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Assessing the financial burden of multimorbidity among patients aged 30 and above in India

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Abstract

Background Multimorbidity is associated with significant out-of-pocket expenditures (OOPE) and catastrophic health expenditure (CHE), especially in low- and middle-income countries like India. Despite this, there is limited research on the financial burden of multimorbidity in outpatient and inpatient care, and cross-state comparisons of CHE are underexplored.

Methods We conducted a cross-sectional analysis using nationally representative data from the National Sample Survey 75th Round 'Social Consumption in India: Health (2017–18)', focusing on patients aged 30 and above in outpatient and inpatient care in India. We assessed multimorbidity prevalence, OOPE, CHE incidence, and CHE intensity. Statistical models, including linear, log-linear, and logistic regressions, were used to examine the financial risk, with a focus on non-communicable diseases (NCDs), healthcare facility choice, and socioeconomic status and Epidemiological Transition Levels (ETLs).

Results Multimorbidity prevalence in outpatient care (6.1%) was six times higher than in inpatient care (1.1%). It was most prevalent among older adults, higher MPCE quintiles, urban patients, and those with NCDs. Multimorbidity was associated with higher OOPE, particularly in the rich quintile, patients seeking care from private providers, low ETL states, and rural areas. CHE incidence was highest in low ETL states, private healthcare users, poorest quintile, males, and patients aged 70 + years. CHE intensity, measured by mean positive overshoot, was greatest among the poorest quintile, low ETL states, rural, and male patients. Log-linear and logistic regressions indicated that multimorbidity patients with NCDs, those seeking private care, and those in low ETL states had higher OOPE and CHE risk. The poorest rural multimorbidity patients had the greatest likelihood of experiencing CHE. Furthermore, CHE intensity was significantly elevated among multimorbidity patients with NCDs (95% CI: 19.29–45.79), patients seeking care in private, poorest, and from low ETL states (95% CI: 7.36–35.79).

Conclusions The high financial burden of OOPE and CHE among multimorbidity patients, particularly those with NCDs, highlight the urgent need for comprehensive health policies that address financial risk at the primary care level. To alleviate the financial burden among multimorbidity patients, especially in low-resource settings, it is crucial to expand public healthcare coverage, incorporate outpatient care into financial protection schemes, advocate for integrated care models and preventive strategies, establish standardized treatment protocols for reducing unnecessary medications linked to polypharmacy, and leverage the support of digital health technologies.

Keywords Multimorbidity, NCDs, Chronic, OOPE, Catastrophic health expenditure, India

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Introduction

The global increase in the prevalence of chronic diseases, compounded by multimorbidity, the coexistence of two or more chronic conditions in the same individual, poses significant management challenges for health systems worldwide, contributing to increased healthcare expenditures and reduced health outcomes for individuals [1–3]. Multimorbidity poses unique challenges compared to comorbidity, where secondary ailments accompany a primary condition. In multimorbidity, each condition holds equal importance and exerts a significant and distinct impact on an individual's overall health status, contributing to the complexity of their management. Conversely, in comorbidity, the primary condition takes precedence, and the other conditions are typically managed with that central focus in mind [4, 5]. Approximately 37.2% of the global population experiences multimorbidity, with its implications varying widely across regions and socioeconomic groups [6, 7]. The coexistence of multiple conditions escalates healthcare costs, particularly for the uninsured [8, 9].

In India, where total health expenditure accounts for 3.83% of the gross domestic product (GDP) and the level of out-of-pocket expenditure (OOPE) is 39.4% of total health expenditures [10]. The financial burden on individuals managing multiple chronic diseases is immense. The rising prevalence of non-communicable diseases (NCDs) has compounded this issue, contributing significantly to OOPE and catastrophic health expenditure (CHE). Studies highlight that multimorbidity can intensify OOPE, ranging between five to ten times higher than the costs associated with treating singular conditions, thus accentuating equity concerns, particularly for lower socioeconomic groups [11]. This disparity burdens individuals with increased hospital admissions, premature deaths, and fragmented care, impinging on their quality of life [2, 3]. The COVID-19 pandemic has further exposed vulnerabilities such as increased risk of severe illness, disruptions in routine care, and heightened mental health challenges among individuals with multimorbidity, emphasizing the importance of comprehensive primary care in reducing hospital admissions [12]. From a public health perspective, the growing prevalence of multimorbidity, combined with increased susceptibility to infectious diseases, reiterates the critical need to strengthen basic healthcare services to reduce the adverse impact of future epidemics and pandemics [13].

In India, the complexities of multimorbidity are exacerbated by disparities in healthcare access and financial inequalities, affecting various demographic segments, including the elderly, urban population, affluent, and those residing in low-income regions [14–16]. Over time, the age differences in multimorbidity prevalence have narrowed largely due to its increase among younger adults over 30 years of age who are significant contributors to the workforce and household income thereby, necessitating targeted interventions due to its economic implications [17].

Despite the extensive literature on single chronic diseases, research examining multimorbidity's distinct financial impact across outpatient and inpatient care is limited. Moreover, there is a notable gap in cross-state comparisons of CHE burden in India, particularly across states with differing Epidemiological Transition Levels (ETLs). While studies have examined the costs associated with multimorbidity, most focus on health system costs rather than individual expenditure burden [11]. Existing studies in India have often restricted the definition of multimorbidity to the coexistence of NCDs, overlooking chronic communicable and infectious diseases [18]. Further, the healthcare landscape in India, comprising both public and private sectors, poses varied financial implications. The public healthcare system, challenged with limited budgets, inadequate infrastructure, insufficient human resources, and shortages of crucial medical supplies and equipment, struggles to cater to rural and marginalized populations. As a result, individuals seek care at private facilities that operate largely without regulation, imposing significant financial burdens on individuals and families, particularly for patients with multiple chronic conditions, more so for people from weaker economic backgrounds [15].

This study seeks to address these gaps by leveraging nationally representative data from the National Sample Survey (2017–2018), providing a comprehensive analysis of the financial implications of managing multimorbidity in India. We selected individuals aged 30 years and above for this study because this age group marks the onset of a higher prevalence of non-communicable diseases (NCDs) and chronic conditions, which are primary contributors to multimorbidity [2, 19, 20]. The risk of developing chronic illnesses such as hypertension and diabetes increases significantly after this age, making it a critical threshold for studying multimorbidity patterns and healthcare utilization. Additionally, this focus aligns with public health priorities, such as India's National Programme for Prevention and Control of Non-Communicable Diseases (NP-NCD), which targets screening and management of NCDs starting at this age [21]. This approach also allows comparability with existing literature, where similar thresholds are commonly used to assess multimorbidity's financial burden and healthcare challenges [16, 18].

This study adopts a broader definition of multimorbidity endorsed by the World Health Organization (WHO), aiming to provide a comprehensive national-level analysis

encompassing all eligible populations at risk of multimorbidity. We address critical gaps observed in previous studies that are confined to specific states, diseases, and older populations [1–4, 15, 22–26]. Our research seeks to assess multimorbidity prevalence, healthcare utilization, and the predictors of out-of-pocket and catastrophic health expenditures for multimorbidity.

The research also investigates both inpatient and outpatient care domains, tackling age-specific healthcare challenges and integrating variables such as socioeconomic status, and epidemiological transition level (ETL) state groups to provide a holistic understanding of multimorbidity in India. We hypothesize that patients with multimorbidity experience significantly higher OOPE and CHE compared to those with single chronic conditions or acute illnesses and that economic disparities and ETL state classifications influence these financial outcomes. By adopting a comprehensive approach, this research endeavours to generate evidence-based insights and recommendations aimed at alleviating the financial strain on multimorbidity patients. These insights hold the potential to inform national health programs like the Ayushman Bharat in India, contributing towards the enhancement of healthcare delivery and financial protection for individuals coping with multimorbidity.

Methodology

Data

This study utilizes unit-level data sourced from the 75th round of the 'Social Consumption in India: Health' survey conducted by the National Sample Survey Office (NSSO), Government of India, spanning from July 2017 to June 2018. The dataset captures information from 113,823 households, representing a total of 555,352 individuals, inclusive of 2,537 deceased members. Employing stratified random sampling techniques, the survey documented 43,240 instances of illness, encompassing 42,107 outpatient cases and 93,925 inpatient cases within the preceding 365 days. A wide array of data was collected spanning demographics, morbidity, mortality, hospitalizations, health insurance coverage, OOPE and healthcare utilization patterns [27].

However, our study narrows its focus to explore the prevalence of multimorbidity and the associated expenditures incurred for outpatient care (within the last 15 days) and inpatient care (within the last 365 days), with an emphasis on discerning disparities between single chronic conditions and acute illnesses vis-à-vis multimorbidity conditions. Notably, the NSS data is available for inpatient or outpatient visits and is not aggregated at the individual level. In our analysis, we aggregate case-level data to individual levels thereby, individuals serving as the primary unit for estimating the outcome variables. All data analyses have been conducted utilizing STATA 16 software. Sampling weights are applied to ensure the representativeness of the sample, whereas the samples provided in the survey remain unweighted. The composition of the sample included in the study is presented in Fig. 1.

Defining multimorbidity

The primary focus of this paper revolves around multimorbidity, which denotes the simultaneous presence of two or more chronic health conditions in an individual. Chronic health conditions, as outlined by the WHO, include cardiovascular diseases, cancer, chronic respiratory conditions, and diabetes [28]. These conditions are characterized by their persistent and long-lasting nature, significantly impeding physical, mental, and social well-being, often resulting in prolonged functional limitations. Given their complex nature, chronic health conditions necessitate continuous medical attention and management of symptoms and complications.

The definition of chronic health conditions may vary across studies and healthcare settings. For instance, Pless and Douglas (1971) defined chronic health conditions as ailments lasting longer than three months or requiring continuous hospitalization for over a month [29]. Centers for Disease Control and Prevention (CDC) broadly defines chronic diseases as conditions lasting more than a year, requiring ongoing medical attention, or limiting daily activities, or both [30]. The National Sample Survey Office (NSSO) in India identifies an ailment as chronic if symptoms persist for more than a month or if treatment continues for a month or more on the date of the survey [27].

For this research, the NSS data was utilized, and the following criteria were used to identify patients with chronic ailments:

1. For outpatient care, patients experiencing symptoms persisting for more than one month at the time of the survey, while for inpatient care, patients taking a course of treatment on medical advice for one month or more and continuing on the date of the survey were considered. Cases of acute illnesses like fevers, malaria, diarrhoea, and worm infections were excluded.
2. Patients with definite diagnosis of diseases such as Tuberculosis, Cancers, Bleeding Disorders, Diabetes, Stroke, Hypertension, Heart Disease, Bronchial Asthma etc. irrespective of the duration of illness, if the ailment persists.

Criteria for chronic ailments were tested and validated by the definition provided in NSS report [27]. Subsequently, the data of patients with chronic ailments

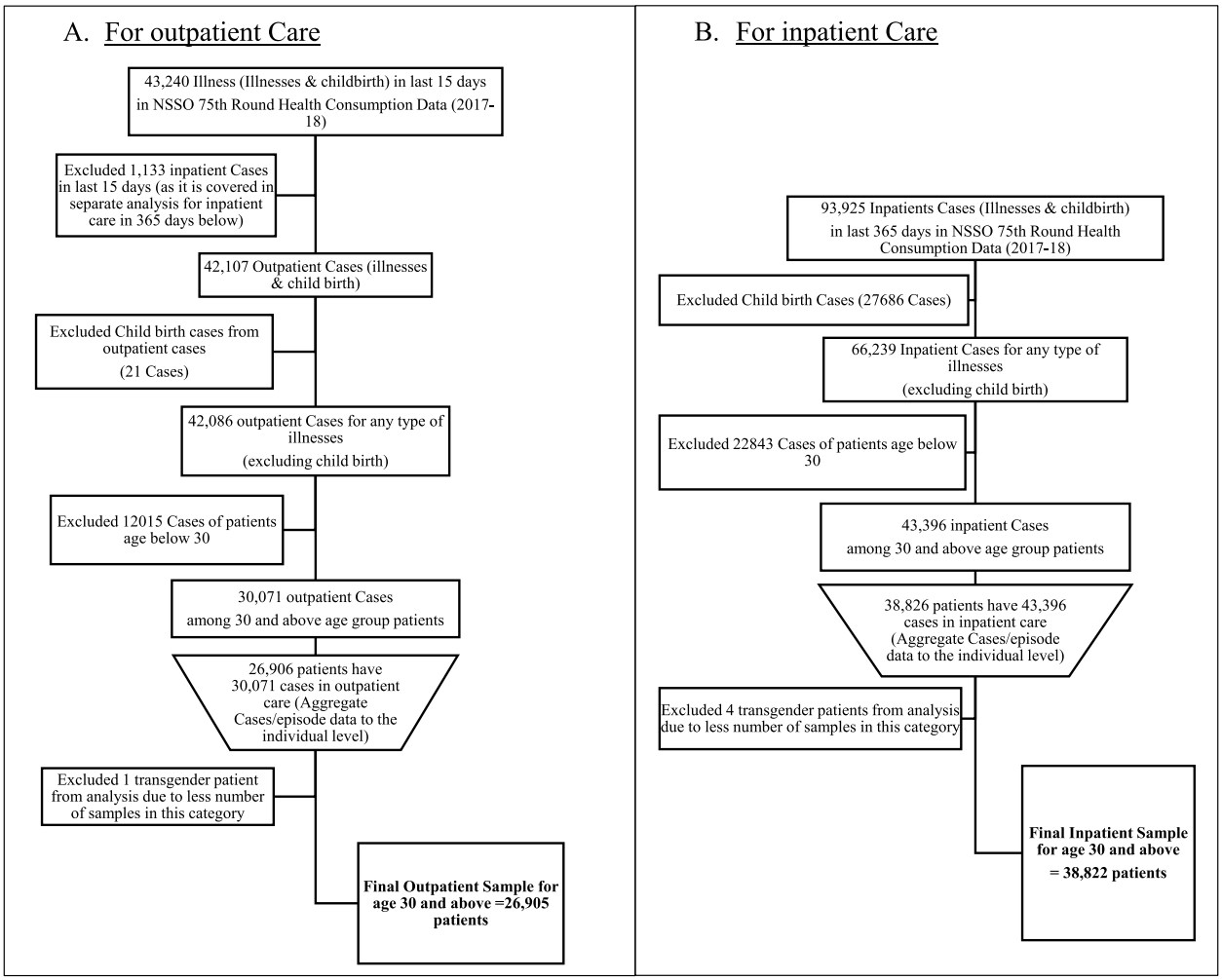

Fig. 1 Flow chart of sample size for outpatient and inpatient care setting, NSS 75th Round Household Social Consumption in India: Health Survey Data, 2017–2018

was further screened to identify patients actively seeking treatment for two or more different chronic conditions in the Outpatient and Inpatient departments. The patients identified after the 2nd level screening of data were identified to be suffering from multimorbidity and were included within the scope of the study.

