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Inequalities in Out-of-Pocket Expenditure for Vascular Healthcare Services in Eastern Uttar Pradesh

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ABSTRACT

Background & Objectives:
This study rigorously examines the magnitude and factors influencing inequities in out-of-pocket expenditure (OOP) for vascular healthcare services in Eastern Uttar Pradesh. Vascular diseases necessitating expensive diagnostics, medical management, and surgical or endovascular interventions frequently impose a considerable financial burden on households. The main goal is to find out how much more people spend on vascular care out of pocket and what social, economic, and health system factors cause these differences in both inpatient and outpatient settings.

Methods:
The analysis is based on primary household-level data that was gathered from two districts of Eastern Uttar Pradesh. The distribution and concentration of vascular-related OOP spending across socioeconomic strata have been evaluated using a combination of descriptive statistics and sophisticated inequality measures like the Lorenz curve, Gini coefficient, and Theil index. These tools make it possible to comprehend financial inequalities in vascular diagnostics, emergency care, surgery, and long-term disease management in detail.

Results:
Significant inequalities in OOP spending for vascular healthcare are revealed by empirical findings. Financial stress is significantly increased by the high costs of necessary vascular services, such as diagnostic imaging (Doppler, CT angiography), medications (antiplatelets, anticoagulants), surgical and endovascular procedures, operation theatre fees, blood transfusions, and oxygen support. Low-income and rural households continue to bear a disproportionately heavy burden, which restricts equitable access to timely and appropriate vascular care and may exacerbate disease outcomes.

Interpretation & Conclusions:
The study highlights an urgent need for targeted policy reforms to reduce financial barriers to vascular healthcare in Eastern Uttar Pradesh. Important steps toward equity include strengthening Universal Health Coverage (UHC), increasing vascular care services at PHCs and CHCs, enhancing referral systems, and lowering reliance on expensive private facilities. Inequalities in financial burden and vascular health outcomes will continue to exist in the absence of systemic improvements. For vascular healthcare to be accessible, affordable, and equitable for all socioeconomic groups, it is imperative that these inequalities be addressed urgently.

KEYWORDS: *Out-of-pocket expenditure, vascular healthcare, inequalities, Lorenz curve, Gini coefficient, Theil index, Eastern Uttar Pradesh.*

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INTRODUCTION

Uttar Pradesh (U.P.) still lags behind the majority of Indian states in important human development and health metrics despite more than 60 years of planned development. While gender development, healthcare, and education have all improved in India, not all areas of Uttar Pradesh, particularly Eastern Uttar Pradesh, have benefited equally from these developments. According to the Planning Commission's National Human Development Report (2002), the state only slightly improved from its 1991 ranking of 13th on the Human Development Index (HDI) in 2001. U.P. is ranked 34th out of 36 states and union territories in the most recent UNDP Human Development Report (2023–24), indicating ongoing developmental challenges.

Inequalities in health are especially severe. Several Millennium Development Goal (MDG) targets, particularly those pertaining to maternal and child health, were not met by Uttar Pradesh (Government of India, 2015). Reducing maternal mortality to less than 70 per 100,000 live births is still a key indicator under the Sustainable Development Goals (SDGs). However, compared to the national average of 97, the state's maternal mortality ratio (MMR) as of 2018–20 is still extremely high at 197 (MoSPI, 2021). According to the UNDP's (2011) Inequality-Adjusted Human Development Index (IHDI), U.P. loses almost 39% of its health index as a result of inequality that is significantly higher than the national average.

These inequalities still exist in terms of access and infrastructure. Although the National Health Policy (2017) places a strong emphasis on providing equitable healthcare, there are still significant gaps in many districts. Large rural populations continue to be disadvantaged by major geographic barriers, insufficient primary facilities, and a lack of medical personnel (Rural Health Statistics, 2019–20). U.P. receives a score of just 46 on "Reduced Inequalities" in the SDG India Index (NITI Aayog, 2018), significantly lower than the national average of 64. Data from the National Sample Survey (NSS 2018), DLHS-4 (2012–13), and NFHS-5 (2019–21) further demonstrate how high out-of-pocket expenses (OOPE) and inadequate infrastructure impede access to necessary care, particularly in the state's eastern region.

In the context of vascular healthcare services, a field that is becoming more and more important for public health, a particularly concerning aspect of this inequality becomes apparent. Vascular diseases like stroke, peripheral artery disease, complications from hypertension, and ischemic heart disease are increasing quickly in India due to the country's epidemiological transition. This burden is disproportionately high in Uttar Pradesh: the state reports a 54% higher burden of ischemic heart disease per capita than the Indian average, and cardiovascular diseases significantly contribute to mortality (ICMR–PHFI–IHME, 2017). Patients with vascular disease are frequently compelled to seek care later, heavily rely on private providers, and incur significant OOPE due to a large rural population, low health literacy, and inadequate preventive services.

The weak economic foundation of U.P. exacerbates the issue. The state's per capita NSDP is only Rs. 114,514, which is less than half the national average, according to the Economic Survey of India (2024–2025). Households with lower incomes have a much harder time managing both acute and chronic vascular conditions, which frequently call for emergency interventions, long-term medication, endovascular procedures, and diagnostic imaging (Doppler, CT angiography), all of which are hard to come by in Eastern U.P. public facilities. The state performs poorly on nearly every health indicator, including life expectancy, mortality rates, and key HDI components, as Table 1 illustrates.

Table-1: Health and Human Development Indicators, Uttar Pradesh & India

Indicator	**Uttar Pradesh**	**India**
Neonatal mortality rate (NNMR)	28	19
Infant mortality rate (IMR)	38	27
Under-5 mortality rate (U5MR)	43	31
Maternal Mortality Rate	197	97
Life expectancy	65	69
Male	64.3	67.8
Female	65.6	70.4
Human Development Index (HDI)	0.468	0.504
Inequality adjusted HDI (IHDI)	0.307	0.343
Income index (adjusted)	0.444 (0.384)	0.465 (0.389)
Education index (adjusted)	0.365 (0.195)	0.400 (0.229)
Health index (adjusted)	0.633 (0.384)	0.688 (0.452)

*Source:*1. NHFS-5 (2019-21)

2. Ministry of Health and Welfare (2021)

2. Sample Registration Survey (SRS, 2020, 2021), Office of the Registrar General of India (RGI)

4. IHDI for India's States, UNDP, 2011.

Families are compelled by these systemic flaws to enter the private sector, where the financial burden becomes disastrous. According to NSS 75th round data (2017–18), hospital stays in private facilities typically cost more than four times as much as those in public facilities (Rs. 33,071 vs. Rs. 7,665). Vascular interventions, which may include costly diagnostics, specialist consultations, stent placements, dialysis for patients with vascular compromise, surgical interventions, and long-term follow-up care that is frequently unavailable in Eastern U.P. public facilities have an even greater disparity in cost. As a result, patients often put off receiving treatment, self-medicate, accrue high-interest debt, or, in many situations, skip out on life-saving procedures.

There are also significant differences between U.P. regions. The most economically disadvantaged area is still the Eastern region, which includes districts like Varanasi, Gorakhpur, Basti, Deoria, Azamgarh, Jaunpur, and Mirzapur. Additionally, it has the lowest total health expenditure per capita (Rs. 4,065.99) and MPCE (Rs. 1,673.29) in the state (NSSO, 2019). Although hospitalization costs in Eastern U.P. are reportedly lower than state averages (Rs. 22,421.82), this usually indicates suppressed utilization because of financial limitations rather than reduced morbidity. These financial limitations result in worse outcomes, increased disability, and increased mortality for vascular diseases, where prompt care is crucial.

This study, which focuses ***on "Inequities in OOPE for vascular healthcare services in Eastern Uttar Pradesh,"*** places these health and economic issues within the larger conversation on inequality. Although earlier research has shown the disastrous effects of OOPE in India (Shahrawat & Rao, 2011; Verma et al., 2017), little is known about how these costs disproportionately impact households seeking vascular care; a field that is by nature linked to high costs, frequent hospitalization, and long-term medication. Furthermore, these disparities are made worse by the lack of universal health coverage for vascular conditions, the low penetration of Ayushman Bharat in specialized services, and the deficient public-sector vascular infrastructure.

The current study uses inequality measures like the Gini Coefficient and Theil Index to provide a rigorous assessment of these inequalities, allowing a distributional analysis of OOPE across income groups, castes, and rural–urban households. Designing equitable financing strategies and identifying socioeconomic gradients in vascular healthcare spending require the use of such an approach.

