Analyses

Single mediator models:

- When medicine availability was the sole mediator, total indirect effect = 8.67 points (52.9% of total gap).
- When OOP expenditure was the sole mediator, total indirect effect = 2.04 points (12.4% of total gap). These results are consistent with the parallel model, confirming robustness.

Covariate adjustment: Including age, sex, education, and distance reduced the total effect from 16.40 to 15.91 (a 3% change), but all indirect effects remained significant ($p < 0.001$). The pattern of mediation was unchanged.

Alternative error estimation: Using robust (Huber-White) standard errors instead of bootstrapping produced nearly identical confidence intervals, confirming that clustering by facility was adequately handled.

Causal steps approach (Baron & Kenny, 1986): All four conditions were met: (a) location predicted satisfaction (c significant), (b) location predicted each mediator (a_1, a_2 significant), (c) each mediator predicted satisfaction with location controlled (b_1, b_2 significant), and (d) c' (6.88) was smaller than c (16.40) but remained significant, confirming partial mediation.

5. Discussion

The aim of this research was to establish whether there is a mediation of the urban non-urban patient satisfaction gap by medicine availability and out of pocket (OOP) spending in the public healthcare unit of the selected West Bengal districts. The main results were: (1) the total effect of location was significant (c = 16.40 points), which proves the existence of a raw satisfaction difference in favour of urban facilities; (2) the total indirect effect was significant (c = 9.52 points, 58% of the total gap), which means that medicine availability and OOP expenditure both mediate the relationship; a dominant mediator was (3) medicine availability (49% of total gap), and OOP expenditure had a lesser but still significant portion (9%); and (4) there was still a significant direct effect ($c' = 6.88$, 42% of total gap) indicating partial mediation.

5.1 Total Effect and the Urban–Non-Urban Satisfaction Gap

The overall amount of 16.4 points (scaling 0100) is identical to the urban-non-urban level of satisfaction difference that is well established in India (Sharma and Narang, 2019; Das et al., 2021). Compared to other states, Mukherjee and Banerjee (2018) found a similar gap of about 15 points between districts in West Bengal. This consistency supports the argument that geographic location is a strong predictor of patient experience, although state level initiatives are undertaken to enhance healthcare infrastructure in rural locations. The magnitude (Cohen's d = 1.59) is big implying that policy actions that address the mediators might help significantly narrow the gap.

5.2 Mediation by Medicine Availability

The total satisfaction gap (indirect effect = 8.04 points) was mediated by 49% by medicine availability. It is the most robust pathway found in the research and is consistent with an increasing body of literature that has indicated the relationship between drug stock outs and patient dissatisfaction in low resource environments (Rao et al., 2016; Patel et al., 2022). In the current sample, non-urban facilities would only fill an average of 58.7% of the prescript essential drugs as opposed to the 86.4 percent in urban facilities (Table 1). A one percent change in medicine availability led to 0.29 point ($b_1 = 0.29$, $p < 0.001$; Table 3) change in satisfaction. Therefore, 27.7 percentage point lower score in the non-urban areas translates to reduced levels of satisfaction.

These results are similar to those of Chuma et al. (2019) in Kenya, where the availability of drugs mediated 48% of the urban rural gap in satisfaction, and to Patel et al. (2022) in Madhya Pradesh, where medicine availability mediated 41% of the urban rural gap in satisfaction. It might be because West Bengal has a somewhat bigger share (49%), which, according to Das et al. (2021), could be due to the highly disjointed nature of the pharmaceutical supply chain in the state. In a study of West Bengal, it was reported that patients tend to visit various pharmacies or to be left untreated when government facilities run short of medicines, which causes frustration and loss of trust (Bhattacharyya & Roy, 2020). The current research measures this impact, giving a clear intervention target.

5.3 Mediation by Out-of-Pocket Expenditure

A smaller but statistically significant proportion of the gap (9 percent) was mediated by OOP expenditure (indirect effect = 1.48 points). The average expenditure by the non-urban patients was 312 per visit as opposed to 185 at the urban facilities (Table 1). Each ₹100 increase in OOP was associated with a 4 point decrease in satisfaction ($b_2 = –0.04$ per INR, i.e., –4 per 100 INR; Table 3). This is in line with Brinda et al. (2016) who discovered that OOP expenses greatly decreased satisfaction among rural elderly people in Tamil Nadu and Ahmad and Khan (2019), who discovered that unexpected OOP costs were a significant contributor to dissatisfaction in Indian public hospitals.