This nuanced approach adopted in the research may facilitate a comprehensive understanding of multimorbidity, along with a deeper understanding of healthcare utilization patterns as well as health expenditures among patients with multimorbidity.

Explanatory variables

The independent variables include the type of health care provider (public/private), NCD status, age, gender, monthly per capita consumption expenditure (MPCE), place of residence (rural/urban) and ETL States [31]. MPCE was obtained by dividing monthly usual consumption expenditure of a household by the size of the household [27]. ETL is described based on the ratio of disability-adjusted life years (DALYs) attributed to communicable diseases and against DALYs from NCDs and injuries combined. A low ratio signifies high ETL and vice versa [31, 32]. The interaction between 'illness type' and 'NCD occurrence' was incorporated into the model to explore how the presence of NCDs influences OOPE (and CHE in subsequent regression analysis) across different illness types (acute, single chronic, and multimorbidity). Similarly, the interaction between 'place of residence' and 'MPCE quintile' was examined to determine how the urban or rural status of the residence affects OOPE (and CHE) across various MPCE quintiles.

Outcome variables

The analysis in this research focuses on several crucial outcome variables that are pivotal to assessing the implications of multimorbidity. These include the prevalence of multimorbidity, the associated OOPE, the incidence of CHE, and the intensity of CHE attributed to multimorbidity for both inpatient and outpatient care. These metrics are integral to comprehending the financial impact and burden posed by multimorbidity patients within the healthcare system.

Out-of-pocket expenditure (OOPE) and OOPE share

Total OOPE includes all direct expenses incurred by an individual, both as an inpatient and outpatient, for medical care and transportation (non-medical) costs associated with accessing healthcare services. OOPE is calculated as:

$$\text{OOPE} = \sum_{i=1}^{N} THE_i - R_i \tag{1}$$

where THE_i represents total health expenditure (medical + non-medical) for i^{th} individual and R_i is total amount reimbursed by the medical insurance company or employer for i^{th} individual. i is an index denoting the individual, ranging from 1 to N, the sample size.

The OOPE share signifies the proportion of an individual's out-of-pocket health expenditure over 30 days relative to their total monthly household consumption expenditure. It serves as a metric to gauge the financial strain of healthcare expenses on an individual's overall monthly budget. The formula for calculating the OOPE share [33] is as follows:

$$\text{OOPE share} = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{OOPE_{(30days)i}}{MHE_i} * 100\right)_i \tag{2}$$

where N represents the sample size, $OOPE_i$ is Out-of-pocket health expenditure for i^{th} individual over 30 days period and MHE_i is the monthly household consumption expenditure for the i^{th} individual and i is an index denoting the individual, ranging from 1 to N.

Catastrophic health expenditure (CHE)

The incidence of CHE is measured using the headcount method, which calculates the proportion of individuals within the sample whose OOPE surpasses a predefined threshold. Although the literature does not establish a universally agreed-upon threshold for CHE, it typically ranges between 5 and 40% of household expenditure. The most commonly used thresholds are 10% of total household expenditure and 40% of non-subsistence expenditure [33, 34]. In our study, we adopted the 10% threshold, using total household consumption expenditure as the denominator, to ensure consistency and comparability with existing studies [35–37].

The headcount formula is expressed as:

$$\text{Headcount} = \frac{1}{N}\sum_{i=1}^{N} CHE_i \tag{3}$$

[38] where N represents the sample size, CHE_i is 1 when the i^{th} individual incurred CHE, and 0 otherwise.

CHE intensity

Measuring the incidence of CHE in silos does not reveal the depth or severity of these costs, specifically how much individual OOPE surpasses the catastrophic threshold typically set at 10%. To understand this phenomenon, the study measures CHE intensity, by employing two indicators: catastrophic overshoot and mean positive overshoot (MPO), i.e. the share of additional payments above 10% of the total household consumption, averaged by the number of households with catastrophic expenditure [39]. Catastrophic overshoot denotes the average extent by which individual OOPE on illness, as a percentage of total individual expenditure, exceeds the set threshold (z) [35]. Conversely, the MPO captures the intensity of CHE through the average excess of OOPE on illness beyond the threshold among individuals who reported CHE incidence [38].

The catastrophic overshoot is mathematically represented as follows:

$$\text{Overshoot} = \frac{1}{N}\sum_{i=1}^{N} CHE_i\left(\frac{OOPE_i}{MHE_i} - z\right) \tag{4}$$

Here N represents the total sample size of individuals receiving outpatient or inpatient care, $OOPE_i$ signifies an individual's out-of-pocket health expenditure, MHE_i is the Monthly Household Consumption Expenditure of the i^{th} individual, and z signifies the 10% threshold for CHE. This threshold indicates that households allocating more than 10% of their monthly household consumption expenditure to healthcare expenses face a significant financial burden.

Unlike the overshoot that uses all the households as denominator, the Mean Positive Overshoot (MPO) uses only those households that have actually experienced CHE as the denominator. Hence MPO measures the degree by which the average OOP expenditure by households that have experienced catastrophe has exceeded the given catastrophic threshold. We measured the MPO by using the following formula,

$$\text{Mean Positive Overshoot (MPO)} = \frac{Overshoot}{Headcount} \quad (5)$$

Hence if household i experienced the CHE, it would have spent ($MPO_i + z$) percentage of the monthly household consumption expenditure on healthcare [38, 40].

Statistical Models

The analytical methods employed in this study include log-linear, logistic, linear regression models, aimed at comprehensively examining the influence of independent factors on OOPE, CHE and CHE intensity.

Log-linear Regression for OOPE

In previous studies, logarithmic or other transformations are frequently employed in statistical analyses to address skewness and approximate a normal distribution, enabling the effective use of linear regression models. In this study, we applied a log-linear model to financial data, such as out of pocket health expenditures, to reduce skewness, stabilize variance, and ensure the assumptions of ordinary least squares (OLS) regression are met [41–43]. The log-linear regression model is used to analyze the impact of various explanatory variables on the logarithmic transformation of OOPE for each patient (i) in the study. The model is defined as:

$$\begin{aligned}\log(\text{OOPE}_i) = \; & \alpha + \beta_1 * \text{interaction\_IllnessType\_NCD\_Occurance}_i \\ & + \beta_2 * \text{LevelOfCare}_i + \beta_3 * \text{ETL\_State}_i \\ & + \beta_4 * \text{interaction\_PlaceOfResidence\_MPCE Quintile}_i \\ & + \beta_5 * \text{Sex}_i + \beta_6 * \text{Age\_Group}_i + \varepsilon_i\end{aligned} \quad (6)$$

where α is the intercept, β1 to β6 are coefficients for the respective predictors, and ϵ_i is the error term. *Interaction_IllnessType_NCD_Occurrence* represents the combined effect of illness type (Acute, Single Chronic, Multimorbidity) and NCD occurrence. *LevelOfCare* distinguishes between public and private healthcare facilities. *ETL_States* refers to Epidemiological Transition Level State Groups. *Interaction_PlaceOfResidence_MPCE_Quintile* combines residence (rural/urban) and economic status (MPCE Quintile). *Sex* and *Age_Group* denote the patient's gender and age group, respectively. The subscript 'i' is used for i^{th} patient.

Logistic Regression for CHE

Logistic regression was employed to analyze CHE, which is a binary variable ('0' for no CHE and '1' for experienced CHE). This method is well-suited for understanding the incidence of CHE and evaluating how different explanatory variables influence the likelihood of its occurrence. The regression model for CHE is articulated as:

$$\begin{aligned}\text{Logit}(\text{CHE}_i) = \; & \alpha + \beta_1 * \text{interaction\_IllnessType\_NCD\_Occurance}_i \\ & + \beta_2 * \text{LevelOfCare}_i + \beta_3 * \text{ETL\_State}_i \\ & + \beta_4 * \text{interaction\_PlaceOfResidence\_MPCE Quintile}_i \\ & + \beta_5 * \text{Sex}_i + \beta_6 * \text{Age\_Group}_i + \varepsilon_i\end{aligned} \quad (7)$$

where CHE_i is the probability of patients incurring catastrophic health expenditure for outpatient and inpatient care. The model estimates the log odds of incurring CHE adjusted for a set of explanatory variables. All explanatory variables remain consistent with those of the log-linear regression equation.

Linear regression for CHE intensity

The linear regression model employed to analyze Mean Positive Overshoot (MPO), which indicates the intensity of CHE aims to evaluate the impact of various explanatory variables. This model plays a crucial role in quantifying the extent of financial burden experienced by patients due to CHE, based on a range of explanatory factors. The linear regression model for MPO is defined as follows:

$$\begin{aligned}MPO_i = \; & \alpha + \beta_1 * \text{interaction\_IllnessType\_NCD\_Occurance}_i \\ & + \beta_2 * \text{LevelOfCare}_i + \beta_3 * \text{ETL\_State}_i \\ & + \beta_4 * \text{interaction\_PlaceOfResidence\_MPCE Quintile}_i \\ & + \beta_5 * \text{Sex}_i + \beta_6 * \text{Age\_Group}_i + \varepsilon_i\end{aligned} \quad (8)$$

where MPO_i is the Mean Positive Overshoot for the i^{th} patient, which serves as an indicator of the intensity of CHE experienced. All explanatory variables remain consistent with those utilized in the log-linear regression equation.

Results

Prevalence of multimorbidity

One in 17 patients in outpatient care have multimorbidity, with a prevalence of 6.1% (95% CI: 5.5–6.7). In comparison, prevalence of single chronic conditions is observed in 63.3% of patients (95% CI: 61.9–64.7), while acute illnesses account for 30.6% (95% CI: 29.3–32.0). In the inpatient setting, the prevalence of multimorbidity is lower at 1.1% (95% CI: 0.9–1.3), with single chronic conditions and acute illnesses reported at 58.0% (95% CI: 56.8–59.1) and 41.0% (95% CI: 39.8–42.1), respectively (Summary Table 1).

Patients with NCDs exhibit higher prevalence of multimorbidity, with 9.4% (95% CI: 8.5–10.3) in outpatient care and 2.5% (95% CI: 2.0–3.1) in inpatient care, compared to those without NCDs (Table 2). Multimorbidity is more prevalent in high ETL states, where the rates reach 12.2% (95% CI: 10.9–13.6) in outpatient care and 2.1% (95% CI: 1.6–2.7) in inpatient care, while low ETL states show the lowest prevalence. Urban areas report higher

Table 1 Overview of comprehensive health indicators for outpatient and inpatient care among patients aged 30 and above in India

Type of Care	Indicators	Acute Illness		Single-Chronic		Multimorbidity	
		Value	95% CI	Value	95% CI	Value	95% CI
For Outpatient Care (last 15 days reference period)	Prevalence %	30.6	29.3–32.0	63.3	61.9–64.7	6.1	5.5–6.7
	Public Health Care Utilization %	23.9	21.7–26.2	29.9	28.4–31.4	30.0	25.6–34.8
	Private Health Care Utilization %	52.8	50.2–55.5	60.5	58.8–62.1	60.8	55.9–65.5
	Medicine Out of Pocket Expenditure (Rs.)	405	381–429	503	489–517	682	643–721
	Diagnostic Out of Pocket Expenditure (Rs.)	82	75–89	83	74–93	70	54–85
	Medical Out of Pocket Expenditure (Rs.)	611	577–644	673	651–694	872	813–931
	Non-Medical/Transportation Out of Pocket Expenditure (Rs.)	99	94–104	85	81–90	78	68–87
	Total Out of Pocket Health Expenditure (Rs.)	709	673–745	758	734–782	950	887–1014
	Incidence of Catastrophic Health Expenditure (at 10% threshold) %	43.0	42.0–45.0	40.0	39.0–41.0	51.0	49.0–53.0
	Mean Intensity of Catastrophic Health Expenditure (%)	29.0	27.0–31.0	30.0	29.0–32.0	27.0	24.0–30.0
For Inpatient Care (last 365 days reference period)	Prevalence %	41.0	39.8–42.1	58.0	56.8–59.1	1.1	0.9–1.3
	Public Health Care Utilization %	42.0	40.1–44.0	39.2	37.9–40.6	26.7	20.3–34.2
	Private Health Care Utilization %	53.9	51.9–55.9	55.2	53.9–56.5	51.7	43.0–60.4
	Medicine Out of Pocket Expenditure (Rs.)	5408	5165–5651	11,154	10,756–11552	21,106	17,447–24,765
	Diagnostic Out of Pocket Expenditure (Rs.)	2182	2087–2276	4364	4210–4517	10,807	8994–12,620
	Medical Out of Pocket Expenditure (Rs.)	15,020	14,389–15,650	29,468	28,567–30,370	62,899	53,820–71978
	Non-Medical/Transportation Out of Pocket Expenditure (Rs.)	2064	1991–2137	3074	3002–3145	6539	5726–7352
	Total Out of Pocket Health Expenditure (Rs.)	17,084	16,415–17,753	32,542	31,604–33480	69,438	59,913–78,963
	Incidence of Catastrophic Health Expenditure (at 10% threshold) %	34.0	33.0–35.0	50.0	50.0–51.0	70.0	65.0–74.0
	Mean Intensity of Catastrophic Health Expenditure (%)	32.0	30.0–34.0	42.0	41.0–44.0	66.0	55.0–77.0

Source: Computed from unit-level NSSO 75th round Household Social Consumption in India: Health Survey Data, 2017–2018

multimorbidity prevalence than rural areas in both outpatient and inpatient settings. Across MPCE quintiles, the richest quintile experiences the highest prevalence, whereas the poorest quintile shows the lowest for both care types. Gender differences are also observed: in outpatient care, males have a slightly lower multimorbidity prevalence (5.9%; 95% CI: 5.1–6.8) compared to females (6.2%; 95% CI: 5.4–7.1), while in inpatient care, males exhibit a higher prevalence (1.2%; 95% CI: 0.9–1.5) compared to females (1.0%; 95% CI: 0.8–1.2).