The study tackles the following important questions in light of these systemic and contextual issues:

- To what degree do disparities in OOPE for vascular healthcare lead to catastrophic spending or poverty in Eastern Uttar Pradesh?
- Which vascular services; diagnostics, emergency interventions, inpatient procedures, or outpatient care—have the biggest financial impact on households?
- What are the differences in OOPE for vascular diseases between rural and urban areas, socioeconomic groups, caste categories, and insurance status?

The paper is divided into five sections to address these questions. The theoretical and empirical literature on health inequality, the burden of vascular disease, and OOPE patterns is reviewed in Section 2. The data sources and methodological tools, including measures of inequality, are described in Section 3. The empirical results are presented and interpreted in Section Four with an emphasis on the socioeconomic distribution of vascular healthcare spending. In order to improve the equity of vascular care financing and fortify public health systems in Eastern Uttar Pradesh, Section Five concludes with important insights and policy recommendations. Through this analysis, the study adds to a more sophisticated understanding of the relationship between the burden of vascular disease, economic vulnerability, and health system inequities insights that are essential for guiding focused health financing reforms at the state and federal levels.

MATERIAL AND METHODS

Data Source and Study Area

The current study is based on primary data gathered from a thorough field survey carried out in Gorakhpur and Varanasi, two significant districts in Eastern Uttar Pradesh. These districts were specifically chosen to examine inequalities in out-of-pocket expenditure (OOPE) on vascular healthcare services because they offer complementary but contrasting contexts. Their selection was guided by multiple methodological and contextual considerations, including (i) epidemiological variation in the prevalence of vascular diseases, (ii) socioeconomic heterogeneity, (iii) significant inequalities in healthcare infrastructure and service utilization, and (iv) policy relevance in representing typical conditions of Eastern Uttar Pradesh, influenced their selection. When taken as a whole, these districts capture the intricate regional dynamics that influence household-level vascular care costs.

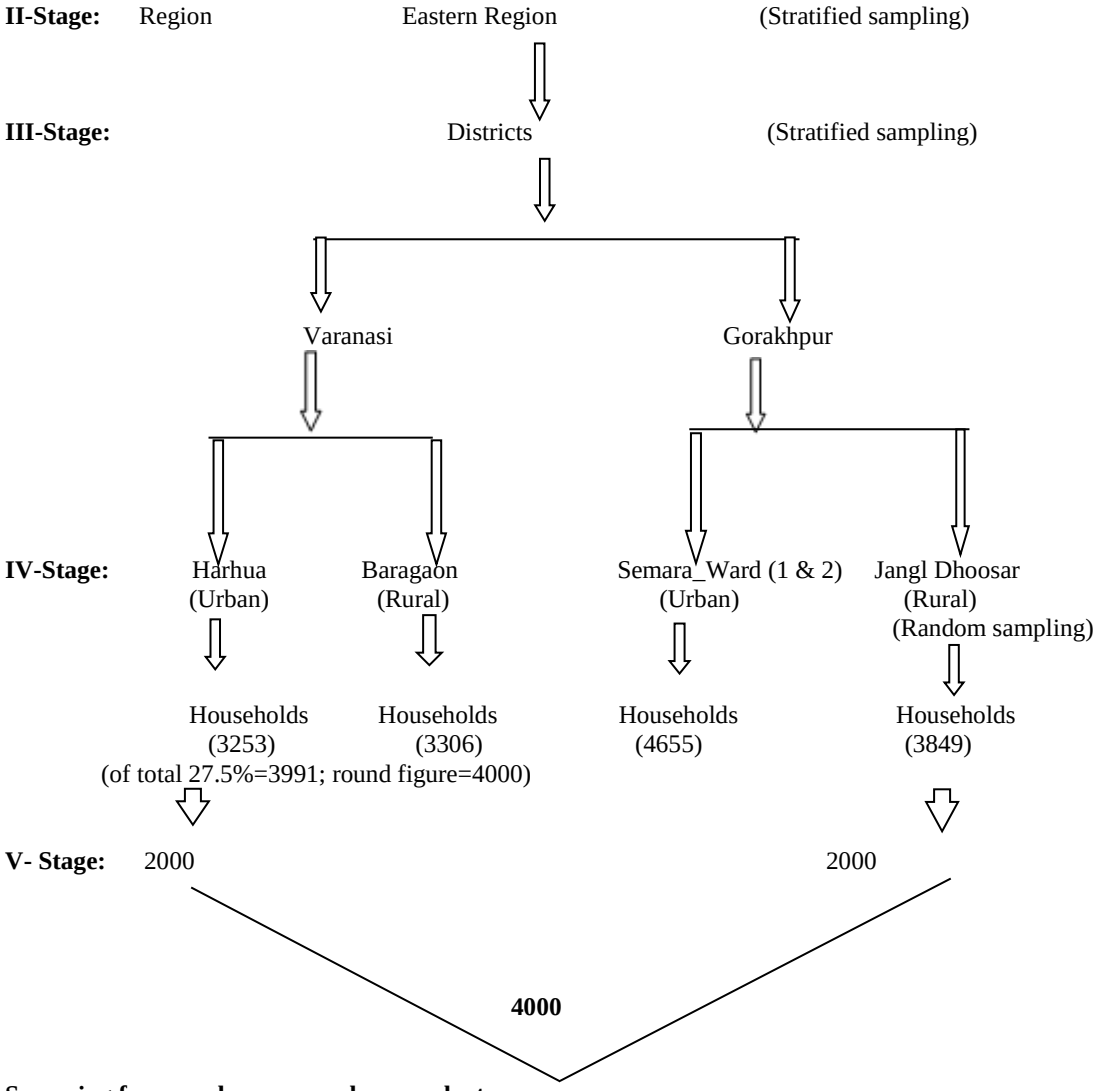
To guarantee representativeness across settlement types, the study included both rural and urban clusters within Varanasi. The Baragaon block, which includes the villages of Madanpur, Bishaipur, Sitapur, Kohran, and Baurahawa, was the source of the rural sample. The urban sample, which included places like Basdevpur, Hatia, Sabaipur, and Kharagpur, was chosen from the Harhua block. These regions were chosen using a randomized sampling technique to guarantee sufficient representation of household diversity. By reducing selection bias, random sampling improves the study's internal and external validity. This is crucial for public health and socioeconomic research that deals with diverse populations and varying disease burdens.

In Gorakhpur, a parallel sampling strategy was used. The Chargawan block's Jungledhusar area, which includes the villages of Baitalgarh, Haiderganj, Kakrahia, and Jungledhusar, made up the rural cluster. The Semra Ward (Wards 1 and 2) provided the urban sample. Both districts provided 800 urban and 1,200 rural households each, chosen using randomized sampling techniques to maintain methodological parity with Varanasi. A total of 3,991 households (rounded to 4,000), or roughly 27.5% of all households in the chosen areas, were surveyed.

Disaggregated analysis of social disparities in vascular healthcare spending was possible because the sample included significant social groups like Scheduled Castes (SC), Scheduled Tribes (ST), Other Backward Classes (OBC), and the Economically Weaker Sections (EWS) within the General category. In order to ensure accurate reporting of health expenditures and care-seeking behavior, the survey's main inclusion criterion was the household head's availability at the time of the interview.

In-depth data on healthcare utilization, OOPE on vascular and related chronic conditions, socioeconomic characteristics, and household demographics were collected over the course of eight months, from January 1, 2021, to August 31, 2021. This dataset offers a strong empirical basis for evaluating the trends, causes, and disparities of OOPE related to vascular healthcare services in Eastern Uttar Pradesh.

Sampling Procedure: In short, the **sampling procedure** can be explained as follows:
I-Stage: Why Uttar Pradesh (Already explained in introduction and previous work done)?



Screening for vascular cases and respondents
Each chosen household was screened to determine whether any household member had experienced vascular disease or used vascular care within the recall period (for instance, the past 12 months or since the last hospitalization; specify the recall period used in your survey instrument) because the study question focuses on OOP for vascular healthcare. To support prevalence and comparative analyses, the household's general health expenditure and socioeconomic characteristics were still gathered even if no member of the household met the vascular screening criteria. Pre-survey administrative lists (clinic/OPD registers) were used to oversample households known to have vascular patients if the study's goal was to maximize the number of vascular cases; if not, the household sample was used to find cases through screening.

Research Tool
In this paper, **an average method** ($\bar{x} = \frac{\Sigma x_i}{n}$) is applied to the data collected from the said field to get the proper result. Furthermore, for the purpose of inequalities in in-patient and out-patient, Lorenz cure, $G = 1 - 2\int_0^1 L(p)dp$ and Theil measures $L = \frac{1}{\mathbb{N}}\sum_{i=1}^{n} ln\left(\frac{u}{x_i}\right)$ are also applied.