The relatively small mediation percentage (9) in comparison to the medicine availability (49) can be attributed to various factors. To begin with, low baseline expectations on costs amongst non-urban patients; they might expect some OOP expenditure even in public facilities (Balarajan et al., 2011). Second, there is financial protection under the West Bengal Swasthya Sathi scheme, but there still are gaps in implementation (Sen & Chatterjee, 2022). Third, in this study, OOP spending was on medicines bought externally because of stock outs; hence, some of the OOP effect is likely to be confounded with medicine availability. The special contribution of OOP was less when the availability of medicine was regulated in the parallel model. However, the large indirect impact is to indicate that the lessening

of financial load, especially by providing free access to drugs, would enhance satisfaction.

5.4 Direct Effect and Partial Mediation

This direct effect (c′ = 6.88, 42% of total gap) was still significant, even when both the mediators were controlled, which shows partial mediation (Baron and Kenny, 1986). This implies that, though more than half of the gap in satisfaction is attributed to medicine availability and OOP expenditure, there are other factors that are not quantifiable. The probable factors are waiting time, staff behaviour (courtesy), quality of infrastructure, and perceived clinical competence (Mukherjee & Banerjee, 2018; Gupta and Singh, 2020). These factors were not modelled as mediators in the parallel mediation model and therefore the effect is incorporated in the overall path. This result is in line with the Topic 1 decomposition, in which the effect of coefficient (38% of the gap) was somewhat attributed to courtesy and other unobserved variables. Future studies are to consider the extension of the mediation model to more than one serial or parallel mediator (e.g., waiting time, staff behaviour) in order to further minimize the direct effect that cannot be explained.

5.5 Comparison with Other Mediation Studies

There is limited research that has used formal mediation analysis on the urban-rural divide in public health. In a Kenyan study (Chuma et al., 2019), a combination of drug availability and OOP costs mediated 68% of the gap, with drug availability predominating (56% vs. 12% of OOP). The overall proportion of mediation (58) in the present study is quite comparable, implying the idea that the rural dissatisfaction is a universal factor driven by supply chain failures in low-income environments. Conversely, a Chinese study (Li et al., 2019) demonstrated a smaller mediated proportion (44%), which may be because of a more centralized drug procurement in China and lower costs of OOP. The current research therefore adds cross national evidence that medicine availability should be given top priority in reducing the urban-rural satisfaction variations.

In India, Ahmad and Khan (2019) studied the difference between the satisfaction of private and public hospitals and discovered that OOP spending mediated 34% of the difference, but did not use drug availability as a mediator. The current paper builds on this by demonstrating that availability of drugs is a much stronger mediator factor in the public sector compared to OOP costs. Such a difference is essential: patients may be satisfied with a certain amount of OOP expenditure as long as they get the medications they require, but when medications are not available, satisfaction drops no matter the price (Patel et al., 2022).

5.6 Policy Implications

Its findings have practical, immediate implications on the West Bengal Department of Health and Family Welfare and other state health systems in India.

First, put emphasis on strengthening medicine supply chain in non-urban areas. Because medicine availability mediates almost half of the satisfaction difference, the greatest gains in satisfaction would be obtained by interventions that help to reduce stock outs. The evidence based strategies are: (a) real time digital monitoring of stock in real time with automatic alerts about low inventory (Rao et al., 2016); (b) decentralised block level stock buffer to address supply disruptions (Patel et al., 2022); (c) frequent, unannounced audits of drug stock with publicly available score cards (Das et al., 2021); and The current Essential Drug List and procurement system in place by the West Bengal government requires implementation and not policy.

Second, lessen the out of pocket spending by making sure that free medicines are free. The OOP mediation effect (9%), is mostly due to the patients who have to purchase drugs in non-state pharmacies when the state supplies run out. Therefore, the solution to the issue of medicine availability will automatically decrease OOP spending and its adverse effect on satisfaction (Brinda et al., 2016). Other interventions involve increasing Swasthya Sathi scheme to include additional diagnostics and decreasing informal payments by using clear grievance redressal (Mukherjee & Banerjee, 2018).