Age was found to be a crucial factor, with multimorbidity prevalence increasing as patients get older. The lowest prevalence in outpatient care is observed in the 30–44 age group (1.2%; 95% CI: 0.8–1.8), while the highest is among those aged 70 and above (10.9%; 95% CI: 9.1–13.0). Inpatient care follows a similar trend, highlighting the growing healthcare needs and hospitalization risks faced by older adults with multimorbidity (Table 2).

Across ETL regions, a high variation between states can be seen for multimorbidity prevalence for both outpatient and inpatient care. In outpatient care, Assam reports the highest multimorbidity prevalence at 2.0% (95% CI: 0.5–7.3) among low ETL states, followed by Madhya Pradesh at 1.6% (95% CI: 0.4–6.3). Among lower-middle ETL states, Gujarat exhibits the highest prevalence at 3.5% (95% CI: 1.8–6.9). In higher-middle ETL states, Lakshadweep stands out with a prevalence of 18.7% (95% CI: 9.6–33.2), followed closely by Andhra Pradesh at 14.2% (95% CI: 11.3–17.8). In high ETL states, Kerala has the highest prevalence of multimorbidity at 20.3% (95% CI: 18.2–22.6), with Tamil Nadu following at 5.6% (95% CI: 3.6–8.5). For inpatient care, in low ETL states, Rajasthan has the highest multimorbidity prevalence at 1.3% (95% CI: 0.6–2.6), followed by Odisha at 1.1% (95% CI: 0.6–2.0). Among lower-middle ETL states, Gujarat reports the highest prevalence at 1.3% (95% CI: 0.6–2.7), followed by Mizoram at 0.5% (95% CI: 0.1–2.1). In higher-middle ETL states, Lakshadweep leads with a prevalence of 2.3% (95% CI: 0.5–9.6), followed by West Bengal at 1.9% (95% CI: 1–3.4). In high ETL states, Kerala again shows the highest prevalence at 3.3% (95% CI: 2.4–4.6), followed by Goa at 1.1% (95% CI: 0.2–5.3) (Fig. 2).

Table 2 Prevalence of acute, single chronic and multimorbidity illnesses in outpatient and inpatient care among patients aged 30 and above by background characteristics in India

Background Characteristics	For Outpatient Care (last 15 days reference period)							For Inpatient Care (last 365 days reference period)						
	Acute Illness		Single-Chronic		Multimorbidity		*Outpatient Sample (n)*	Acute Illness		Single-Chronic		Multimorbidity		*Inpatient Sample (n)*
	%	95% CI	%	95% CI	%	95% CI		%	95% CI	%	95% CI	%	95% CI	
Type of Illness														
Non-NCD	64.3	61.9–66.5	35.4	33.1–37.8	0.3	0.2–0.6	*8272*	54.9	53.6–56.2	44.6	43.3–46.0	0.5	0.4–0.6	*26,392*
Have NCD	11.2	10.2–12.4	79.4	78.0–80.7	9.4	8.5–10.3	*18,633*	10.4	9.0–12.0	87.1	85.5–88.6	2.5	2.0–3.1	*12,430*
ETL State Group														
Low ETL State	47.5	44.7–50.3	51.8	49.0–54.6	0.7	0.4–1.2	*6419*	39.8	37.7–41.9	59.6	57.5–61.7	0.6	0.4–0.8	*12,768*
Lower-middle ETL State	33.3	27.9–39.2	63.6	57.6–69.2	3.1	1.6–6.2	*1655*	45.7	42.4–49.0	53.3	50.0–56.6	1.0	0.5–2.0	*4907*
Higher-middle ETL State	24.9	23.0–26.9	68.3	66.2–70.3	6.9	5.9–8.0	*11,497*	42.5	40.6–44.5	56.5	54.6–58.4	1.0	0.7–1.4	*14,004*
High ETL State	20.1	18.1–22.3	67.7	65.4–70.0	12.2	10.9–13.6	*7334*	38.4	36.4–40.5	59.5	57.4–61.6	2.1	1.6–2.7	*7143*
Sector														
Rural	0.0	33.1–36.7	60.1	58.2–61.9	5.0	4.3–5.8	*13,402*	42.1	40.6–43.6	57.0	55.5–58.5	0.9	0.7–1.2	*21,258*
Urban	23.8	22.0–25.7	68.5	66.6–70.4	7.7	6.8–8.7	*13,503*	38.9	37.3–40.6	59.7	58.0–61.3	1.4	1.2–1.7	*17,564*
MPCE Quintile														
Poorest	41.8	38.3–45.3	55.9	52.4–59.3	2.3	1.6–3.4	*4167*	41.6	38.8–44.5	57.6	54.8–60.4	0.8	0.5–1.2	*6900*
Poor	37.8	34.4–41.3	57.2	53.7–60.7	5.0	3.7–6.7	*4348*	41.2	38.0–44.4	58.0	54.8–61.1	0.9	0.6–1.2	*6538*
Middle	31.3	28.4–34.3	64.5	61.5–67.5	4.2	3.3–5.3	*5355*	42.1	39.5–44.6	57.0	54.5–59.5	0.9	0.7–1.3	*7864*
Rich	27.4	24.7–30.3	66.3	63.3–69.2	6.3	5.1–7.7	*5474*	41.5	38.9–44.1	57.4	54.8–60.0	1.1	0.6–1.8	*7979*
Richest	21.5	19.3–23.8	68.3	65.8–70.7	10.3	8.9–11.8	*7561*	38.9	37.0–40.8	59.5	57.6–61.4	1.6	1.2–2.2	*9541*
Sex														
Male	28.7	26.8–30.7	65.5	63.4–67.4	5.9	5.1–6.8	*12,367*	36.6	35.0–38.2	62.3	60.6–63.9	1.2	0.9–1.5	*19,464*
Female	32.1	30.4–34.0	61.7	59.8–63.5	6.2	5.4–7.1	*14,538*	45.2	43.6–46.9	53.7	52.1–55.4	1.0	0.8–1.2	*19,358*
Age Group														
30–44	52.5	49.5–55.4	46.3	43.4–49.3	1.2	0.8–1.8	*5187*	47.4	45.2–49.6	51.7	49.5–53.9	0.9	0.7–1.1	*11,799*
45–59	30.0	27.9–32.1	64.1	61.9–66.3	5.9	5.0–7.0	*10,151*	42.4	40.6–44.2	57.0	55.2–58.7	0.7	0.5–0.9	*15,028*
60–69	18.2	16.0–20.6	73.8	71.2–76.2	8.0	6.8–9.5	*6897*	34.3	31.8–36.8	64.4	61.9–66.8	1.3	1.0–1.8	*6929*
70+	17.4	14.8–20.5	71.7	68.4–74.7	10.9	9.1–13	*4670*	30.5	27.6–33.5	67.1	64.0–70.0	2.5	1.6–3.8	*5066*
Total	30.6	29.3–32.0	63.3	61.9–64.7	6.1	5.5–6.7	*26,905*	41.0	39.8–42.1	58.0	56.8–59.1	1.1	0.9–1.3	*38,822*

Source: Computed from unit-level NSSO 75th round Household Social Consumption in India: Health Survey Data, 2017–2018

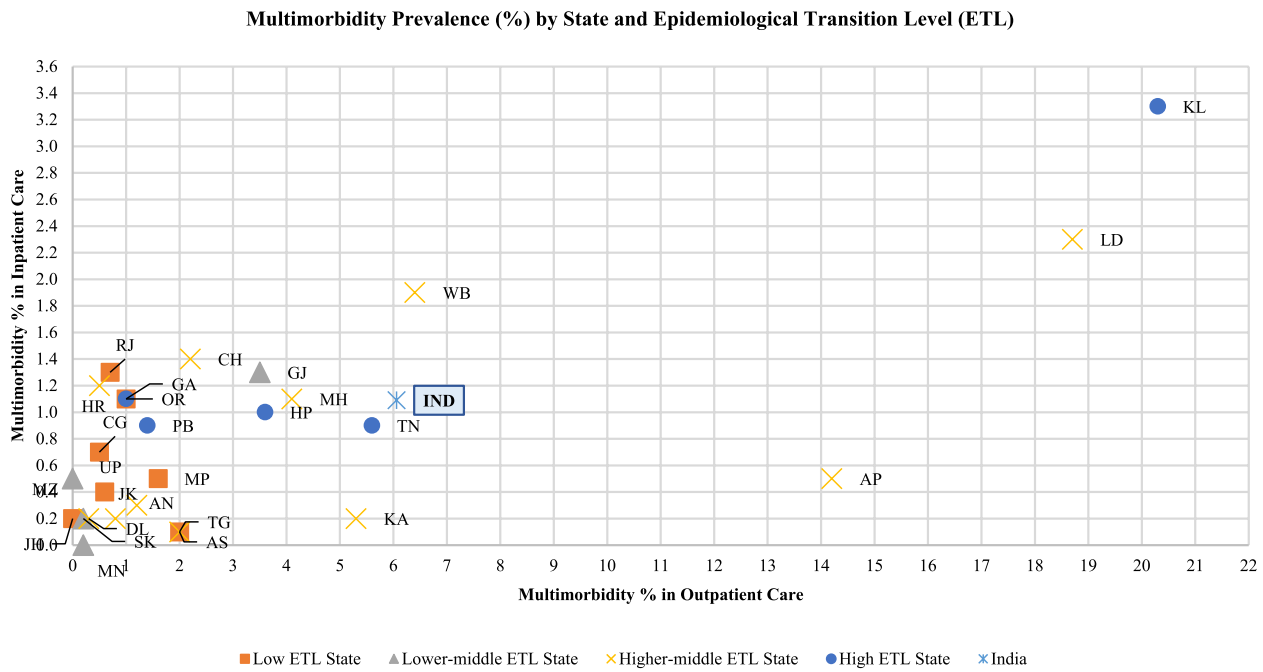

Fig. 2 Multimorbidity prevalence in outpatient and inpatient care among patients aged 30 and above across Indian states, stratified by epidemiological transition level (ETL) regions. Source: Computed from unit-level NSSO 75th round Household Social Consumption in India: Health Survey Data, 2017–2018

Health seeking behavior

Healthcare utilization patterns among multimorbidity patients aged 30 and above highlight disparities in the preference for private as opposed to public healthcare facilities. In outpatient care, most patients with multimorbidity opt for private healthcare services, with 60.8% (95% CI: 55.9–65.5) using private providers, compared to 30.0% (95% CI: 25.6–34.8) who access public healthcare. A similar trend is observed in inpatient care, where 51.7% (95% CI: 43.0–60.4) of multimorbidity patients choose private facilities, while only 26.7% (95% CI: 20.3–34.2) utilize public hospitals (Summary Table 1). Among MPCE quintiles, there is a significant disparity in the utilization of public and private healthcare services. In outpatient care, most patients from the richest quintile use private health care facilities (65%) compared poorest quintiles (41%). This disparity is even more pronounced in inpatient care, where 64% of the richest patients utilize private facilities, compared to 38% of the poorest patients (Fig. 3).

Out-of-pocket-expenditures

Out-of-pocket expenditures (OOPE) are higher for patients with multimorbidity in both outpatient and inpatient care. In outpatient care, multimorbidity patients incur the highest OOPE, averaging Rs. 950 (95% CI: 887–1014), compared to Rs. 758 (95% CI: 734–782) for single chronic conditions and Rs. 709 (95% CI: 673–745) for acute illnesses. Similarly, in inpatient care, the OOPE for multimorbidity is considerably higher at Rs. 69,438 (95% CI: 59,913–78,963) compared to Rs. 32,542 (95% CI: 31,604–33,480) for single chronic conditions and Rs. 17,084 (95% CI: 16,415–17,753) for acute illnesses. The higher costs of medicines and diagnostics play a crucial role in the high OOPE for multimorbidity patients. In outpatient care, the OOPE for medicines is Rs. 682 (95% CI: 643–721) for multimorbidity patients, compared to Rs. 503 (95% CI: 489–517) for single chronic conditions and Rs. 405 (95% CI: 381–429) for acute illnesses. For inpatient care, medicine costs are similarly burdensome, with multimorbidity patients spending Rs. 21,106 (95% CI: 17,447–24,765), much higher than the Rs. 11,154 (95% CI: 10,756–11,552) spent by patients with single chronic conditions and Rs. 5,408 (95% CI: 5,165–5,651) spent by those with acute illnesses. Diagnostic expenses were also higher with multimorbidity patients in inpatient care incurring Rs. 10,807 (95% CI: 8,994–12,620), compared to Rs. 4,364 (95% CI: 4,210–4,517) for single chronic conditions and Rs. 2,182 (95% CI: 2,087–2,276) for acute illnesses (Summary Table 1).