Empirical Results and Discussion

Table-2: Average income and Health Expenditure of Varanasi, Gorakhpur and combined of both the districts (in-patient hospitalization)

Variable	Varanasi	Gorakhpur		Combined observation
1. Household income	14650.60	12405.70		13528.15
2. Health care provider's fees (consultation charges)	341.11	440.65		390.88

3. Medicines from hospital	3710.80	2941.40		3326.10
4. Medicines from outside	2208.10	2126.40		2167.25
5. Tests/investigation	1115	1100.70		1107.85
6. Hospital and nursing home charges including bed charges, food	554.40	721.35		637.875
7. Operation theatre charges, surgery charges and related expenses	487.20	793.50		640.35
8. Blood, oxygen cylinder	307.20	263.70		285.45
9. Transportation	292.80	380.60		336.70
10. Expenses of the accompanying person(s) (food/accommodation)	237.50	295		266.25
11. Expenditure not elsewhere reported (others)	168.30	270.52		219.41
Total Health Expenditure	9422.41	9333.82		9378.12

Source: *Estimated from the Field Survey data, 1 January 2021 to 31 August 2021.*

Significant socioeconomic and spending-related differences between Varanasi and Gorakhpur, the two main Eastern Uttar Pradesh districts surveyed, are revealed by the empirical analysis. **Table 2** illustrates that the average monthly household income in Gorakhpur is Rs. 12,405.70, whereas in Varanasi it is Rs. 14,650.60. Wide inter-district variation is evident in the combined mean income of Rs. 13,528.15, which reflects broader economic disparities typical of the eastern region of the state. These disparities in income serve as the structural basis for inequalities in out-of-pocket expenses (OOPE), especially for expensive and chronic conditions like vascular diseases that require ongoing medical care, diagnostic tests, and specialized procedures.

Remarkably, the average total in-patient health expenditure is almost the same in both districts—Rs. 9,422.41 in Varanasi and Rs. 9,333.82 in Gorakhpur despite the disparity in income. Despite income disparities, households in both districts face a comparable financial burden, as evidenced by the combined average OOPE of Rs. 9,378.12 for hospitalization episodes. This implies that essential vascular healthcare costs are comparatively rigid, including consultation fees, medications purchased both inside and outside the hospital, diagnostic tests, surgical and operating room fees, and hospital/nursing home fees. They put disproportionate pressure on poorer households because they do not adapt to household economic capacity.

Disaggregated expenditure components reveal significant disparities at the district level. Gorakhpur households report higher consultation fees and significantly higher surgery-related costs (Rs. 793.50 compared to Rs. 487.20 in Varanasi), and Varanasi households spend more on hospital-supplied medicines (Rs. 3,710.80) than Gorakhpur households (Rs. 2,941.40). These variations reflect variations in hospital referral patterns, the availability of vascular specialists, and healthcare provider practices. Due to the lack of specialized services in public hospitals, patients are reportedly depending more on private facilities for vascular procedures, which is consistent with higher surgery-related costs in Gorakhpur.

Regardless of household income, the overall similarity in total OOPE shows a consistently high cost of accessing vascular care, despite district-specific variations in some cost components. This makes financial stress worse, especially for households with lower incomes who already have fewer coping strategies. Families are forced to rely primarily on out-of-pocket expenses due to the low insurance penetration, which further increases the burden. The average OOPE reported here is significantly higher than the corresponding national estimates from NSSO (2018), indicating that hospitalization care in Eastern Uttar Pradesh is more costly.

Together, these results indicate substantial inequalities in OOPE for vascular healthcare: although the necessary medical costs are largely constant, household income varies greatly. Because of this, households with lower incomes in Gorakhpur and Varanasi bear a disproportionately greater financial burden in comparison to their income. This inequality highlights systemic weaknesses in Eastern Uttar Pradesh's financial protection mechanisms, raises the risk of poverty from medical expenses, and jeopardizes prompt care-seeking for vascular diseases.

Table-3: Average of sources to meet the expenses for healthcare expenditure (in-patient hospitalization)

Variable	Varanasi	Gorakhpur	Combined observation
1. Personal income	3050.17	2773.65	2911.91
2. Household income excluding personal income	172.50	150	161.25
3. Savings	472.50	322	397.25
4. Loans (bank/friends/relatives/moneylender)	3277.89	2847.22	3062.56
5. Contribution from friends/relatives	1148.25	1206.95	1177.60
6. Selling assets/property/land	1510.10	1639	1574.55
7. Other	0	0	0
8. Total Expenditure on health	8522.41	8433.82	8478.12

9. Total spending on all in-patient visits to health care facilities/providers (including your most recent visit) during the past one year	18153.82 +recent visit 13214.20= Total =31368.02	17372.64+ recent visit 12594.45= Total =29967.09	17763.24+ recent visit 12904.33= Total =30667.57

Source: *Estimated from the Field Survey data, 1 January 2021 to 31 August 2021.*

The distribution of household sources used to pay for inpatient vascular healthcare expenditure in Varanasi and Gorakhpur is shown in Table 3. The findings demonstrate a substantial financial burden related to inpatient hospitalization, exposing the amount of out-of-pocket expenses (OOPE) as well as the disparities between households in the two districts.

In both districts, personal income continues to be the main source of funding for inpatient medical care; households in Varanasi contribute an average of Rs. 3,050.17, while those in Gorakhpur contribute Rs. 2,773.65. The use of savings, loans, and household income (not including personal income) all show a similar pattern, but the most notable finding is the significant reliance on borrowing. The average amount raised through loans such as from banks, moneylenders, friends, or relatives dominates all other sources, standing at Rs. 3,277.89 in Varanasi and Rs. 2,847.22 in Gorakhpur. This indicates that vascular healthcare often forces households into debt, demonstrating vulnerability in both districts but relatively greater reliance in Varanasi.

Contributions from family members and distress financing methods like selling property or assets also account for a sizable amount of overall inpatient spending. Gorakhpur households appear to be somewhat more economically fragile, as evidenced by the slightly higher value of assets sold in Gorakhpur (Rs. 1,639) compared to Varanasi (Rs. 1,510.10). The combined use of savings, asset sales, and unofficial transfers shows that vascular hospitalization episodes force families to make more money than they would normally be able to, exposing systemic disparities in financial resilience.

The study calculates the average OOPE for inpatient hospitalization to be Rs. 5,936.24 in Varanasi, Rs. 5,693.17 in Gorakhpur, and Rs. 5,814.71 for the combined observations based on the sum of these expenditure components. These amounts highlight the disproportionately high-cost burden of vascular illnesses in Eastern Uttar Pradesh, surpassing the 2018 NSSO national estimates for inpatient OOPE. The total yearly expenditure on all inpatient visits—Rs. 31,368.02 for Varanasi, Rs. 29,967.09 for Gorakhpur, and Rs. 30,667.57 for the combined sample—further illustrates the severity of the cost burden. These amounts, which include the costs of the most recent hospital stay, imply that vascular diseases frequently necessitate repeated or protracted treatment episodes.

Importantly, the results indicate that inpatient medical expenses account for roughly 27–28% of all household spending in the study region. Given the lack of efficient insurance penetration or financial protection mechanisms, this share is startlingly high. In addition to highlighting the shortcomings of the current health financing system, the reliance on loans, out-of-pocket savings, and asset liquidation also highlights households' uneven ability to handle catastrophic health shocks. Vascular healthcare is a medical and financial challenge in Eastern Uttar Pradesh because of the financing pattern, which blatantly reflects socioeconomic disparities: households with lower incomes, fewer savings, or restricted access to formal credit instruments are disproportionately burdened.