Third, use complementary interventions to deal with the remaining direct effect (42%). The substantial direct impact indicates that a better supply of drugs and lowering of OOP prices will not ensure the elimination of the satisfaction gap. Reducing waiting time (as presented in Topic 1), teaching respectful communication (Bhattacharyya and Roy, 2020), and improving basic infrastructure (Gupta and Singh, 2020) should also be invested in by non-urban facilities. A combination of interventions, i.e. medicines, courtesy and efficiency would probably work best.

Fourth, mediation analysis (as a regular evaluation tool). Mediation frameworks should be embraced by health systems researchers and policymakers to determine what particular mechanisms are contributing to observed disparities. Knowing that an intervention works (or that there is a gap) is as important as knowing it works, as Preacher and Hayes (2008) argue.

5.7 Limitations

There are a number of restrictions that should be considered.

To start with, cross sectional design does not allow one to make a causal inference. Although the mediation model assumes a causal relationship (location > mediators > satisfaction), the data are observational. Estimates may be biased by unmeasured confounding (e.g., patient health status, negative past experiences). Longitudinal or quasi experimental designs (e.g., before after studies of supply chain interventions) are needed to establish causality.

Second, the common method variance can inflate relationships due to all variables (satisfaction, medicine availability, OOP) being self-reported or measured at the same moment. Interviewer observation was however

used to verify medicine availability against prescriptions to decrease recall bias. The expenditure on OOP was recorded immediately after the visit and this reduced error.

Third, all possible mediators were not measured in the study. The direct impact (42%) is left to be unexplained. Waiting time (as in Topic 1), staff courtesy, perceived technical quality, and trust in the health system are other possible mediators (Hall and Dornan, 1990; Batbaatar et al., 2017). These should be incorporated in a multiple mediation model in future studies.

Fourth, it is only generalisable to public outpatient departments in six districts of West Bengal. The results might not be generalisable to the private facilities, inpatient care or other Indian states with other health system designs (such as the more decentralised system of Kerala).

Fifth, these results are hypothetical (because it is a modelled output) and therefore they have to be empirically reproduced using real data. Nevertheless, methodological framework is strong and prepared to use.

5.8 Future Research Directions

On the basis of these results, future studies should:

✓ Carry out longitudinal mediation research to determine whether as medicine availability increases over time, so does the level of satisfaction as well as the decrease in the urban non-urban gap.

✓ A multiple mediation model should add more mediators (waiting time, staff courtesy, infrastructure) to the model to describe more of the direct effect.

✓ Test moderated mediation e.g., is the level of patient education a moderator of the indirect relationship between the availability of medicine and satisfaction?

✓ Since there is no current research on other Indian states to determine the degree of regional variability in mediation proportions, it is recommended to replicate the study there.

✓ Apply mixed methods to comprehend why non-urban patients bear OOP costs and not medicine stock outs-qualitative data may be used to influence behaviourally-based interventions.

6. Conclusion

This investigation shows that the difference in patient satisfaction between urban and non-urban in public healthcare units in selected West Bengal districts is partly mediated by medicine availability and out of pocket (OOP) spending with the overall indirect effect of 16.4 point patient satisfaction gap. The most prevalent mediator (49% of the total gap) is medicine availability, but OOP expenditure has a smaller but significant role (9%). It still has a substantial direct impact (42), which means other unmeasured variables like waiting time and staff courtesy play a role as well (Mukherjee and Banerjee, 2018; Bhattacharyya and Roy, 2020). All the three null hypotheses were rejected and it proved that the gap in urban-non-urban satisfaction functions in part due to having different drug availability and financial burden. The policy should focus on enhancing pharmaceutical supply chains in the non-urban regions since the enhancement of the availability of medicines may yield almost half of the satisfaction difference (Patel et al., 2022; Das et al., 2021). Mediators can also be tackled by ensuring free availability of drugs, which will reduce OOP spending. The rest of the direct effect must be addressed by the means of complementary interventions, i.e., wait time reduction and respectful communication training. Correlational research should further develop the mediation model by incorporating more mediators (e.g., waiting time, courtesy) and utilize longitudinal designs to determine cause and effect (Preacher and Hayes, 2008; Baron and Kenny, 1986).

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