Patients with NCDs incur higher OOPE for both outpatient and inpatient care across all illness categories. For multimorbidity in inpatient care, the OOPE for those with NCDs is Rs. 75,882, compared to Rs. 53,196

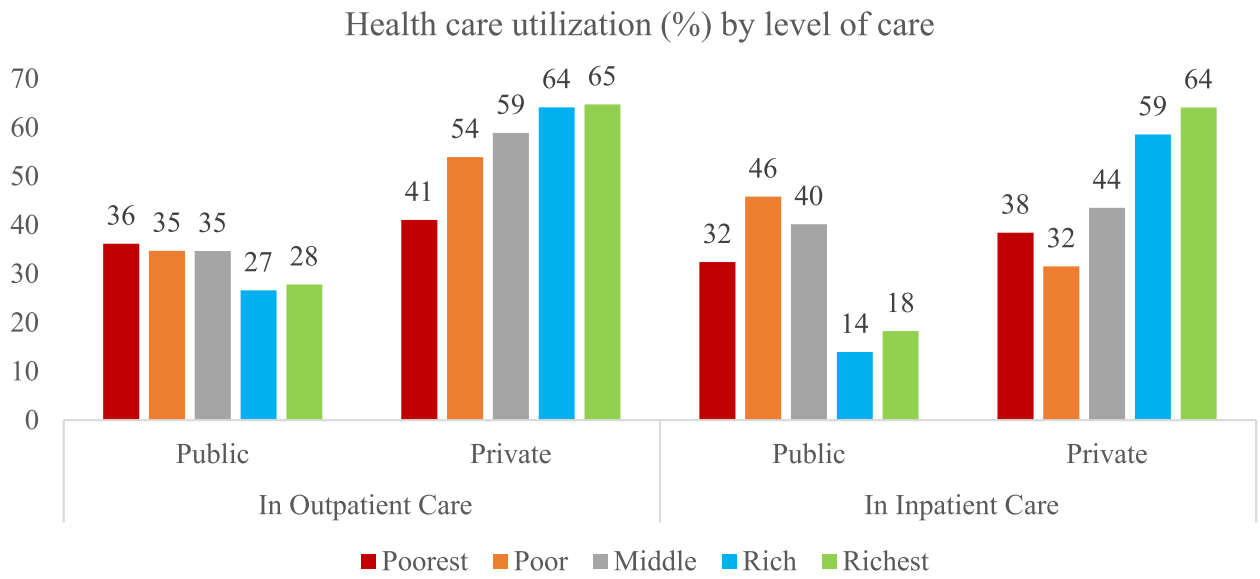

Fig. 3 Health care utilization by level of care among multimorbidity patients aged 30 and above in India. Source: Computed from unit-level NSSO 75th round Household Social Consumption in India: Health Survey Data, 2017–2018

for patients without NCDs. There is a considerable disparity between the OOPE in private and public healthcare facilities. In outpatient care, multimorbidity patients using private healthcare services face an OOPE of Rs. 1,159 compared to just Rs. 485 in public facilities. In inpatient care, the difference is even more striking, with private healthcare costing Rs. 97,211, while public care amounts to Rs. 13,876. Rural–urban disparities in OOPE are evident, with urban residents facing higher expenses in outpatient care across all illness categories. For multimorbidity, urban patients incur Rs. 1,181 compared to Rs. 731 for their rural counterparts. However, in inpatient care, rural patients with multimorbidity bear a heavier burden, with OOPE reaching Rs. 80,822, compared to Rs. 56,171 for urban patients. Socioeconomic disparities are also pronounced, with patients from the richest MPCE quintile incurring significantly higher OOPE for multimorbidity compared to the poorest quintile. Moreover, male patients and those in the older age group (70 + years) report higher OOPE for multimorbidity, reflecting their increased healthcare needs and associated financial burden (Table 3).

OOPE for multimorbidity varies significantly across states with differing ETL and places of residence, revealing disparities in healthcare costs and accessibility. Patients in lower ETL states face higher financial burdens for outpatient care, with an average OOPE of Rs. 1,627, compared to Rs. 935 in higher ETL states. In inpatient care, the trend continues, with patients in lower ETL states incurring higher OOPE (Rs. 75,370) compared to those in higher ETL states (Rs. 60,372). Among low ETL states, Uttar Pradesh reports the highest OOPE for outpatient care at Rs. 2,392, followed by Assam at Rs. 996. For inpatient care, Assam stands out with an exceptionally high OOPE of Rs. 148,545, while Uttar Pradesh follows with Rs. 100,693. In lower-middle ETL states, Sikkim has the highest outpatient OOPE (Rs. 3,533), while Tripura shows the most substantial inpatient care burden (Rs. 2,52,668). Higher-middle ETL states report higher costs, with Delhi leading in outpatient OOPE (Rs. 2,349) and the Andaman & Nicobar Islands showing the highest inpatient OOPE (Rs. 3,07,008). In contrast, high ETL states demonstrate relatively lower variability in OOPE. Goa has the highest OOPE at Rs. 1,252 in outpatient while Punjab leads in inpatient care with an average OOPE of Rs. 1,14,233. These findings highlight the significant regional differences in healthcare costs for patients with multimorbidity, particularly between lower and higher ETL states (Fig. 4).

Determinants of out-of-pocket expenditure

The log-linear regression analysis for overall outpatient care (26,905 patients) revealed significant increases in healthcare spending among multimorbidity patients. Multimorbidity patients with NCDs faced a 42% (exp(0.35)−1) higher likelihood of increased expenditure. Private healthcare utilization was a key driver of higher OOPE. Patients residing in low (Coeff: 0.41, 95% CI: 0.37, 0.46) and lower-middle ETL (Coeff: 0.38, 95% CI: 0.31, 0.44) states also experienced a greater financial burden than those in high ETL states. Among multimorbidity patients in outpatient care (2,055 observations),

Table 3 Average out of pocket expenditure for outpatient and inpatient care among patients aged 30 and above by type of illnesses and by background characteristics in India

Background Characteristics	OOPE for Outpatient Care (Rs.) (last 15 days reference period)				OOPE for Inpatient Care (Rs.) (last 365 days reference period)			
	Acute Illness	Single Chronic	Multimorbidity	Overall Outpatient Care	Acute Illness	Single Chronic	Multimorbidity	Overall Inpatient Care
Type of Illness								
Non-NCD	694	1007	1180	807	15,461	26,683	53,196	20,641
Have NCD	758	694	946	725	35,864	39,117	75,882	39,694
Level of Care								
Public	484	493	485	490	4054	8837	13,876	6828
Private	929	950	1159	957	27,032	46,890	97,211	39,382
ETL State Group								
Low ETL State	719	1042	1627	893	17,520	33,420	75,370	27,350
Lower-middle ETL State	577	607	901	607	12,842	26,853	43,823	20,618
Higher-middle ETL State	671	686	923	698	17,654	31,804	79,835	26,256
High ETL State	835	660	935	729	16,496	33,896	60,372	27,761
Sector								
Rural	650	733	731	704	15,110	28,609	80,822	23,406
Urban	851	794	1181	837	20,857	39,191	56,171	32,287
MPCE Quintile								
Poorest	572	720	918	663	13,440	23,927	52,306	19,783
Poor	636	909	798	801	17,784	28,278	41,240	24,070
Middle	782	660	909	708	17,251	29,493	46,371	24,498
Rich	707	647	1169	696	14,878	31,645	116,459	25,611
Richest	870	852	909	862	21,226	44,728	69,057	35,986
Sex								
Male	766	783	962	789	18,911	37,211	85,212	31,071
Female	671	737	942	729	15,635	27,243	51,968	22,245
Age Group								
30–44	656	883	1085	766	14,995	27,886	45,850	21,928
45–59	782	685	812	721	17,429	31,108	74,280	25,604
60–69	607	759	1036	753	21,070	36,253	64,009	31,427
70+	812	793	1017	821	17,552	39,816	89,130	34,251
India-Total	709	758	950	755	17,084	32,542	69,438	26,613

Source: Computed from unit-level NSSO 75th round Household Social Consumption in India: Health Survey Data, 2017–2018

patients who use private healthcare facilities incur 146% (exp(0.90)−1) significantly higher OOPE compared to those using public healthcare. Multimorbidity patients in low ETL states experience 97% (exp(0.68)−1) higher OOPE for outpatient care compared to multimorbidity patients in high ETL states and the result is statistically significant ($p < 0.001$, 95% CI: 0.43, 0.93). The poorest rural multimorbidity patients incur 60% (exp(−0.93)—1) lower OOPE compared to the richest urban patients. Female multimorbidity patients experience 15% (exp(−0.16)−1) lower OOPE compared to male multimorbidity patients. For inpatient care (38,822 patients), multimorbidity patients with NCDs are 2.3 times (exp (1.2)−1) more likely to bear higher healthcare costs compared to those without NCDs. Further regression among multimorbidity patients (363 observations) shows that patients who sought inpatient care in private institutions experienced 4.87 times (exp(1.77)−1) higher OOPE compared to those who utilized public healthcare facilities (95% CI: 1.44, 2.10) and result is highly statistically significant, indicating the substantial financial burden of private care. Multimorbidity patients from low ETL states have 51% (exp(0.41)−1) higher OOPE among inpatient care compared to those in high ETL

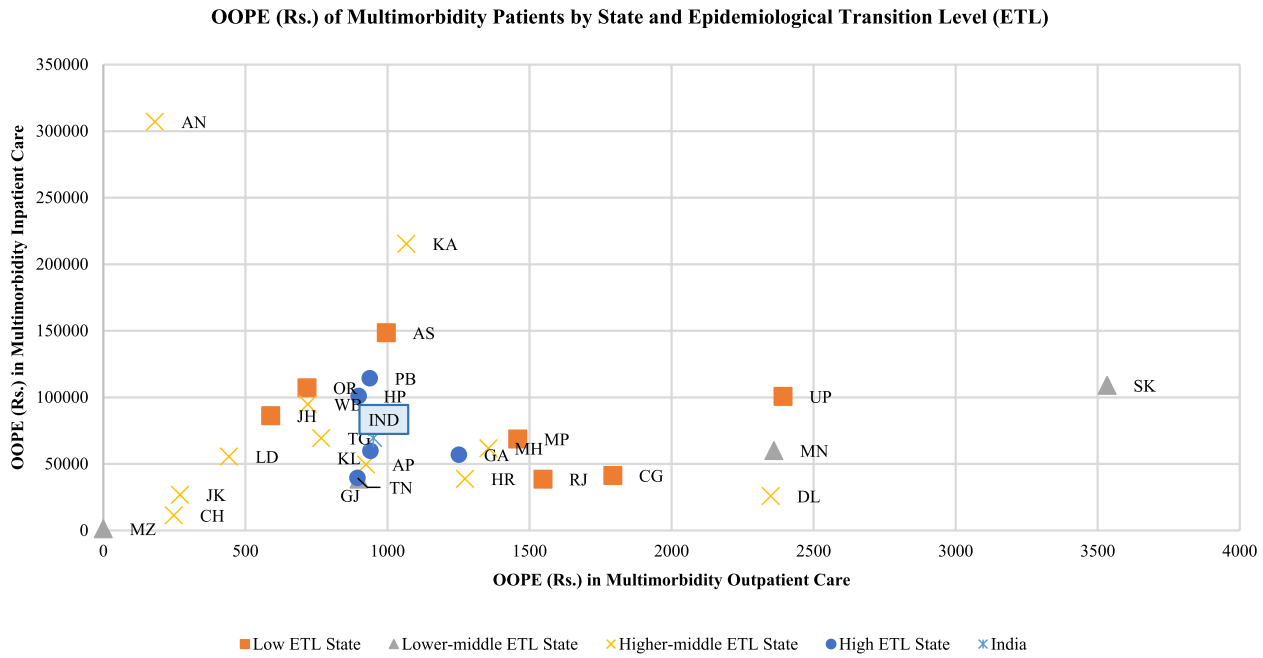

Fig. 4 OOPE (Rs.) for multimorbidity patients in outpatient and inpatient care among patients aged 30 and above across Indian states, stratified by their epidemiological transition level (ETL) regions. Source: Computed from unit-level NSSO 75th round Household Social Consumption in India: Health Survey Data, 2017–2018

states. The urban poor multimorbidity patients experience 53% (exp(−0.77)−1) lower OOPE compared to the richest urban residents. Female multimorbidity patients in inpatient care incur 35% (exp(−0.43)−1) lower OOPE compared to male patients. Multimorbidity patients aged 70 and above face 68% (exp(0.52)−1) higher OOPE compared to those aged 30–44 (Table 4).

Incidence and intensity of CHE

The incidence of CHE is highest among multimorbidity patients, particularly in outpatient care, where 51.3% of these patients experience CHE compared to those with acute or single chronic conditions. In inpatient care, the burden is even more significant, with 69.6% of multimorbidity patients facing CHE, and the mean positive overshoot (MPO) reaching 66.0%. For multimorbidity patients with NCDs, the incidence rises to 75%, with an intensity of 66% MPO in inpatient care. Geographic and socioeconomic disparities further intensify the incidence of CHE. Multimorbidity patients in rural areas face higher CHE in inpatient care (79.9%) compared to their urban counterparts (58%). Elderly individuals experience the highest CHE incidence in inpatient care (80%), while those in the lowest economic quintiles report the highest CHE rates in both outpatient (75%) and inpatient care (71%). For the poorest quintile, the MPO is for inpatient care. Across all ETL state groups, multimorbidity patients consistently experience the highest CHE incidence compared to those with acute and single chronic conditions. In low ETL states, outpatient CHE for multimorbidity patients is the most severe, with incidences reaching 89% and an MPO of 25% (Table 5).