Table-4: Average income and Health Expenditure of Varanasi, Gorakhpur Districts and combined of both (Out-patient visits)

Variable	Varanasi	Gorakhpur	Combined observation
1. Household income	14650.60	12405.70	13528.15
2. Healthcare provider's fees (consultation charges)	386.01	408.42	397.22
3. Medicines from hospital	1996.70	1630.94	1813.82
4. Medicines from outside	1343.36	1485.76	1414.56
5. Tests/investigation	848.30	946.15	897.23
6. Hospital and nursing home charges including bed charges, food	554.40	721.35	637.88
7. Blood, oxygen cylinder	112.10	106	109.05
8. Transportation	195.75	187.85	191.80
9. Expenses of the accompanying person(s) (food / accommodation)	59.30	61.76	60.53
10. Expenditure not elsewhere reported (others)	48.10	42.56	45.33
Total expenditure	**4815.42**	**4794.34**	**4804.88**

Source: *Estimated from the Field Survey data, 1 January 2021 to 31 August 2021.*

The average household income and out-of-pocket expenses for outpatient vascular healthcare services in Varanasi and Gorakhpur are shown in Table 4. The results show that households in Gorakhpur have an average income of Rs. 12,405.70, whereas

households in Varanasi have an average income of Rs. 14,650.60. The total average outpatient expenditure in the two districts, however, is almost the same despite this income disparity: Rs. 4,815.42 in Varanasi and Rs. 4,794.34 in Gorakhpur, with a combined average of Rs. 4,804.88. These figures indicate a growing financial burden, particularly for vascular healthcare in the area, as they are significantly higher than the 2018 NSSO national estimates for outpatient care.

The majority of outpatient OOP payments are made up of medications and diagnostic tests, according to a closer look at expenditure components. Gorakhpur households pay more for medications bought from outside pharmacies (Rs. 1,485.76), as well as more for diagnostic tests (Rs. 946.15) and hospital-related fees. Varanasi households spend more on medications bought on hospital grounds (Rs. 1,996.70). This pattern suggests that there are structural and supply-side disparities between districts, including differences in hospital procurement procedures, the accessibility of subsidized medications, and the dependence on private diagnostic centers.

Overall, the regressive nature of vascular healthcare spending in Eastern Uttar Pradesh is highlighted by the nearly equal outpatient spending despite income disparities. The region's systemic problems with outpatient service delivery, medication accessibility, and risk protection mechanisms are highlighted by the fact that households, regardless of income level, seem forced to devote significant resources for necessary medications and diagnostics. These inter-district differences further suggest that inequities in OOP expenditure may be driven less by income and more by differences in health system capacity, market price structures, and household coping mechanisms.

Table-5: Average figures of sources to meet the expenses for healthcare expenditure (Out-patient)

Variable	Varanasi	Gorakhpur	Combined observation
1. Personal income	3864	3799.65	3831.825
2. Household income excluding personal income	72.5	70	71.25
3. Savings	168.5	162	165.25
4. Loans (bank/friends/relatives)	228.75	220.1	224.425
5. Contribution from friends/relatives	305.98	289.7	297.84
6. Selling assets/property	160.6	155	157.8
7. Other	15.09	97.89	56.49
8. Total medical expenditure	4815.42	4794.34	4804.88
9. Total spending on all your outpatient visits to health care facilities/providers (including your most recent visit) during the last 12 months	7433.95	8258.75	7846.35

Source: *Estimated from the Field Survey data, 1 January 2021 to 31 August 2021.*

The distribution of average sources used to pay for outpatient medical care in Varanasi, Gorakhpur, and the combined observation is shown in Table 5. According to the results, the average out-of-pocket (OOP) cost per outpatient visit is Rs. 710.42 in Varanasi, Rs. 762.69 in Gorakhpur, and Rs. 736.56 for the combined observation. These averages demonstrate the growing cost burden of outpatient vascular healthcare in the area, as they are significantly higher than corresponding estimates published in the 75th round of the NSSO (2017–18).

The majority of household health financing in both districts comes from personal income, which continues to be the primary source for covering outpatient costs (Rs. 3864 in Varanasi and Rs. 3799.65 in Gorakhpur). This reliance on immediate earnings underscores limited financial protection measures and the absence of comprehensive pre-payment mechanisms. Household income excluding personal income, savings, and loans constitute the next major sources, with borrowing (Rs. 228.75 in Varanasi and Rs. 220.10 in Gorakhpur) reflecting a recurring coping strategy adopted by vulnerable households.

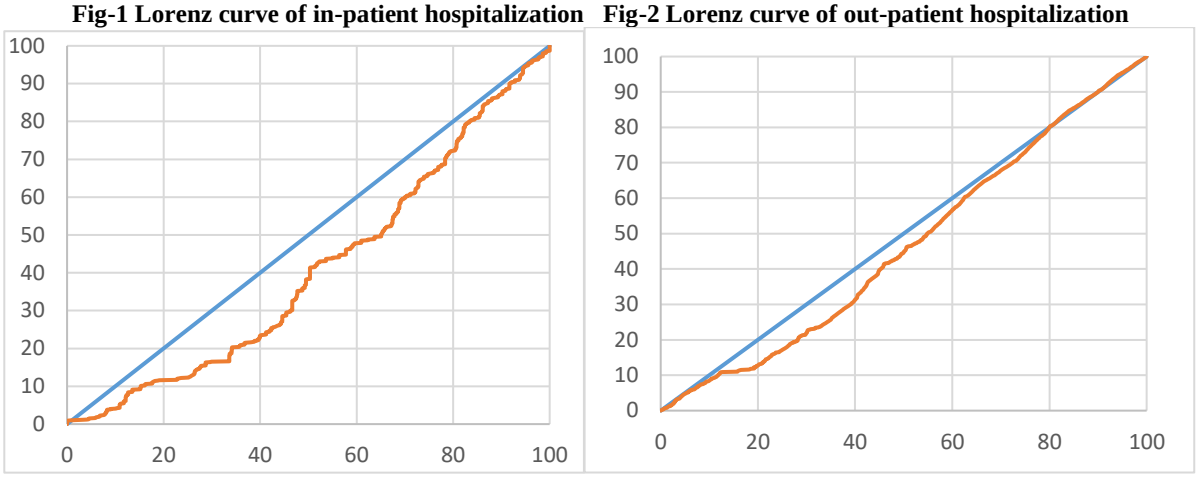
A notable pattern emerges from the relatively high dependence on asset liquidation and contributions from friends or relatives, which signals significant financial fragility even for non-hospitalization treatment. Such strategies are typically associated with distress financing and demonstrate the inadequacy of social safety nets for outpatient vascular care. Interestingly, Gorakhpur displays a substantially higher value in the “Other” category (Rs. 97.89 compared to Rs. 15.09 in Varanasi), indicating the presence of informal, ad hoc, or non-conventional support systems that households utilize to mitigate health-related financial shocks.

Overall, these findings reveal a clear pattern of inequity in outpatient OOP expenditure across districts, with Gorakhpur households relying more heavily on diverse and informal financing sources. This suggests greater financial vulnerability and deeper structural limitations in access to risk-pooling mechanisms, with important implications for targeted policy interventions aimed at protecting poorer households from impoverishing health expenditures.

Lorenz Curve and Inequality Measures for the Study Area

This section presents the empirical assessment of inequalities in out-of-pocket (OOP) health expenditure using standard inequality metrics such as the Lorenz curve, Gini coefficient, and Theil index. Lorenz curves have been constructed separately for inpatient and outpatient health expenditures in the districts of Varanasi and Gorakhpur based on primary survey data collected. For Varanasi, Lorenz curves were derived by plotting the cumulative proportion of the population against the cumulative share of OOP expenditure for both inpatient hospitalization and outpatient visits. **Figure 1** represents the Lorenz curve for inpatient expenditure, while **Figure 2** depicts the Lorenz curve for outpatient expenditure.

Fig-1 Lorenz curve of in-patient hospitalization **Fig-2 Lorenz curve of out-patient hospitalization**



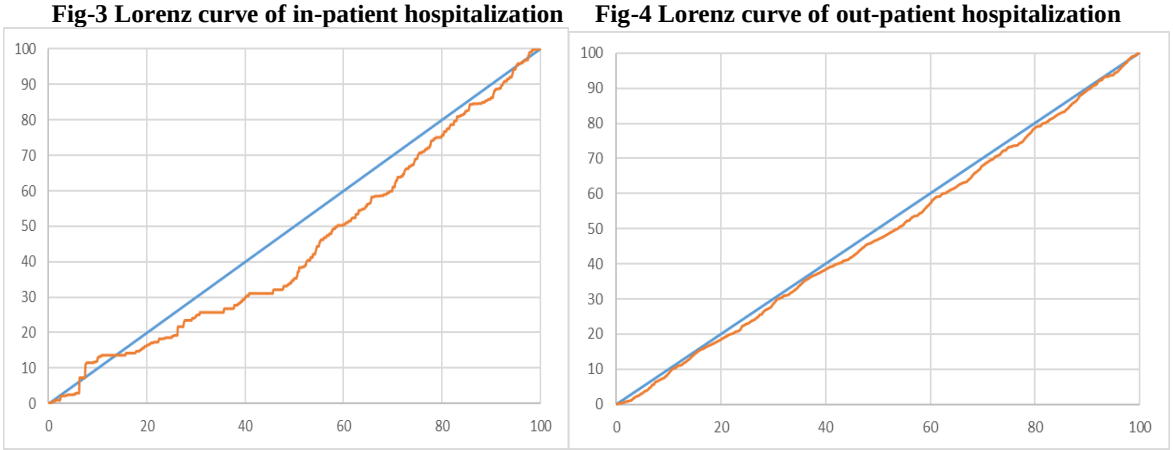
Source: *Estimated from the Field Survey data, 1 January 2021 to 31 August 2021.*

Figures 1 and 2 clearly indicate that both inpatient and outpatient expenditure distributions deviate substantially from the line of equality. However, the Lorenz curve for inpatient care lies farther from the equality line compared to outpatient care, implying greater inequality in the distribution of inpatient spending. This pattern reflects the highly varying nature of inpatient treatment costs for vascular conditions: while some households reported minimal expenditure, others incurred extremely high costs due to complications, prolonged hospitalization, or the need for specialized diagnostic and interventional procedures.