In states like Assam and Odisha, multimorbidity patients face a staggering 100% CHE incidence in both outpatient and inpatient care. Similarly, in Bihar, 100% of patients encounter CHE in inpatient settings. Lower-middle ETL states, including Sikkim and Manipur, also report a 100% CHE incidence across both care types. In higher-middle ETL states, Telangana and Karnataka show alarming inpatient CHE incidences of 100% and 92%, respectively. While high ETL states such as Punjab and Himachal Pradesh report lower outpatient CHE incidences (13% and 26%), they still exhibit high inpatient CHE rates, with 94% and 84% of multimorbidity patients facing CHE (Fig. 5).

Determinants of CHE

The logistic regression analysis revealed key predictors of catastrophic health expenditure (CHE) among patients in outpatient care and inpatient care in India (Table 6). Among outpatient cases (26,905 patients), multimorbidity patients with NCDs had a 33% higher likelihood of incurring CHE (OR: 1.33, 95% CI: 1.18–1.50) than those with acute conditions. For inpatient care (38,822 patients), the financial burden was even more

Table 4 Log-linear regression for out of pocket health expenditure for outpatient and inpatient Care among patients aged 30 and above in India

Explanatory Variables	For Outpatient Care (last 15 days reference period)						For Inpatient Care (last 365 days reference period)					
	Only for Multimorbidity Patients			For Overall Illnesses			Only for Multimorbidity Patient			For Overall Illnesses		
	Coef.	*p*-value	95% CI	Coef.	*p*-value	95% CI	Coef.	*p*-value	95% CI	Coef.	*p*-value	95% CI
Interaction of Illnesses Type and NCDs Occurrence												
Acute#Non-NCDs®												
Acute#NCDs				−0.13	0.001	−0.20,−0.06				0.35	0.000	0.28,0.43
Single-Chronic#Non-NCDs				0.09	0.002	0.03,0.14				0.45	0.000	0.42,0.48
Single-Chronic#NCDs				−0.09	0.000	−0.14,−0.05				0.67	0.000	0.64,0.71
Multimorbidity# Non-NCDs				0.51	0.007	0.14,0.88				0.88	0.000	0.65,1.11
Multimorbidity# NCDs				0.35	0.000	0.28,0.42				1.20	0.000	1.04,1.36
Type of Illness												
Non-NCD®												
Have NCD	−0.13	0.460	−0.47,0.21				0.16	0.298	−0.14,0.46			
Level of Care												
Public®												
Private	0.90	0.000	0.79,1.02	0.82	0.000	0.78,0.85	1.77	0.000	1.44,2.10	1.84	0.000	1.82,1.87
ETL State Group												
Low ETL State	0.68	0.000	0.43,0.93	0.41	0.000	0.37,0.46	0.41	0.038	0.02,0.81	0.07	0.001	0.03,0.10
Lower-middle ETL State	0.17	0.315	−0.16,0.51	0.38	0.000	0.31,0.44	−0.12	0.709	−0.73,0.50	0.16	0.000	0.12,0.21
Higher-middle ETL State	−0.01	0.856	−0.12,0.10	0.02	0.288	−0.02,0.06	−0.03	0.873	−0.35,0.30	−0.06	0.002	−0.09,−0.02
High ETL State®												
Interaction of Place of Residence and MPCE Quintile												
Rural # Poorest	−0.93	0.000	−1.40,−0.45	−0.36	0.000	−0.44,−0.28	−0.19	0.663	−1.07,0.68	−0.21	0.000	−0.27,−0.14
Rural # Poor	−0.51	0.003	−0.84,−0.18	−0.34	0.000	−0.42,−0.26	−0.14	0.714	−0.88,0.60	−0.12	0.000	−0.18,−0.05
Rural # Middle	−0.40	0.002	−0.66,−0.15	−0.28	0.000	−0.34,−0.21	−0.53	0.103	−1.18,0.11	−0.14	0.000	−0.20,−0.08
Rural # Rich	−0.30	0.005	−0.51,−0.09	−0.21	0.000	−0.28,−0.15	0.00	0.994	−0.60,0.60	−0.13	0.000	−0.19,−0.08
Rural # Richest	−0.21	0.013	−0.37,−0.04	−0.11	0.000	−0.17,−0.05	−0.25	0.286	−0.72,0.21	0.00	0.899	−0.06,0.05
Urban # Poorest	−0.25	0.037	−0.49,−0.02	−0.33	0.000	−0.39,−0.26	−0.31	0.299	−0.90,0.28	−0.20	0.000	−0.26,−0.14
Urban # Poor	−0.31	0.002	−0.51,−0.11	−0.26	0.000	−0.33,−0.19	−0.77	0.007	−1.34,−0.21	−0.15	0.000	−0.21,−0.09
Urban # Middle	−0.29	0.002	−0.47,−0.11	−0.24	0.000	−0.30,−0.17	−0.30	0.301	−0.86,0.27	−0.06	0.043	−0.12,−0.00
Urban # Rich	−0.23	0.012	−0.41,−0.05	−0.14	0.000	−0.20,−0.07	−0.15	0.590	−0.68,0.39	−0.02	0.504	−0.08,0.04
Urban # Richest®												
Sex												
Male®												
Female	−0.16	0.001	−0.26,−0.07	−0.10	0.000	−0.13,−0.07	−0.43	0.002	−0.71,−0.15	−0.14	0.000	−0.16,−0.11

Table 4 (continued)

Explanatory Variables	For Outpatient Care (last 15 days reference period)						For Inpatient Care (last 365 days reference period)					
	Only for Multimorbidity Patients			For Overall Illnesses			Only for Multimorbidity Patient			For Overall Illnesses		
	Coef.	*p*-value	95% CI	Coef.	*p*-value	95% CI	Coef.	*p*-value	95% CI	Coef.	*p*-value	95% CI
Age Group												
30–44®												
45–59	−0.07	0.547	−0.30,0.16	0.00	0.823	−0.05,0.04	0.57	0.006	0.16,0.97	0.00	0.855	−0.03,0.03
60–69	0.00	0.988	−0.23,0.23	0.02	0.440	−0.03,0.07	0.39	0.061	−0.02,0.79	0.09	0.000	0.05,0.13
70+	0.09	0.468	−0.15,0.32	0.09	0.000	0.04,0.15	0.52	0.010	0.12,0.92	0.17	0.000	0.12,0.21
Number of observations	1,923			25,180			361			38,644		
F (22, 1900)	18.13			179.39			9.81			1014.37		
Prob > F	0.000			0.000			0.000			0.000		
R-squared	0.1735			0.1564			0.3659			0.3866		
Adjusted R-squared	0.1639			0.1556			0.3287			0.3863		
Root MSE	1.0713			1.2045			1.2649			1.2497		

Source: Computed from unit-level NSSO 75th round Household Social Consumption in India: Health Survey Data, 2017–2018; Note: ® is reference category

Table 5 Incidence (at 10% threshold) and intensity (mean positive overshoot) of catastrophic health expenditure for outpatient and inpatient care among patients aged 30 and above by type of illnesses and by background characteristics in India

Background Characteristics	Outpatient Care (last 15 days reference period)								Inpatient Care (last 365 days reference period)							
	Acute Illness		Single Chronic		Multimorbidity		Total Outpatient Care		Acute Illness		Single Chronic		Multimorbidity		Total Inpatient Care	
	CHE Incidence %	Mean Positive Overshoot	CHE Incidence %	Mean Positive Overshoot	CHE Incidence %	Mean Positive Overshoot	CHE Incidence %	Mean Positive Overshoot	CHE Incidence %	Mean Positive Overshoot	CHE Incidence %	Mean Positive Overshoot	CHE Incidence %	Mean Positive Overshoot	CHE Incidence %	Mean Positive Overshoot
Type of Illness																
Non-NCD	44.4	28.6	45.0	48.5	69.5	19.3	44.7	35.6	33.2	27.3	49.5	38.3	55.8	67.3	40.6	33.6
Have NCD	39.5	31.7	38.8	24.7	50.9	27.3	40.0	25.8	44.6	68.3	51.0	46.6	75.1	65.6	51.0	49.2
Level of Care																
Public	36.6	26.0	29.2	30.5	23.5	17.1	30.8	28.4	9.5	16.1	21.2	22.8	24.9	30.6	16.2	21.2
Private	56.0	28.9	48.1	30.6	63.4	27.7	51.3	29.9	52.5	34.2	69.0	44.9	86.6	66.7	62.5	41.6
ETL Group State																
Low ETL	46.8	32.2	54.5	39.5	88.6	24.7	51.1	36.1	39.1	28.0	56.3	45.1	76.5	89.3	49.6	40.2
Lower-middle ETL	27.5	21.1	30.7	20.2	64.0	12.9	30.7	20.0	21.7	20.2	36.9	32.4	47.0	40.3	30.1	28.5
Higher-middle ETL	44.4	22.4	37.9	26.2	55.6	27.7	40.7	25.3	34.8	35.6	49.5	39.1	67.8	64.3	43.4	38.3
High ETL	35.2	43.1	32.3	26.5	42.1	27.7	34.1	30.2	28.4	31.9	45.2	45.2	70.9	58.1	39.3	42.0
Sector																
Rural	45.8	30.8	44.9	33.1	51.5	27.4	45.5	32.0	35.6	33.0	52.7	43.9	79.9	77.3	45.7	40.9
Urban	37.2	24.7	33.3	24.5	51.0	26.8	35.6	24.8	31.2	28.7	46.1	39.1	57.6	47.7	40.5	36.1
MPCE Quintile																
Poorest	49.0	35.6	51.5	43.8	75.4	32.5	51.0	40.1	40.7	34.0	59.8	49.8	70.5	95.4	51.9	45.2
Poor	39.9	31.1	45.1	46.2	57.4	40.9	43.8	40.7	35.0	47.0	50.1	43.6	51.6	61.0	43.9	44.9
Middle	49.1	25.0	40.2	22.7	54.5	17.8	43.6	23.2	34.5	27.8	46.5	42.6	56.2	44.4	41.5	37.5
Rich	40.3	26.8	35.9	19.1	55.7	30.6	38.3	22.4	30.1	23.7	49.0	35.6	86.5	85.4	41.5	33.2
Richest	37.0	26.8	35.1	24.3	42.9	21.4	36.3	24.5	31.9	27.1	48.1	40.5	72.7	52.0	42.2	36.9
Sex																
Male	44.5	27.8	39.7	29.5	48.7	19.4	41.6	28.3	35.7	37.6	52.1	48.2	76.5	75.6	46.4	45.7
Female	42.4	30.3	40.4	30.7	53.1	32.2	41.8	30.7	32.8	26.4	48.1	35.0	62.0	52.8	41.3	32.2
Age Group																
30–44	38.1	29.7	44.5	36.5	56.5	31.7	41.3	33.1	32.3	26.7	50.1	39.6	54.4	54.3	41.7	35.0
45–59	47.1	30.1	38.1	25.3	50.8	18.6	41.5	26.5	34.3	35.0	48.8	43.0	73.4	78.5	42.8	40.7
60–69	44.2	25.9	40.7	35.2	55.1	28.1	42.5	32.7	38.5	35.0	52.0	45.2	68.4	61.7	47.6	42.7
70+	49.6	28.7	39.1	25.3	46.8	37.1	41.8	27.4	33.6	29.9	51.6	41.6	80.1	66.4	46.8	40.1
Total	43.3	29.2	40.1	30.2	51.3	27.1	41.7	29.6	34.1	31.6	50.2	42.3	69.6	66.0	43.8	39.3

Source: Computed from unit-level NSSO 75th round Household Social Consumption in India: Health Survey Data, 2017–2018