Extending the analysis to Gorakhpur, the study similarly constructed Lorenz curves using the cumulative proportion of inpatient and outpatient OOP expenditures relative to the cumulative population. As in Varanasi, the Lorenz curves for Gorakhpur also exhibit a pronounced distance from the equality line, indicating significant inequalities in health expenditure across households. The curvature suggests that a small proportion of households' accounts for a disproportionately large share of OOP spending, particularly in cases requiring inpatient hospitalization.

Overall, the Lorenz curves for both districts demonstrate substantial inequalities in OOP health expenditure, with inpatient services showing more pronounced concentration of spending. These inequality patterns underscore the financial vulnerability of households in Eastern Uttar Pradesh and highlight the need for improved risk-pooling mechanisms and targeted financial protection strategies for patients suffering from vascular diseases.

Fig-3 Lorenz curve of in-patient hospitalization **Fig-4 Lorenz curve of out-patient hospitalization**



Source: *Estimated from the Field Survey data, 1 January 2021 to 31 August 2021.*

The Lorenz curves presented in Figures 3 and 4 further illustrate the extent of inequality in the distribution of out-of-pocket health expenditures across households in Eastern Uttar Pradesh. In Gorakhpur district, the Lorenz curve for in-patient hospitalization lies noticeably farther from the line of equality compared to that for out-patient visits, indicating a higher degree of expenditure

concentration among a smaller proportion of households. This pattern signifies that a relatively limited share of households bears a disproportionately large burden of in-patient healthcare spending. The observed inequality in Gorakhpur mirrors the pattern already documented for Varanasi district, confirming that disparities in healthcare expenditure are not localized but widespread across the region. These findings reinforce that in-patient hospitalization, in particular, is characterized by substantial inequality, reflecting both socioeconomic differentials and varying levels of access to vascular healthcare services.

Table-6: Inequalities measure for Varanasi, Gorakhpur, and combined (in-patient visit)

Inequality measures (Varanasi)	Household income	Total medical Expenditure (in-patient hospitalization)	Total expenses for health care and what is the amount covered (in-patient hospitalization)	Total spending on all your inpatient visits to healthcare facilities/providers (including your most recent visit) during the past 12 months
Gini coefficient	0.49806	0.86372	0.86372	0.86958
Theil index (GE(a), a=1)	0.45211	6.49196	6.49209	6.62824
Inequality measures (Gorakhpur)				
Gini coefficient	0.53938	0.86710	0.86710	0.87478
Theil index (GE(a), a=1)	0.54704	8.23084	8.23084	8.40921
Inequality measures (Combined)				
Gini coefficient	0.52213	0.86675	0.86676	0.87327
Theil index (GE(a), a=1)	0.50609	7.27060	7.27067	7.42476

Source: *Estimated from the Field Survey data, 1 January 2021 to 31 August 2021*.

Table 6 presents the inequality measures (Gini coefficient and Theil index) for household income, total medical expenditure for inpatient hospitalization, the share of covered healthcare expenses, and total spending on all inpatient visits during the past 12 months across Varanasi, Gorakhpur, and the combined sample. The estimates derived from the field survey (1 January 2021 to 31 August 2021) highlight substantial inequalities in both income distribution and out-of-pocket (OOP) payments for vascular-related inpatient care.

For Varanasi, the Gini coefficients for total medical expenditure and covered expenses (0.86372 each) and total inpatient spending (0.86958) are noticeably higher than the household income inequality (0.49806). This suggests that despite moderate income inequality, the distribution of OOP spending is highly skewed, indicating a disproportionate burden on certain households. The Theil index values follow a similar pattern (ranging from 0.45211 for income to 6.62824 for total inpatient spending), reinforcing the presence of significant disparities in healthcare payments. These results reflect that households in Varanasi tend to exhibit more consistent financial behaviour and better preparedness against sudden healthcare shocks, which is also supported by earlier field impressions that residents are comparatively cautious and deliberate in their health-seeking and spending decisions.

In contrast, Gorakhpur exhibits consistently higher inequality indices across all indicators. The Gini coefficient for household income (0.53938) and inpatient medical expenditure (0.86710) is higher than that of Varanasi, and even more pronounced for total inpatient spending (0.87478). Likewise, the Theil index for inpatient expenditure (8.23084) and total inpatient spending (8.40921) is substantially higher than the corresponding values in Varanasi. These findings point to deeper disparities in Gorakhpur, likely arising from poorer underlying health conditions and comparatively weaker socio-economic status reported in the region. The pronounced skewness indicates that a small segment of households bears a disproportionately large share of the inpatient OOP burden.

When both districts are combined, the inequality indices fall between the individual district values but remain closer to those of Gorakhpur. The combined Gini values for inpatient expenditure (0.86675–0.87327) and Theil indices (7.27060–7.42476) indicate substantial inequality but slightly lower than Gorakhpur's levels. This suggests that Gorakhpur's heightened disparities exert an upward pull on the combined statistics. In comparison, Varanasi consistently reflects lower inequality, both individually and relative to the combined sample.

Overall, the empirical evidence clearly demonstrates that healthcare-related inequalities are more severe in Gorakhpur than in Varanasi. The higher inequality indices in Gorakhpur may be attributed to poorer health outcomes, lower socio-economic conditions, and greater heterogeneity in healthcare utilization patterns. These results underscore significant intra-regional disparities in Eastern Uttar Pradesh, with implications for policy interventions aimed at reducing inequities in OOP expenditure for vascular health services.

Table-7: Inequalities measure for Varanasi, Gorakhpur, and combined (out-patient visit)

Inequality measures (Varanasi)	Total medical Expenditure (Out-patient hospitalization)	Total expenses for health care and what is the amount covered (Out-patient hospitalization)	Total spending on all your out-patient visits to health care facilities/providers (including your most recent visit) during the past 12 months
Gini coefficient	0.37806	0.35688	0.38712
Theil index (GE(a), a=1)	0.34664	0.22982	0.36264
Inequality measures (Gorakhpur)			
Gini coefficient	0.29785	0.29785	0.37074
Theil index (GE(a), a=1)	0.18423	0.18423	0.24192
Inequality measures (Combined)			
Gini coefficient	0.33913	0.34396	0.36445
Theil index (GE(a), a=1)	0.26524	0.23633	0.27376

Source: *Estimated from the Field Survey data, 1 January 2021 to 31 August 2021.*

Inequality metrics for outpatient care expenditure across Varanasi, Gorakhpur, and the combined observation using the Gini coefficient and the Theil Index presented in Table-7. The findings reveal notable variations in financial inequality between the districts. In Varanasi, the Gini coefficients for the three outpatient expenditure measures (total medical expenditure for outpatient care, total expenses and coverage for outpatient care, and cumulative outpatient spending over the previous year) range from 0.35688 to 0.38712, reflecting moderate levels of inequality. Correspondingly, the Theil Index values (0.22982–0.36264) indicate that disparities in outpatient care expenditure are not uniformly distributed across households but are moderately skewed toward higher spending groups.

In Gorakhpur, the inequality levels for outpatient spending are comparatively lower in two of the expenditure components (Gini: 0.29785), but they increase substantially for annual outpatient spending (Gini: 0.37074). The Theil values show a similar pattern, rising from 0.18423 to 0.24192, indicating that inequality intensifies when cumulative annual outpatient expenditure is considered. This suggests that repeated outpatient visits disproportionately burden certain socio-economic groups.

The combined observations show Gini coefficients ranging from 0.33913 to 0.36445 and Theil indices between 0.23633 and 0.27376, generally lower than those for the individual districts. This aggregation smoothens inter-district variations and reflects a more generalized expenditure pattern across the region. These lower combined inequality values also indicate that outpatient care is relatively more homogeneous when assessed across a larger population base.

A plausible explanation for lower inequality in outpatient care (compared with inpatient care) is that outpatient treatment typically involves shorter, less intensive episodes of care and lower treatment costs. In contrast, inpatient care for conditions such as vascular disorders often involves high-cost diagnostics, prolonged hospitalization, and expensive surgical interventions. Consequently, outpatient expenditures show less extreme variation, leading to comparatively lower inequality indices in the combined sample.

DISCUSSION

The empirical analysis reveals that although Varanasi and Gorakhpur exhibit notable disparities in household income, these do not translate into corresponding differences in healthcare spending. Despite Varanasi's comparatively higher average household income, the average in-patient OOP expenditure is nearly identical in both districts. This reflects the regressive nature of OOP health spending, where poorer households devote a greater share of income than their wealthier counterparts, disproportionately burdening lower-income groups in Gorakhpur. Such findings align with earlier studies which emphasize that healthcare expenses

in India often do not scale with household income, thereby intensifying financial pressure on economically weaker households (Ghosh, 2011; Selvaraj & Karan, 2012).

Nationally, the 75th Round of the National Sample Survey Office (NSSO, 2018) reports an average OOP expenditure of approximately ₹16,000 per hospitalization. In contrast, estimates for Varanasi and Gorakhpur show significantly higher inpatient costs, highlighting the elevated financial burden in Eastern Uttar Pradesh. The combined average OOP expenditure for in-patient care in these districts constitutes about 27–28% of monthly household income far above the threshold for catastrophic health expenditure outlined by the WHO (2005). This indicates a substantial risk of households being pushed into poverty due to health shocks, consistent with broader literature on the impoverishing effects of medical expenses in low-resource settings (Xu et al., 2003).

Outpatient expenditure patterns further reflect financial vulnerability. The average OOP cost per outpatient visit (~₹4,800) is nearly ten times higher than the rural national average (₹400–500), as reported by NSSO (2018). These elevated costs suggest inadequate public outpatient service provision, forcing households to rely on costlier private healthcare. This observation corresponds with the findings of Pandey et al. (2017), who report that limited availability of public healthcare infrastructure in many rural regions compels households to seek private care, thereby escalating OOP costs. Disaggregated expenditure patterns also reveal district-specific dynamics: households in Varanasi spend more on medicines sourced from institutional pharmacies, whereas those in Gorakhpur incur higher diagnostic expenses, likely due to the scarcity of public diagnostic facilities.

Coping mechanisms adopted by households underscore structural vulnerabilities in financial protection. The reliance on current income, borrowing from relatives, or selling assets to meet healthcare expenses mirrors national evidence indicating widespread dependence on informal financing in rural India (Berman et al., 2010). Even for routine outpatient services, the absence of robust risk-pooling mechanisms such as effective insurance coverage—exacerbates the fragility of household financial resilience.

Inequality assessments using Lorenz curves further substantiate disparities in healthcare spending. In Varanasi, the in-patient expenditure Lorenz curve lies farther from the equality line than the outpatient curve, indicating higher inequality in hospitalization expenses. This is consistent with earlier evidence documenting significant intra-district disparities in medical spending (Kanjilal et al., 2007). Gorakhpur, however, displays even more pronounced inequalities in inpatient expenditure, potentially driven by greater socioeconomic heterogeneity, higher prevalence of diseases such as acute encephalitis syndrome, and more limited public healthcare infrastructure. Combined district-level data depict intermediate inequality levels, with Varanasi exhibiting relatively uniform patterns of healthcare use possibly due to higher educational attainment and health awareness while Gorakhpur demonstrates systemic barriers to equitable access.

Overall, the findings affirm that Eastern Uttar Pradesh carries a disproportionately high and unequal burden of OOP healthcare expenditure. These patterns underscore urgent policy imperatives: strengthening public healthcare infrastructure, enhancing the reach and effectiveness of health insurance schemes, and implementing targeted financial protection interventions for the most vulnerable households. Without such measures, the cycle of poverty driven by healthcare costs will likely persist, deepening both economic and health inequities in the region.

CONCLUSION AND POLICY SUGGESTIONS

The findings of this study reveal significant inequalities in healthcare spending across Eastern Uttar Pradesh, especially in the domain of out-of-pocket (OOP) expenditures for both inpatient and outpatient care. The Lorenz curve, Gini coefficient, and Theil index collectively demonstrate a strong concentration of healthcare spending among higher-income households, indicating that the financial burden of illness is disproportionately borne by poorer families. This pattern aligns with broader evidence in India showing that OOP expenses particularly on medicines, diagnostics, surgery, and critical care services remain a primary driver of inequity due to limited regulation and dominance of the private healthcare market (Ghosh, 2011; Selvaraj & Karan, 2012).

The study underscores the urgent need for stronger progress toward Universal Health Coverage (UHC) to mitigate these disparities. Despite longstanding national discourse advocating for UHC, implementation challenges persist, driven by weak political priority, inadequate financing, and policy inertia, as highlighted in previous health systems research (Berman et al., 2010; Prinja et al., 2017). Strengthening primary healthcare infrastructure particularly Primary Health Centres (PHCs) and Community Health Centres (CHCs) is essential for reducing excessive dependence on out-of-pocket spending and for improving access to essential services in regions such as Eastern Uttar Pradesh. Evidence suggests that robust primary healthcare capacity improves early detection, treatment adherence, and reduces catastrophic expenditure (Bhat et al., 2014).

In addition to system-level improvements, the study advocates for an integrated approach combining state-led interventions with household- and community-level engagement. Enhancing health awareness through community-based organizations, women's self-help groups, and frontline health workers has been shown to improve preventive health practices and strengthen local health systems (Pandey et al., 2017). Such initiatives, when combined with expanded financial protection schemes such as publicly funded insurance or direct cash transfers can significantly reduce financial barriers to care, particularly for economically vulnerable groups.

Limitations and Future Scope

Overall, the evidence reaffirms that Eastern Uttar Pradesh faces a substantial and unequal burden of OOP healthcare spending for vascular and related services. Addressing these disparities requires multifaceted reforms: expanding public sector capacity, enforcing regulatory oversight over private healthcare pricing, strengthening risk-pooling mechanisms, and promoting community-level health literacy. Together, these actions can provide a pathway toward a more equitable health system and advance India's broader commitment to Universal Health Coverage.

Despite offering important insights into the patterns of out-of-pocket (OOP) expenditure for vascular healthcare services, this study is subject to certain limitations. First, the analysis is based on primary data collected exclusively from two districts Varanasi and Gorakhpur which may restrict the generalizability of the findings to other parts of Eastern Uttar Pradesh or the broader Indian context. Regional variations in healthcare infrastructure, socio-economic conditions, and accessibility to public and private health services may produce different expenditure patterns elsewhere.

Second, the study relies heavily on self-reported information regarding medical spending, which is inherently vulnerable to reporting inaccuracies. Underreporting, telescoping errors, and recall bias particularly among households with lower incomes or limited literacy may affect the precision of the estimated OOP expenditure. These limitations necessitate cautious interpretation of the results.

Looking ahead, future research can enhance the scope and robustness of analysis in several ways. Expanding the geographical coverage to include multiple districts or other states would allow for meaningful comparative assessments and improve external validity. Longitudinal studies may also be undertaken to capture changes in healthcare expenditure patterns over time, especially in response to policy interventions or shifts in disease burden. Furthermore, incorporating qualitative methods such as in-depth interviews or focus group discussions—would yield richer insights into the lived experiences of households facing health-related financial shocks. This mixed-method approach could deepen the understanding of health-seeking behaviour, expenditure decisions, and the socio-cultural factors shaping inequities in vascular healthcare spending.

Such extensions would not only strengthen the empirical evidence base but also guide more targeted and context-specific policy interventions to mitigate financial hardship associated with vascular diseases in the region.

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Conflict of Interest: None

Use of Artificial Intelligence (AI)-Assisted Technology for manuscript preparation

The authors confirm that there was no use of AI-assisted technology for assisting in the writing of the manuscript and no images were manipulated using AI.