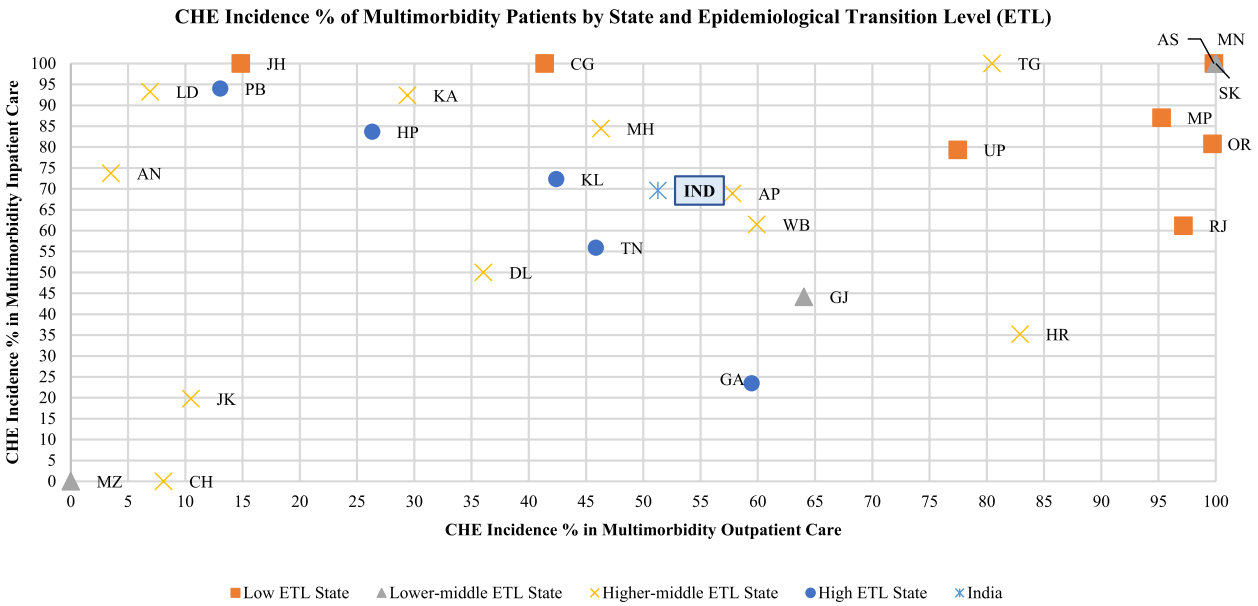

Fig. 5 CHE incidence (%) for multimorbidity patients in outpatient and inpatient care among patients aged 30 and above across Indian states, stratified by their epidemiological transition level (ETL) regions in India. Source: Computed from unit-level NSSO 75th round Household Social Consumption in India: Health Survey Data, 2017–2018

pronounced, with multimorbidity patients having NCDs being 5.9 times more likely to face CHE ($p < 0.001$, 95% CI: 4.25–8.20). The type of healthcare facility chosen was also a critical factor influencing CHE. Outpatients opting for private healthcare were 2.6 times more likely to experience CHE than those seeking care in public facilities (OR: 2.60, 95% CI: 2.45–2.76). Inpatient care at private facilities posed an even greater risk, with patients being 9.85 times more likely to encounter CHE compared to those using public healthcare. Geographical disparities further impacted the CHE incidence. Patients residing in low ETL states had a 67% higher likelihood of incurring CHE in outpatient care compared to those in high ETL states. Also, the economic and residential settings played a significant role. The poorest rural outpatients were 5.5 times more likely to experience CHE than their wealthier urban counterparts (OR: 5.49, 95% CI: 4.73–6.36), indicating the financial vulnerability of disadvantaged populations in India. The analysis highlighted a significant disparity in the likelihood of CHE among different demographic groups. The poorest rural residents were found to have 6.73 times greater likelihood of incurring CHE compared to the wealthiest urban residents. Gender differences also emerged, with females demonstrating a 15% lower likelihood of facing CHE compared to their male counterparts (OR: 0.85, 95% CI: 0.81–0.89). Age was another significant factor influencing the likelihood of CHE. Individuals aged 60 to 69 were 22% more likely to experience CHE, while those aged 70 and above faced a 20% higher likelihood compared to individuals aged 30 to 44.

Determinants of Intensity of CHE

The linear regression analysis examined the factors that affect the intensity of CHE, focusing on the positive overshoot, among patients aged 30 and above in both outpatient and inpatient care in India (Table 7). Multimorbidity patients having NCDs were significantly associated with a higher CHE intensity in inpatient care (Coef: 32.54, 95% CI: 19.29–45.79), which indicates that the combination of multimorbidity and NCDs places patients at a much higher risk of catastrophic health expenditure, reflecting the compounded financial burden due to more complex care needs and long-term treatments. Low ETL states (Coef: 21.57, 95% CI: 7.36–35.79) show the most substantial impact on CHE intensity among multimorbidity patients in outpatient care, which underscores the geographical disparities in healthcare costs, with lower ETL states facing disproportionately high financial burdens for multimorbidity patients. Private care usage statistically significantly increased CHE intensity in both outpatient (Coef: 5.73, 95% CI: 2.62–8.84) and inpatient care (Coef: 24.75, 95% CI: 21.15–28.34), suggesting that those seeking care from private providers are more likely to experience higher out-of-pocket spending. The interaction analysis between MPCE quintiles and sectors reveals that patients from the rural poorest MPCE quintile have a higher likelihood of having a higher intensity of CHE

Table 6 Logistic regression for catastrophic health expenditure (CHE) incidence (at 10% threshold) for outpatient care and inpatient care among patients aged 30 and above in India

Explanatory Variables	For Outpatient Care (last 15 days reference period)						For Inpatient Care (last 365 days reference period)					
	Only for Multimorbidity Patients			For Overall Illnesses			Only for Multimorbidity Patients			For Overall Illnesses		
	OR	*p*-value	95% CI	OR	*p*-value	95% CI	OR	*p*-value	95% CI	OR	*p*-value	95% CI
Interaction of Illnesses Type and NCDs Occurrence												
Acute#Non-NCDs®												
Acute#NCDs				0.82	0.003	0.72,0.94				1.48	0.000	1.29,1.70
Single-Chronic#Non-NCDs				0.96	0.418	0.88,1.06				1.91	0.000	1.81,2.02
Single-Chronic#NCDs				0.76	0.000	0.70,0.82				2.46	0.000	2.31,2.61
Multimorbidity# Non-NCDs				2.01	0.032	1.06,3.79				2.48	0.000	1.60,3.84
Multimorbidity# NCDs				1.33	0.000	1.18,1.50				5.90	0.000	4.25,8.20
Type of Illness												
Non-NCD®												
Have NCD	0.70	0.283	0.36,1.35				2.02	0.032	1.06,3.84			
Level of Care												
Public®												
Private	4.31	0.000	3.44,5.40	2.60	0.000	2.45,2.76	14.06	0.000	6.88,28.73	9.85	0.000	9.33,10.40
Epidemiological Transition Level (ETL) State												
Low ETL State	2.27	0.002	1.34,3.84	1.67	0.000	1.55,1.81	2.33	0.071	0.93,5.85	1.09	0.016	1.02,1.17
Lower-middle ETL State	0.92	0.806	0.48,1.76	1.34	0.000	1.19,1.51	0.80	0.741	0.22,2.98	1.01	0.845	0.92,1.10
Higher-middle ETL State	1.05	0.638	0.86,1.29	1.09	0.015	1.02,1.16	0.77	0.456	0.39,1.52	0.99	0.840	0.93,1.06
High ETL State®												
Interaction of Place of Residence and MPCE Quintile												
Rural # Poorest	3.64	0.010	1.36,9.73	5.49	0.000	4.73,6.36	4.21	0.265	0.34,52.67	6.73	0.000	5.95,7.61
Rural # Poor	2.96	0.001	1.57,5.57	3.26	0.000	2.85,3.73	6.01	0.102	0.70,51.58	4.19	0.000	3.73,4.71
Rural # Middle	4.10	0.000	2.47,6.81	3.26	0.000	2.89,3.69	1.34	0.684	0.33,5.47	3.34	0.000	3.00,3.72
Rural # Rich	2.70	0.000	1.81,4.04	2.62	0.000	2.33,2.95	5.55	0.025	1.24,24.85	2.77	0.000	2.49,3.07
Rural # Richest	2.21	0.000	1.62,3.02	2.12	0.000	1.90,2.36	1.08	0.882	0.40,2.90	2.23	0.000	2.03,2.46
Urban # Poorest	4.58	0.000	2.84,7.38	2.51	0.000	2.23,2.83	1.59	0.474	0.45,5.67	3.08	0.000	2.77,3.44
Urban # Poor	1.76	0.004	1.20,2.59	1.79	0.000	1.59,2.02	0.33	0.060	0.10,1.05	2.01	0.000	1.80,2.25
Urban # Middle	1.48	0.028	1.04,2.10	1.51	0.000	1.34,1.70	0.70	0.549	0.22,2.23	1.75	0.000	1.57,1.95
Urban # Rich	1.56	0.010	1.11,2.20	1.40	0.000	1.24,1.57	0.98	0.971	0.33,2.95	1.41	0.000	1.27,1.58
Urban # Richest®												
Sex												
Male®												
Female	0.85	0.101	0.71,1.03	0.89	0.000	0.84,0.93	0.58	0.074	0.31,1.05	0.85	0.000	0.81,0.89

Table 6 (continued)

Explanatory Variables	For Outpatient Care (last 15 days reference period)						For Inpatient Care (last 365 days reference period)					
	Only for Multimorbidity Patients			For Overall Illnesses			Only for Multimorbidity Patients			For Overall Illnesses		
	OR	*p*-value	95% CI	OR	*p*-value	95% CI	OR	*p*-value	95% CI	OR	*p*-value	95% CI
Age Group												
30–44®												
45–59	0.76	0.226	0.48,1.19	0.96	0.319	0.89,1.04	2.89	0.019	1.19,7.02	1.07	0.020	1.01,1.13
60–69	0.80	0.319	0.51,1.25	0.97	0.492	0.90,1.05	2.41	0.044	1.02,5.66	1.22	0.000	1.14,1.31
70 +	0.78	0.300	0.50,1.24	1.05	0.304	0.96,1.15	2.60	0.024	1.14,5.94	1.20	0.000	1.11,1.30
Number of observations	2055			26,905			363			38,822		
LR chi^2 (24)	263.42			2989.71			146.56			10,655.3		
Prob > chi^2	0.000			0.000			0.000			0.000		
Pseudo R^2	0.0926			0.0824			0.3222			0.2012		
Log likelihood	−1290.6915			−16,645.25			−154.15472			−21,147.427		

Source: Computed from unit-level NSSO 75th round Household Social Consumption in India: Health Survey Data, 2017–2018; Note: ® is reference category

Table 7 Linear regression for intensity of catastrophic health expenditure for outpatient and inpatient care among patients aged 30 and above in India

Explanatory Variables	Outpatient Care (last 15 days reference period)						Inpatient Care (last 365 days reference period)					
	Only for Multimorbidity Patients			For Overall Illnesses			Only for Multimorbidity Patients			for Overall Illnesses		
	Coef.	*p*-value	95% CI	Coef.	*p*-value	95% CI	Coef.	*p*-value	95% CI	Coef.	*p*-value	95% CI
Interaction of Illnesses Type and NCDs Occurrence												
Acute#Non-NCDs®												
Acute#NCDs				−2.73	0.406	−9.17,3.71				9.77	0.021	1.48,18.06
Single-Chronic#Non-NCDs				4.26	0.060	−0.18,8.70				9.16	0.000	5.71,12.61
Single-Chronic#NCDs				−1.53	0.416	−5.23,2.16				23.88	0.000	20.30,27.46
Multimorbidity# Non-NCDs				17.71	0.186	−8.52,43.94				37.76	0.001	16.47,59.05
Multimorbidity# NCDs				0.39	0.894	−5.30,6.08				32.54	0.000	19.29,45.79
Have NCDs?												
Non-NCDs®												
NCDs	−9.45	0.369	−30.08,11.17				−8.04	0.609	−38.96,22.88			
Level of Care												
Public®												
Private	0.00	1.000	−8.67,8.68	5.73	0.000	2.62,8.84	25.69	0.249	−18.10,69.47	24.75	0.000	21.15,28.34
Epidemiological Transition Level (ETL) State												
Low ETL State	21.57	0.003	7.36,35.79	6.75	0.000	2.96,10.53	12.08	0.541	−26.77,50.92	−2.64	0.208	−6.75,1.47
Lower-middle ETL State	−4.08	0.736	−27.79,19.63	5.14	0.089	−0.78,11.05	−22.29	0.517	−89.89,45.31	−5.79	0.036	−11.20,−0.37
Higher-middle ETL State	−2.14	0.556	−9.27,4.99	−1.82	0.292	−5.22,1.57	−15.23	0.375	−48.96,18.50	−3.76	0.062	−7.71,0.19
High ETL State®												
Interaction of Place of Residence and MPCE Quintile												
Rural # Poorest	17.90	0.211	−10.17,45.97	25.63	0.000	18.80,32.47	59.74	0.132	−18.22,137.70	26.65	0.000	19.72,33.58
Rural # Poor	11.92	0.252	−8.48,32.32	14.47	0.000	7.77,21.16	38.50	0.266	−29.55,106.56	17.36	0.000	10.54,24.18
Rural # Middle	4.02	0.624	−12.06,20.09	11.23	0.000	5.03,17.43	−4.61	0.886	−67.66,58.44	13.58	0.000	7.11,20.05
Rural # Rich	4.82	0.492	−8.94,18.59	9.15	0.003	3.05,15.24	44.14	0.119	−11.49,99.77	8.13	0.012	1.80,14.46
Rural # Richest	−7.52	0.194	−18.86,3.83	10.60	0.000	4.86,16.35	−4.24	0.857	−50.50,42.02	5.45	0.077	−0.59,11.48
Urban # Poorest	−6.88	0.352	−21.37,7.61	9.65	0.002	3.47,15.83	47.81	0.108	−10.62,106.24	14.88	0.000	8.41,21.35
Urban # Poor	−9.88	0.170	−24.01,4.25	4.40	0.181	−2.04,10.84	−21.00	0.520	−85.15,43.15	9.69	0.006	2.78,16.60
Urban # Middle	−12.25	0.069	−25.44,0.93	2.29	0.481	−4.08,8.67	5.42	0.858	−54.01,64.84	4.74	0.168	−1.99,11.47
Urban # Rich	−3.62	0.575	−16.30,9.06	1.20	0.718	−5.33,7.73	5.99	0.822	−46.30,58.27	1.49	0.672	−5.39,8.36
Urban # Richest®												
Sex												
Male®												
Female	0.66	0.842	−5.87,7.19	−1.73	0.185	−4.29,0.83	−20.99	0.125	−47.85,5.86	−8.78	0.000	−11.48,−6.07
Age Group												
30–44®												
45–59	−3.81	0.606	−18.28,10.67	−1.22	0.507	−4.84,2.39	32.96	0.116	−8.24,74.16	0.90	0.599	−2.46,4.27
60–69	−0.50	0.947	−15.05,14.06	1.69	0.408	−2.31,5.69	27.76	0.187	−13.60,69.11	3.39	0.101	−0.67,7.44
70 +	2.52	0.741	−12.47,17.52	−0.70	0.753	−5.07,3.67	12.09	0.556	−28.30,52.47	1.75	0.446	−2.75,6.24
Number of observations	984			10,844			247			16,513		
F (24, 16,488)	1.89			6.96			1.17			22.42		
Prob > F	0.0081			0.0000			0.2856			0.0000		
R-squared	0.0414			0.0164			0.0935			0.0316		
Adjusted R-squared	0.0194			0.0141			0.0133			0.0302		
Root MSE	50.791			67.54			104.05			87.668		

Source: Computed from unit-level NSSO 75th round Household Social Consumption in India: Health Survey Data, 2017–2018; Note: ® is reference category

followed by the rural poor and rural middle MPCE, compared to their wealthier urban counterparts, both in outpatient (Coefficient: 25.63, 95% CI: 18.80, 32.47) and inpatient care settings (Coefficient: 26.65, 95% CI: 19.72, 33.58). The poorest urban also faced significant financial burdens compared to the urban richest.