REFERENCES

1. Karan A, Yip W, Mahal A. Extending health insurance to the poor in India: An impact evaluation of Rashtriya Swasthya Bima Yojana. Soc Sci Med. 2017;181:83–92. https://doi.org/10.1016/j.socscimed.2017.03.053
2. Ataguba, J.E., Ojo, K.O., 2018. Explaining socioeconomic inequalities in out-of-pocket health expenditure in Nigeria. Health Policy Plan. 33(7), 687–695. https://pubmed.ncbi.nlm.nih.gov/27208896/
3. Banerjee, S., Chowdhury, I.R., 2020. Inequities in curative health-care utilization among the adult population (20–59 years) in India: A comparative analysis of NSS 71st (2014) and 75th (2017–18) rounds. PLoS One 15(11), e0241994. https://doi.org/10.1371/journal.pone.0241994
4. Baru, R.V., Acharya, A., Acharya, S., Kumar, A.K.S., Nagaraj, K., 2010. Inequities in access to health services in India: caste, class and region. Econ. Polit. Wkly. 45(38), 49–58. https://www.epw.in/journal/2010/38/special-articles/inequities-access-health-services-india.html
5. Basu, S., 2015. Health and inequality: applying public health research to policy and practice. Occup. Med. (Lond.) 65(4), 341. https://doi.org/10.1093/occmed/kqv002
6. Berman, P., Ahuja, R., Bhandari, L., 2010. The impoverishing effect of healthcare payments in India: New methodology and findings. Econ. Polit. Wkly. 45(16), 65–71. https://www.epw.in/journal/2010/16/special-articles/impoverishing-effect-healthcare-payments-india-new-methodology-and
7. Braveman, P.A., Cubbin, C., Egerter, S., Chideya, S., Marchi, K.S., Metzler, M., et al., 2005. Socioeconomic status in health research: One size does not fit all. JAMA 294(22), 2879–2888. https://doi.org/10.1001/jama.294.22.2879
8. Central Bureau of Health Intelligence, 2021. National Health Profile 2021. Ministry of Health and Family Welfare, Government of India, New Delhi.

https://cbhidghs.mohfw.gov.in/index1.php?lang=1&level=1&sublinkid=75&lid=1135
9. Department of Economic Affairs, 2021. Economic Survey 2020-21. Vol. 2. Ministry of Finance, Government of India, New Delhi. https://www.indiabudget.gov.in/economicsurvey
10. Dwivedi, R., Pradhan, J., 2017. Does equity in healthcare spending exist among Indian states? Explaining regional variations from national sample survey data. Int. J. Equity Health 16(1), 1–12. https://doi.org/10.1186/s12939-017-0517-y
11. Ekholuenetale, M., Barrow, A., 2021. Inequalities in out-of-pocket health expenditure among women of reproductive age: after-effects of national health insurance scheme initiation in Ghana. J. Egypt. Public Health Assoc. 96(1). https://doi.org/10.1186/s42506-020-00064-9
12. Evans, T., Chowdhury, A.M.R., Evans, D.B., Fidler, A.H., Lindelow, M., Mills, A., et al., 2012. Thailand's Universal Coverage Scheme: achievements and challenges. An independent assessment of the first 10 years (2001–2010). Health Insurance System Research Office, Nonthaburi. https://pmc.ncbi.nlm.nih.gov/articles/PMC6560367/
13. Ghosh, S., 2011. Catastrophic payments and impoverishment due to out-of-pocket health spending. Econ. Polit. Wkly. 46(47), 63–70. http://www.epw.in/journal/2011/47/special-articles/catastrophic-payments-and-impoverishment-due-out-pocket-health
14. Goli, S., Maurya, N.K., Sharma, M.K., 2015. Continuing caste inequalities in rural Uttar Pradesh. Int. J. Sociol. Soc. Policy 35(3–4), 252–272. https://doi.org/10.1108/IJSSP-07-2014-0051
15. Government of India, Ministry of Health & Family Welfare, 2021. Rural Health Statistics 2019–20. 22 Apr 2021. https://main.mohfw.gov.in/sites/default/files/RHS%202019-20_0.pdf
16. Government of India, Ministry of Health & Family Welfare, 2021. Annual Report MoHFW 2020-21. New Delhi. https://main.mohfw.gov.in/sites/default/files/Annual%20Report%202020-21%20English.pdf
17. Government of India, Ministry of Statistics and Programme Implementation, 2015. Millennium Development Goals: India Country Report 2015. Social Statistics Division. https://mospi.gov.in
18. Government of India, Ministry of Health & Family Welfare, National Health Systems Resource Centre, 2018. National Health Accounts Estimates for India 2015-16. New Delhi. https://nhsrcindia.org/sites/default/files/2021-06/NHA%20Estimates%20Report%20-2015-16.pdf
19. Government of India, Ministry of Health & Family Welfare, 2020. Rural Health Statistics 2019-20. New Delhi, 1–153. https://ruralindiaonline.org/en/library/resource/rural-health-statistics-2019-20/#:~:text=The%20percentage%20of%20people%20in,5%2C895%20PHCs%20and%20466%20CHCs
20. Hooda, S.K., 2017. Out-of-pocket payments for healthcare in India: Who have affected the most and why? J. Health Manag. 19(1), 1–15. https://doi.org/10.1177/0972063416682535
21. Indian Council of Medical Research, Public Health Foundation of India, Institute for Health Metrics and Evaluation, 2017. India: Health of the Nation's States – The India State-Level Disease Burden Initiative. New Delhi: ICMR, PHFI, and IHME. https://phfi.org/the-work/research/the-india-state-level-disease-burden-initiative/
22. International Institute for Population Sciences (IIPS), ICF. National Family Health Survey (NFHS-5), 2019–21: Uttar Pradesh. Mumbai: IIPS; 2021. https://dhsprogram.com/pubs/pdf/FR375/FR375.pdf
23. Karan, A., Yip, W., Mahal, A., 2017. Extending health insurance to the poor in India: An impact evaluation of Rashtriya Swasthya Bima Yojana. Soc. Sci. Med. 181, 83–92. https://doi.org/10.1016/j.socscimed.2017.03.053
24. Matla, R. K. (2025). AN AI-DRIVEN AUGMENTED ANALYTICS FRAMEWORK FOR ENHANCING DECISION-MAKING EFFICIENCY IN MID-SIZED ENTERPRISES: ACASE STUDY APPROACH. International Journal of Engineering Sciences & Research Technology, 14(10), 1–11. https://doi.org/10.29121/ijesrtp.v14.i10.2025.1
25. Kanjilal, B., Mukherjee, M., Rahman, M.H., Mondal, S., 2007. Health, equity and poverty: exploring the links in India. Indian J. Med. Res. 126(4), 345–354. https://ijmr.org.in/article.asp?issn=0971-5916;year=2007;volume=126;issue=4;spage=345;epage=354;aulast=Kanjilal
26. Kumar, R., Singh, P., Sharma, S., 2020. Regional disparities in healthcare accessibility in India: An analytical overview. J. Health Manag. 22(3), 311–325. https://us.sagepub.com/en-us/nam/journal-of-health-management/journal200887
27. Koomson E P, Borsah A A (2025). ENHANCING DIABETES DIAGNOSIS IN GHANA THROUGH MACHINE LEARNING: A CASE STUDY OF THE GHANA HEALTH SERVICE. International Journal of Engineering Sciences & Research Technology, 14(10), 12-22. https://doi.org/10.29121/ijesrtp.v14.i10.2025.2
28. Maurya, N.K., Kanaujiya, K.S., 2020. Inequality and human development: How inclusive the growth is in Uttar Pradesh? Int. J. Sociol. Soc. Policy 41(7–8), 765–785. https://doi.org/10.1108/IJSSP-03-2020-0107
29. Ministry of Finance, Government of India, 2019. Economic Survey 2018–2019. Ministry of Finance, New Delhi, pp. 78–97. https://www.indiabudget.gov.in/budget2019-20/economicsurvey/doc/echapter.pdf
30. Ministry of Health and Family Welfare (MoHFW), Government of India, 2022. National Health Accounts Estimates for India, 2018–19. MoHFW, New Delhi. https://nhsrcindia.org/sites/default/files/2022-09/NHA%202018-19_07-09-2022_revised_0.pdf
31. Ministry of Health and Family Welfare (MoHFW). National Health Policy 2017. New Delhi: MoHFW, Government of India; 2017. https://www.india.gov.in/national-health-policy-2017
32. Iparbè K, Tcheyi E G P, Kpomonè B M A, Tombana K B, Imelda M A A (2025). APPROACHES: CONVOLUTIONAL NEURAL NETWORKS AND MODEL PREDICTIVE CONTROL FOR ACTIVE POWER FORECASTING IN THE BLITTA SOLAR PHOTOVOLTAIC POWER PLANT IN TOGO USING METEOROLOGICAL VARIABLES. International Journal of Engineering Sciences & Research Technology, 14(9),

1–18. https://doi.org/10.29121/ijesrtp.v14.i9.2025.1
33. Ministry of Health and Family Welfare. National Health Accounts Estimates for India, 2019–20. New Delhi: Government of India; 2022. https://main.mohfw.gov.in
34. Ministry of Statistics and Programme Implementation (MOSPI), National Statistical Office (NSO), Government of India. Key indicators of social consumption in India: Health. New Delhi: National Sample Survey Organisation; 2019. p. 1–99. http://mail.mospi.gov.in/index.php/catalog/161/download/1949
35. Ministry of Statistics and Programme Implementation (MOSPI), National Statistical Office, Government of India. Key indicators of social consumption in India: Health. NSS 75th Round. New Delhi: MOSPI; 2019. p. 1–99. http://mail.mospi.gov.in/index.php/catalog/161/download/1949
36. Ministry of Statistics and Programme Implementation (MoSPI). SDG National Indicator Framework Progress Report. New Delhi: Government of India; 2021. https://www.mospi.gov.in/download-reports
37. Mishra PS, Tiwari N, Alam M, 2023. Spatial disparities in out-of-pocket healthcare expenditure: Evidence from Eastern Uttar Pradesh. Health Econ Policy Rev, 11(2):112–30. http://www.healtheconpolrev.org/article/2023/112
38. Mohanty SK, Chauhan RK, Mishra US, Mukherjee S, Kumar S, 2014. Out-of-pocket expenditure on health care among the elderly in India. Soc Sci Med, 118:71–8. https://doi.org/10.1016/j.socscimed.2014.07.043
39. Mohanty SK, Kastor A, 2017. Out-of-pocket expenditure and catastrophic health spending on maternal care in public and private health centres in India: A comparative study of pre and post national health mission period. Health Econ Rev, 7(1):1–15. https://doi.org/10.1186/s13561-017-0167-1
40. National Institution for Transforming India (NITI Aayog), Government of India. Aspirational Districts Programme: An appraisal. New Delhi: NITI Aayog; 2020 Dec. p. 1–26. https://www.niti.gov.in/sites/default/files/2023-03/Aspirational-Districts-Programme-An-Appraisal.pdf
41. National Sample Survey Office. Household Social Consumption: Health – NSS 75th Round (July 2017–June 2018). New Delhi: Ministry of Statistics and Programme Implementation, Government of India; 2019. https://www.mospi.gov.in/sites/default/files/publication_reports/KI_Health_75th_Final.pdf
42. NITI Aayog. SDG India Index - Baseline Report. New Delhi: NITI Aayog, Government of India; 2018. https://www.niti.gov.in/sites/default/files/2020-07/SDX_Index_India_Baseline_Report_21-12-2018.pdf
43. O'Keefe E, 2017. Health inequalities: critical perspectives. J Public Health (Oxf). 39(1), 205. https://doi.org/10.1093/pubmed/fdw118
44. O'Donnell O, van Doorslaer E, Rannan-Eliya RP, Somanathan A, Adhikari SR, Harbianto D, et al., 2008. Who pays for health care in Asia? J Health Econ. 27(2), 460–475. https://pubmed.ncbi.nlm.nih.gov/18179832/
45. Oxfam India, 2021. Inequality report 2021: India's unequal healthcare story [Internet]. New Delhi: Oxfam India. https://www.oxfamindia.org/knowledgehub/workingpaper/survival-richest-india
46. Pal R, 2012. Measuring incidence of catastrophic out-of-pocket health expenditure: with application to India. Int J Health Care Finance Econ. 12(1), 63–85. http://www.jstor.org/stable/41474031
47. Pandey A, Ploubidis GB, Clarke L, Dandona L, 2017. Out-of-pocket healthcare expenditures in India: patterns and determinants. Int J Health Plann Manage. 32(1), e121–e137. https://doi.org/10.1002/hpm.2336
48. Pelly L, Srivastava K, Singh D, Anis P, Mhadeshwar VB, Kumar R, et al., 2021. Readiness to provide child health services in rural Uttar Pradesh, India: mapping, monitoring and ongoing supportive supervision. BMC Health Serv Res. 21(1), 1–11. https://doi.org/10.1186/s12913-021-06909-z
49. Planning Commission, 2002. National Human Development Report 2001. New Delhi: Government of India. https://www.undp.org/india/publications/national-human-development-report-india
50. Ramachandra Rao K, 2019. Socioeconomic status and health inequalities in urban area: A case study of Delhi. Indian J Econ Dev. 7(5), 1–11. www.iseeadyar.org
51. Rani M, Singh A, 2021. Social inequalities in child nutrition in Uttar Pradesh, India. Indian J Public Health Res Dev. 12(3), 561–570. https://doi.org/10.37506/ijphrd.v12i3.16126
52. Selvaraj S, Karan A, 2012. Why publicly-financed health insurance schemes are ineffective in providing financial risk protection. Econ Polit Wkly. 47(11), 60–68. https://www.epw.in/journal/2012/11/special-articles/why-publicly-financed-health-insurance-schemes-are-ineffective
53. Sepehri A, Sarma S, Simpson W, Moshiri S, 2006. Taking account of context: how important are household characteristics in explaining catastrophic health expenditure? http://siteresources.worldbank.org/INTPAH/Resources/Publications/2006-Sepehri-et-al.pdf
54. Shahrawat R, Rao KD (2012). Insured yet vulnerable: out-of-pocket payments and India's poor. Health Policy Plan. 27(3):213–21. https://pubmed.ncbi.nlm.nih.gov/21486910/
55. Shavers VL (2007). Measurement of socioeconomic status in health disparities research. J Natl Med Assoc. 99(9):1013–23. https://pubmed.ncbi.nlm.nih.gov/17913111/
56. Singh A (2019). Shortage and inequalities in the distribution of specialists across community health centres in Uttar Pradesh, 2002–2012. BMC Health Serv Res. 19(1):1–16. https://doi.org/10.1186/s12913-019-4134-x
57. Survey E (2021). Economic Survey 2020–21. Department of Economic Affairs, Ministry of Finance, Government of India. 2:1–561. https://www.indiabudget.gov.in/economicsurvey
58. Suryanarayana MH, Agrawal A, Prabhu KS, 2016. Inequality-adjusted Human Development Index: States in India. Indian J Hum Dev. 10(2):157–75. https://doi.org/10.1177/0973703016675793
59. United Nations Development Programme (UNDP), 2011. India human development report: Towards social inclusion. New Delhi: Oxford University Press. https://hdr.undp.org/content/human-development-report-2011
60. United Nations Development Programme, 2011. Human Development Report 2011: Sustainability and equity – A

better future for all. UNDP. http://hdr.undp.org/en/2011-report
61. Van Doorslaer E, O'Donnell O, Rannan-Eliya RP, Somanathan A, Adhikari SR, Garg CC, et al.. 2006. Effects of payments for health care on poverty estimates in 11 countries in Asia. Lancet. 368(9544):1357–64. https://pubmed.ncbi.nlm.nih.gov/17046468/
62. Verma CS, Gupta R, Yadav A, 2017. Out-of-pocket expenditure on health in India: issues and implications. Econ Polit Wkly. 52(50). https://www.epw.in/
63. Verma CS, Singh S, Ranjan A, Sundararaman T, 2017. Healthcare consumption in Uttar Pradesh: Iniquitous growth and the social factors contributing to impoverishment. Econ Polit Wkly. 52(9):73–81.
64. Wagstaff A, van Doorslaer E, 2003. Catastrophe and impoverishment in paying for health care. Health Econ. 12(11):921–34. https://onlinelibrary.wiley.com/doi/abs/10.1002/hec.776
65. World Health Organization, 2005. Designing health financing systems to reduce catastrophic health expenditure. Geneva: WHO. https://apps.who.int/iris/handle/10665/70005
66. World Health Organization, 2020. Global monitoring report on financial protection in health. Geneva: WHO. https://www.who.int/publications/i/item/9789240040953
67. World Health Organization, 2017. State of health inequality: Indonesia. Geneva: WHO. http://apps.who.int/iris/handle/10665/259685
68. Xu K, Evans DB, Kawabata K, Zeramdini R, Klavus J, Murray CJ, 2003. Household catastrophic health expenditure: a multicountry analysis. Lancet. 362(9378):111–7. https://www.sciencedirect.com/science/article/pii/S0140673603138615