Discussions

This study highlights the substantial financial burden faced by patients with multimorbidity in India, with OOPE and CHE far exceeding those incurred by individuals with single chronic conditions or acute illnesses. To date, there has been no peer-reviewed research offering a thorough examination of multimorbidity for both outpatient and inpatient cases separately. Furthermore, the absence of cross-state comparisons regarding CHE associated with OOPE has limited a comprehensive understanding of health system resilience and the development of policies aimed at mitigating financial hardship. Our research seeks to address these gaps by utilizing data from the National Sample Survey (2017–18), which is nationally representative. Our findings reveal that the prevalence of multimorbidity in outpatient care is six times higher than that in inpatient care. This observation aligns closely with the findings of Varanasi et al. (2024) study that conducted a systematic review and meta-analysis indicating a multimorbidity prevalence range of 1.16% to 65.9%. The significantly lower prevalence of multimorbidity among inpatients suggests an underutilization of hospital services, despite the evident healthcare needs. Barriers such as prohibitive costs, significant travel distances and prior high out-of-pocket expenses may contribute to this underutilization [16, 44]. Our research also highlights that multimorbidity prevalence is higher in urban areas compared to rural regions, with increases noted alongside rising income and age for both outpatient and inpatient care consistent with previous findings from nationally representative studies in India [18, 20, 45, 46]. The epidemiological transition plays a significant role in the observed prevalence of multimorbidity; our study indicates that individuals with NCDs exhibit higher rates of multimorbidity in both outpatient (9.4%) and inpatient care (2.5%). These findings are corroborated by a study, which analyzed nationally representative data from the World Health Organization [47].

Multimorbidity presents distinct challenges in healthcare access, affordability, and financial protection across different levels of care. Patients with multimorbidity predominantly utilize private healthcare services for both outpatient and inpatient care, suggesting significant barriers to accessing public healthcare. Factors such as long wait times, perceived lower quality of care, and the lack of specialized services in the public sector contribute to this preference for private healthcare [48, 49]. This reliance on private healthcare exacerbates the financial burden on patients with multimorbidity, as private care is often associated with higher OOPE, placing a significant strain on these individuals [50].

Our findings demonstrate substantial variability in multimorbidity prevalence across states, with economic factors and ETL classifications significantly influencing this condition in India. For instance, Kerala, classified as an economically advanced and high ETL state, shows a higher prevalence of multimorbidity, while states like Meghalaya and Nagaland, categorized as low ETL and economically disadvantaged, exhibit lower prevalence rates. This discrepancy can be partly explained by increased awareness and the inclusion of NCDs tracking in routine healthcare practices in more developed states, leading to better detection and diagnosis. Our findings are consistent with previous research that highlights the role of improved healthcare systems in detecting chronic conditions [36, 51].

Numerous studies indicate that OOPE serves as the primary means of healthcare financing in low- and middle-income countries [52]. India mirrors this trend, with health expenditure accounting for 3.83% of GDP, leading to significant implications for healthcare funding in the country. Our findings align with previous studies indicating that patients with multimorbidity often resort to private healthcare, which leads to higher OOPE due to the lack of specialized public healthcare services [48, 49], compared to those with single chronic conditions or acute illnesses. Specifically, OOPE for multimorbidity patients with NCDs (Rs. 75,882) in inpatient care is far exceeding the costs for patients with acute illnesses. Log-linear regression analysis indicates that multimorbidity patients with NCDs have a 42% higher likelihood of incurring higher outpatient expenses, while in inpatient care, these patients are 2 times more likely to experience higher costs compared to those with acute conditions. These results highlight the compounded financial strain faced by multimorbidity patients, particularly when NCDs are involved. A key factor contributing to these elevated costs is polypharmacy, as managing multiple chronic conditions often requires numerous medications. Polypharmacy increases the risks of adverse drug reactions, medication non-adherence, and harmful drug interactions [53–55], which can worsen patient outcomes, lead to more frequent hospital admissions, and escalate overall healthcare costs [56]. Our analysis further identifies medication and diagnostic expenditures as the main drivers of high OOPE, consistent with previous research findings [57].

The stark urban–rural and socioeconomic disparities in OOPE, particularly for inpatient care, underscore

the need for targeted interventions. Patients from urban areas experience higher OOPE for outpatient care than rural across all illness categories, with the disparity most pronounced among multimorbidity patients. However, rural multimorbidity patients faced significantly higher inpatient OOPE (Rs. 80,822) than their urban counterparts (Rs. 56,171), likely due to travel and accommodation expenses, as well as limited local service availability and greater indirect costs [58]. Socioeconomic inequalities manifest in OOPE for multimorbidity, with the wealthiest MPCE quintile incurring significantly higher costs compared to the poorest quintile. This discrepancy likely stems from the wealthiest quintile's consistent preference for private healthcare facilities, which charge higher treatment costs than public services, in both outpatient and inpatient contexts. Previous research has suggested that the limited availability of NCD services in the public sector drives patients towards private hospitals, where inadequate health insurance coverage compounds their out-of-pocket costs [36]. Additionally, males and older age groups (70 + years) report elevated OOPE for multimorbidity, reflecting increased healthcare needs arising from higher multimorbidity incidence. These findings align with global patterns where healthcare costs are closely linked to socioeconomic status, leading to increased OOPE disparities [59, 60].

Our analysis of CHE reinforces the argument that multimorbidity disproportionately affects the poorest quintiles, with high OOPE often leading to financial catastrophe, exacerbating the difficulties in managing complex health conditions [36]. Specifically, our findings indicate that multimorbidity patients experience the highest CHE incidences in both outpatient (51.3%) and inpatient care (69.6%) settings due to a high proportion of OOPE. Demographic and epidemiological transitions further influence the distribution of health expenditures across disease and age groups. Patients with NCDs experience an even higher CHE incidence and intensity, particularly in inpatient settings, where CHE incidence reaches 75%, and the mean positive overshoot—a measure of financial intensity-is 66%. Logistic regression analysis indicates that multimorbidity patients with NCDs are 33% more likely to incur CHE in outpatient care and 5.9 times more likely in inpatient care compared to those without multimorbidity. Moreover, linear regression analysis underscores that multimorbidity significantly increases the severity of CHE.

Additionally, the increased CHE incidence among patients utilizing private healthcare facilities demonstrates the inadequacy of current public healthcare infrastructure in managing complex cases of multimorbidity, especially in low-ETL states, with CHE incidence in private healthcare facilities reaching 63% in outpatient care and 87% in inpatient care, compared to 24% and 25%, respectively, in public facilities. Our logistic regression findings further reveal that outpatients opting for private care are 2.6 times more likely to incur CHE, while inpatients using private facilities face a 9.8 times higher likelihood of experiencing CHE.

The study acknowledges a few limitations that should be considered when interpreting the findings. The first limitation of the present study included the morbidities and expenditures were self-reported which might have brought in measurement bias. Further, self-reported data can be subject to recall bias and social desirability bias, which may affect the reliability of certain findings. Moreover, the collection of data over the last 15 days for outpatient care and 365 days for inpatient care may result in limited time frames for outpatient data and potential recall bias for inpatient data. Another limitation pertains to the findings related to average health expenditures, which should be approached cautiously due to observed skewness and high variability in the data.

Conclusions

Understanding health expenditure dynamics at the national level is crucial for informing effective policy responses. Our study sheds light on the prevalence of multimorbidity in India and its significant financial implications, particularly emphasizing the striking disparities in OOPE and CHE. It illustrates the financial strain that the increasing burden of multimorbidity imposes across various healthcare settings, socioeconomic groups and geographic regions. This complex scenario necessitates a comprehensive, multifaceted strategy to address the challenges of multimorbidity, particularly at the primary care level. The study highlights the importance of improving access to affordable, high-quality public healthcare services, especially for NCD management.

With outpatient care contributing significantly to OOPE, enhancing primary care systems emerges as a critical intervention. Furthermore, extending financial protection schemes to cover outpatient care is essential to reduce OOPE and CHE for patients managing multiple chronic conditions. By bringing healthcare services closer to communities, this approach aims to prevent disease progression and reduce the financial burdens faced by individuals. Furthermore, expanding the Pradhan Mantri Jan Aarogya Yojana (PMJAY) to include outpatient care can help the healthcare system address a significant portion of CHE arising from outpatient expenditures. Such an expansion could include coverage for outpatient consultations, diagnostic tests, medications and routine procedures essential for managing multimorbidity. The compounded financial burden from polypharmacy, diagnostic expenses, and frequent hospitalizations due

to multimorbidity conditions highlights the urgent need for financial protection mechanisms and the inclusion of outpatient care under schemes like PMJAY [50].

Medication costs represent a substantial portion of OOPE for those with multimorbidity, primarily due to the prevalence of polypharmacy, which can lead to increased morbidity, hospitalizations and higher overall healthcare expenditures. Managing polypharmacy demands careful consideration of the benefits and risks associated with multiple medications in patients who already bear significant financial and healthcare burdens [61]. To mitigate the risks of polypharmacy, it is essential to conduct regular medication reviews, facilitate coordinated care among healthcare providers, educate patients on effective medication management and employ comprehensive medication management strategies that optimize therapeutic outcomes while minimizing potential adverse effects. Effective approaches for managing polypharmacy include routine medication evaluations, deprescribing when appropriate and adherence to clinical guidelines to refine pharmacotherapy [62]. Implementing standardized treatment protocols and reducing unnecessary medications could also lower the risks associated with polypharmacy, thereby decreasing OOPE and improving treatment adherence.

Integrating preventive strategies, such as early detection and effective management of NCDs and multimorbidity, into the existing Comprehensive Primary Health Care (CPHC) framework [63] is essential. Emphasizing these measures through public health campaigns and regular screenings can help prevent the progression to multimorbidity, improving overall health outcomes. At a health systems level, there is an urgent need to integrate various health programs and interventions. Leveraging support of digital health technologies under the Ayushman Bharat Digital Health Mission like Electronic Health Records (EHR) and Telemedicine consultations with Specialists can bridge existing gaps in the continuum of care and availability of Human Resources for Health. By strategically implementing these technologies, patient care can be streamlined, facilitating remote consultations with specialists and thereby bringing specialized care closer to communities. This initiative has the potential to enhance both the affordability and accessibility of healthcare for patients managing multimorbidity.

Future research could explore the effectiveness of integrating outpatient care into financial protection schemes like PMJAY, assessing its impact on reducing OOPE and CHE for multimorbidity patients. Additionally, studies could investigate the role of polypharmacy management in improving health outcomes and lowering healthcare costs, as well as the effectiveness of digital health technologies in enhancing access to primary and specialized care for individuals with multimorbidity. Research on preventive strategies within the Comprehensive Primary Health Care framework could also explore early detection and management of NCDs to prevent the progression of multimorbidity. Given that individuals with multimorbidity are at a higher risk of physical and mental health declines, leading to disability, reduced quality of life, increased mortality, and greater healthcare costs compared to those with a single health condition, addressing these research areas is essential for improving health outcomes and reducing the burden on healthcare systems.

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Authors' contributions
SKS, PJ and ASN contributed to the concept and design of the paper. SKS developed the data analysis plan and conducted the formal analysis. SKS, SK and NS performed the literature search and prepared the manuscript. PJ and RS were involved in project administration, and supervision, along with reviewing the manuscript, editing, and approving the final version of the manuscript. The manuscript was collectively reviewed and revised by SKS, PJ, SK, ASN, NS and RS.

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Data availability
The datasets were derived from sources in the public domain: NSSO: Social Consumption and Health 75th round and can be downloaded upon registration and filling in basic details at https://microdata.gov.in/nada43/index.php/catalog/152.

Declarations

Ethics approval and consent to participate
Ethical approval was not required for this study as it used only anonymized data from secondary sources, publicly available from the National Sample Survey Office (NSSO). Therefore, no ethical issues or approval from an ethics committee, nor consent to participate, were necessary. All methods were conducted in accordance with relevant guidelines and regulations.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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References

1. Van den Akker M, Buntix F, Metsemakers JFM, Roos S, Knottnerus JA. Multimorbidity in general practice: Prevalence, incidence, and determinants of co-occurring chronic and recurrent diseases. J Clin Epidemiol. 1998;51(5):367–75.
2. Barnett K, Mercer SW, Norbury M, Watt G, Wyke S, Guthrie B. Epidemiology of multimorbidity and implications for health care, research, and medical education: A cross-sectional study. Lancet. 2012;380(9836):37–43.
3. Salisbury C, Johnson L, Purdy S, Valderas JM, Montgomery AA. Epidemiology and impact of multimorbidity in primary care: A retrospective cohort study. Br J Gen Pract. 2011;61(582):12–21.

4. Skou ST, Mair FS, Fortin M, Guthrie B, Nunes BP, Miranda JJ, Boyd CM, Pati S, Mtenga S, Smith SM. Multimorbidity. Nat Rev Dis Primers. 2022;8(1):48. https://doi.org/10.1038/s41572-022-00376-4.
5. Mercer S, Salisbury C, Fortin M. ABC of multimorbidity. Wiley Blackwell; 2014. p. 1–166. ISBN 978-1-118-38388-9.
6. Chowdhury SR, Chandra Das D, Sunna TC, Beyene J, Hossain A. Global and regional prevalence of multimorbidity in the adult population in community settings: a systematic review and meta-analysis. EClinicalMedicine. 2023;57:1–22.
7. Ho ISS, Azcoaga-Lorenzo A, Akbari A, Davies J, Hodgins P, Khunti K, et al. Variation in the estimated prevalence of multimorbidity: Systematic review and meta-analysis of 193 international studies. BMJ Open. 2022;12:1–11.
8. Marengoni A, Angleman S, Melis R, Mangialasche F, Karp A, Garmen A, et al. Aging with multimorbidity: A systematic review of the literature. Ageing Res Rev. 2011;10:430–9.
9. Violan C, Foguet-Boreu Q, Flores-Mateo G, Salisbury C, Blom J, Freitag M, et al. Prevalence, determinants and patterns of multimorbidity in primary care: A systematic review of observational studies. PLoS One. 2014;9(7):1–9.
10. National Health Systems Resource Centre. National Health Systems Resource Centre [Internet]. 2024 [cited 2024 Nov 10]. Available from: https://nhsrcindia.org/national-health-accounts-records.
11. Larkin J, Walsh B, Moriarty F, Clyne B, Harrington P, Smith SM. What is the impact of multimorbidity on out-of-pocket healthcare expenditure among community-dwelling older adults in Ireland? A cross-sectional study. BMJ Open. 2022;12(9):1–12.
12. Rodrigues LP, De Oliveira Rezende ACDST, Delpino FM, Mendonça CR, Noll M, Nunes BP, et al. Association between multimorbidity and hospitalization in older adults: systematic review and meta-analysis. Age Ageing. 2022;51:1–16.
13. Russell CD, Lone NI, Baillie JK. Comorbidities, multimorbidity and COVID-19. Nat Med. 2023;29:334–43.
14. Kone AP, Mondor L, Maxwell C, Kabir US, Rosella LC, Wodchis WP. Rising burden of multimorbidity and related socio-demographic factors: a repeated cross-sectional study of Ontarians. Can J Public Health. 2021;112(4):737–47.
15. Pati S, Sinha A, Ghosal S, Kerketta S, Lee JT, Kanungo S. Family-Level Multimorbidity among Older Adults in India: Looking through a Syndemic Lens. Int J Environ Res Public Health. 2022;19(16):1–12.
16. Shukla SK, Singh N, Mazumdar S. Multiple Chronic Conditions as Predictors of Inequality in Access to and Use of Health Services Among the Elderly in India. In: Mohanty SK, Mazumdar S, editors. Handbook of Aging, Health and Public Policy. Singapore: Springer Nature Singapore; 2023. p. 1–29.
17. Loprinzi PD. Sedentary behavior and medical multimorbidity. Physiol Behav. 2015;151:395–7.
18. Karan A, Farooqui HH, Hussain S, Hussain MA, Selvaraj S, Mathur MR. Multimorbidity, healthcare use and catastrophic health expenditure by households in India: a cross-section analysis of self-reported morbidity from national sample survey data 2017–18. BMC Health Serv Res. 2022;22(1):1–12.
19. Vargese SS, Mathew E, Johny V, Kurian N, GA V, Raju AS. Prevalence and pattern of multimorbidity among adults in a primary care rural setting. Clin Epidemiol Glob Health. 2020;8(2):482–5.
20. Arokiasamy P, Uttamacharya, Jain K. Multi-morbidity, functional limitations, and self-rated health among older adults in India: Cross-sectional analysis of LASI pilot survey, 2010. Sage Open. 2015;5(1):1–10.
21. MoHFW. Ministry of Health & Family Welfare NATIONAL PROGRAMME FOR PREVENTION AND CONTROL OF NON-COMMUNICABLE DISEASES OPERATIONAL GUIDELINES National Programme for Prevention and Control of Non-Communicable Diseases. 2023.
22. Pati S, Swain S, Knottnerus JA, Metsemakers JFM, Van Den Akker M. Magnitude and determinants of multimorbidity and health care utilization among patients attending public versus private primary care: A cross-sectional study from Odisha, India. Int J Equity Health. 2020;19(1):1–12.
23. Palo SK, Nayak SR, Sahoo D, Nayak S, Mohapatra AK, Sahoo A, et al. Prevalence and pattern of multimorbidity among chronic kidney disease patients: a community study in chronic kidney disease hotspot area of Eastern India. Front Med (Lausanne). 2023;10:1–6.
24. Prenissl J, De Neve JW, Sudharsanan N, Manne-Goehler J, Mohan V, Awasthi A, et al. Patterns of multimorbidity in India: A nationally representative cross-sectional study of individuals aged 15 to 49 years. PLOS Glob Public Health. 2022;2(8):1–16.
25. Gupta P, Prabhakaran D, Mohan S. Multimorbidity or multiple long-term conditions: need for bridging the evidence & care gaps to address an emerging priority public health issue in India. Indian J Med Res. 2022;156:381–3.
26. Barik M, Panda SN, Tripathy SS, Sinha A, Ghosal S, Acharya AS, et al. Is multimorbidity associated with higher risk of falls among older adults in India? BMC Geriatr. 2022;22(1):1–8.
27. National Statistical Office. National Statistical Office [Internet]. New Delhi; 2020 [cited 2024 Nov 10]. Available from: https://www.mospi.gov.in/sites/default/files/publication_reports/NSS%20Report%20no.%20586%20Health%20in%20India.pdf.
28. Lwan A. WHO | Global status report on noncommunicable diseases 2010. WHO. 2015. p. 1–176.
29. Pless IB, Douglas JW. Chronic illness in childhood. I. Epidemiological and clinicl characteristics. Pediatrics. 1971;47(2):405–14.
30. CDC. National Center for Chronic Disease Prevention & Health Promotion. 2022 [cited 2024 Nov 10]. CDC: About Chronic Diseases. Available from: https://www.cdc.gov/chronic-disease/about/index.html.
31. Dandona L, Dandona R, Kumar GA, Shukla DK, Paul VK, Balakrishnan K, et al. Nations within a nation: variations in epidemiological transition across the states of India, 1990–2016 in the Global Burden of Disease Study. Lancet. 2017;390(10111):2437–60.
32. Prabhakaran D, Jeemon P, Sharma M, Roth GA, Johnson C, Harikrishnan S, et al. The changing patterns of cardiovascular diseases and their risk factors in the states of India: the Global Burden of Disease Study 1990–2016. Lancet Glob Health. 2018;6(12):e1339–51.
33. Ahmad F, Mohanty PC. Incidence and intensity of catastrophic health expenditure and impoverishment among the elderly: an empirical evidence from India. Sci Rep. 2024;14(1):1–19.
34. Azzani M, Roslani AC, Su TT. Determinants of household catastrophic health expenditure: A systematic review. Malaysian Journal of Medical Sciences. 2019;26(1):15–43.
35. Liu C, Liu Z min, Nicholas S, Wang J. Trends and determinants of catastrophic health expenditure in China 2010–2018: a national panel data analysis. BMC Health Serv Res. 2021 Dec 1;21(1).
36. Sriram S, Albadrani M. Impoverishing effects of out-of-pocket healthcare expenditures in India. J Family Med Prim Care. 2022;11(11).
37. Bilger M, Sajaia Z, Lokshin M. Health Equity and Financial Protection, The World Bank. 2011.
38. O'Donnell O, van Doorslaer E, Rannan-Eliya RP, Somanathan A, Adhikari SR, Akkazieva B, et al. Who pays for health care in Asia? J Health Econ. 2008;27(2):460–75.
39. Saito E, Gilmour S, Rahman MM, Gautam GS, Shrestha PK, Shibuya K. Dépenses catastrophiques de santé des ménages au Népal: Une enquête transversale. Bull World Health Organ. 2014;92(10):760–7.
40. Bhojani U, Thriveni B, Devadasan R, Munegowda C, Devadasan N, Kolsteren P, et al. Out-of-pocket healthcare payments on chronic conditions impoverish urban poor in Bangalore, India. BMC Public Health. 2012;12(1):1–13.
41. Malehi AS, Pourmotahari F, Angali KA. Statistical models for the analysis of skewed healthcare cost data: a simulation study. Health Econ Rev. 2015;5(1):1–16.
42. Mohanty SK, Kastor A. 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. 2017;7(1):1–15.
43. Deb P, Norton EC. On: Fri. Annu Rev Public Health [Internet]. 2018;39:28. Available from: https://doi.org/10.1146/annurev-publhealth.
44. Dalui A, Banerjee S, Roy R. Determinants of out-of-pocket and catastrophic health expenditure in rural population: A community-based study in a block of Purba Barddhaman, West Bengal. Indian J Public Health. 2020;64(3):223–8.
45. Varanasi R, Sinha A, Nayak D, Manchanda RK, Janardhanan R, Tandon S, et al. Prevalence and correlates of multimorbidity among patients attending AYUSH primary care settings in Delhi-National Capital Region, India. BMC Complement Med Ther. 2023;23(1):1–9.

46. Nguyen H, Manolova G, Daskalopoulou C, Vitoratou S, Prince M, Prina AM. Prevalence of multimorbidity in community settings: A systematic review and meta-analysis of observational studies. J Comorb. 2019;9:1–15.
47. Pati S, Agrawal S, Swain S, Lee JT, Vellakkal S, Hussain MA, et al. Non communicable disease multimorbidity and associated health care utilization and expenditures in India: Cross-sectional study. BMC Health Serv Res. 2014;14(1):1–9.
48. Allen EM, Call KT, Beebe TJ, McAlpine DD, Johnson PJ. Barriers to Care and Health Care Utilization among the Publicly Insured. Med Care. 2017;55(3):1–19.
49. Basu S, Andrews J, Kishore S, Panjabi R, Stuckler D. Comparative performance of private and public healthcare systems in low- and middle-income countries: A systematic review. PLoS Med. 2012;9(6):1–14.
50. Selvaraj S, Karan AK. Why publicly-financed health insurance schemes are ineffective in providing financial risk protection. Econ Polit Wkly. 2012;47(11):60–8.
51. Wagstaff A, Flores G, Hsu J, Smitz MF, Chepynoga K, Buisman LR, et al. Progress on catastrophic health spending in 133 countries: a retrospective observational study. Lancet Glob Health. 2018;6(2):e169–79.
52. Zhao Y, Atun R, Oldenburg B, McPake B, Tang S, Mercer SW, et al. Physical multimorbidity, health service use, and catastrophic health expenditure by socioeconomic groups in China: an analysis of population-based panel data. Lancet Glob Health. 2020;8(6):e840–9.
53. Aggarwal P, Woolford SJ, Patel HP. Multi-morbidity and polypharmacy in older people: Challenges and opportunities for clinical practice. Geriatrics (Switzerland). 2020;5:1–11.
54. Payne RA, Avery AJ, Duerden M, Saunders CL, Simpson CR, Abel GA. Prevalence of polypharmacy in a Scottish primary care population. Eur J Clin Pharmacol. 2014;70(5):575–81.
55. Duerden M, Avery T, Payne R. Polypharmacy and medicines optimisation: Making it safe and sound. https://www.kingsfund.org.uk/publications/polypharmacy-and-medicines-optimisation. The King's Fund. 2013.
56. Pirmohamed M, James S, Meakin S, Green C, Scott AK, Walley TJ, et al. Adverse drug reactions as cause of admission to hospital: Prospective analysis of 18 820 patients. Br Med J. 2004;329(7456):15–9.
57. Sum G, Hone T, Atun R, Millett C, Suhrcke M, Mahal A, et al. Multimorbidity and out-of-pocket expenditure on medicines: A systematic review. BMJ Global Health. 2018;3:1–12.
58. Kornelsen J, Khowaja AR, Av-Gay G, Sullivan E, Parajulee A, Dunnebacke M, et al. The rural tax: comprehensive out-of-pocket costs associated with patient travel in British Columbia. BMC Health Serv Res. 2021;21(1):1–17.
59. Álvarez-Gálvez J, Ortega-Martín E, Carretero-Bravo J, Pérez-Muñoz C, Suárez-Lledó V, Ramos-Fiol B. Social determinants of multimorbidity patterns: A systematic review. Front Public Health. 2023;11:1–13.
60. McMaughan DJ, Oloruntoba O, Smith ML. Socioeconomic Status and Access to Healthcare: Interrelated Drivers for Healthy Aging. Front Public Health. 2020;8:1–9.
61. Maher RL, Hanlon J, Hajjar ER. Expert Opinion on Drug Safety Clinical consequences of polypharmacy in elderly Clinical consequences of polypharmacy in elderly. Expert Opin Drug Saf. 2014;13(1):1–11.
62. Scott IA, Hilmer SN, Reeve E, Potter K, Couteur D Le, Rigby D, et al. Reducing inappropriate polypharmacy: The process of deprescribing. JAMA Intern Med. 2015;175:827–34.
63. Ministry of Health and Family Welfare. Ayushman Bharat: comprehensive primary health care through health and wellness centers operational guidelines. [Internet]. New Delhi; 2018 [cited 2024 Nov 10]. Available from: https://www.nhm.gov.in/New_Updates_2018/NHM_Components/Health_System_Stregthening/Comprehensive_primary_health_care/letter/Operational_Guidelines_For_CPHC.pdf.

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