Multiple Chronic Conditions as Predictors of Inequality in Access to and Use of Health Services Among the Elderly in India

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Multiple Chronic Conditions as Predictors of Inequality in Access to and Use of Health Services Among the Elderly in India

Sudheer Kumar Shukla, Nishikant Singh, and Sumit Mazumdar

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Abstract

Ageing and the associated burden of non-communicable diseases (NCDs) are increasing disproportionately in low- and middle-income countries. In addition to that, multiple chronic conditions (MCCs) among the aged population are considered one of the key emerging concerns of health systems globally. This has made the prevention and management of NCDs a global priority and a major challenge to limited social and health care systems. Utilizing the nationally

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representative health consumption data from the National Sample Survey (2017–2018), this study investigates the growing prevalence of multiple chronic conditions and co-morbidities, particularly among the elderly in India with stretched public primary health care systems. This study brings out distinct dissimilarities in the equity aspect and incidence of the burden from out-of-pocket expenses as well as catastrophic health expenditures on health care across the states and at the national level. Multiple chronic conditions among the elderly emerge as one of the important predictors of overall inequality in health care use and access. Moreover, these conditions create a higher predisposition to incur disproportionately higher medical expenditures. The population, especially the elderly suffering from MCCs, intensifies more structural inequalities in the welfare distribution, acknowledging its typical gradient and patterns among the elderly.

Keywords

Chronic diseases · NCDs · Inequality · Access · Catastrophic · Elderly · India

1 Introduction

By 2030, one in every six people in the world will be aged 60 or over. At this time, the share of the population aged 60 and over will increase from 1 billion in 2020 to 1.4 billion. Further, by 2050, the world's population of people aged 60 and older will double (2.1 billion) (WHO, 2021). Along with rapid ageing, the increasing burden of NCDs, which fall disproportionately on low- and middle-income countries (LMICs), has made the prevention and management of NCDs a global priority and posed a major challenge to limited social and health care systems. At the same time, the burden of non-communicable (also known as chronic) diseases, which tend to be long in duration and are the result of environmental, genetic, psychological, and behavioural factors (World Health Organization, 2014), along with their consequences, is also increasing rapidly. This reflects the emergent association of increasing age and being diagnosed with multiple chronic ($\geq$2) conditions (MCCs) (Baker et al., 2017). Such a focus is particularly relevant considering the current demographic transition (Marengoni & Vetrano, 2021).

Despite the growing number of people suffering from multiple chronic conditions, methodological problems concerning the measurements of MCC still persist. So far, there is no single and standard definition of MCCs; hence, considerable heterogeneity in estimates of MCCs was found in the previous studies (Hajat & Stein, 2018). However, the simplest definition of MCCs is the presence of two or more chronic diseases, but what constitutes a chronic disease is also variable across the literature (Lefèvre et al., 2014). For instance, some studies define chronic conditions by their respective organ systems (e.g. chronic lung disease), whereas others differentiate within organ systems (e.g. COPD and interstitial lung disease) (Diederichs et al., 2011).

The MCCs are increasingly being considered one of the key emerging concerns of health systems globally. Approximately one in three adults suffers from multiple chronic conditions (MCCs) at the global level (Hajat & Stein, 2018). MCC is a burden not only for the patients who suffer but also for the health care system overall. Despite this problem's growth, the delivery of health services has continued to employ outmoded "siloed" approaches that focus on individual chronic diseases (Parekh et al., 2011). Those with multiple chronic conditions have poorer health, use more health services, and spend more on health care. As a result, the problem of MCCs has rapidly escalated to become a major public health and medical challenge (Parekh et al., 2011), especially for the most disadvantaged sub-populations. For instance, elderly population and further gender segregation among elderly population as women are more likely than men to have multiple chronic conditions, due to the fact that many women live longer than men do (Buttorff et al., 2017). Globally, one in every three adults lives with more than one chronic condition, or MCCs, and accrue a disproportionate health and cost burden (Marengoni et al., 2011). This figure is closer to three out of every four older adults living in developed countries and is predicted to rise dramatically (Buttorff et al., 2017), with the proportion of patients with four or more diseases almost doubling between 2015 and 2035 in the United Kingdom (Hajat & Stein, 2018). The combined effects of increasing life expectancy and the ageing of the population will undoubtedly increase the associated societal burden of chronic illnesses among future populations of the elderly.

In India, the concern arises from the increased demand for health services, requiring a long period of medication due to the growing incidence of individuals with MCCs in a fragmented health system already stressed to provide basic primary health care; the predominant out-of-pocket financing of medical care (Balarajan et al., 2011) can accentuate inequality in access (Bhan et al., 2016), use, and financing of medical care and lead to deepening of health care inequality (Alam et al., 2015). Moreover, older age, undesirable lifestyle factors, and low socioeconomic status (SES) have been consistently associated with the development of MCCs (McPhail, 2016). Many chronic illnesses are more prevalent in people from socioeconomically deprived backgrounds. The presence of two or more long-term health conditions poses a growing global health care challenge, is more common, and can occur a decade earlier in individuals from areas of socioeconomic deprivation (Barnett et al., 2012).

In light of these discussions, the research on MCCs' trajectories remains grossly understudied, especially for the elderly in low- and middle-income countries (LMICs) context, and robust evidence on how inadequate medical care consumption among individuals with multiple chronic conditions fuels overall health care inequality remains rare. Again, the dimensions of inequality can be more severe among specific population groups, e.g. the elderly, having higher risks of having MCCs along with facing multiple barriers to accessing and using health care, including financial constraints. Using the large-scale NSSO health consumption survey, the study delineates the pathways through which such inequality outcomes are shaped among the elderly and identifies the likely psychosocial, economic, and health service use parameters that can be targeted in implementing corrective policies

aligned with current national priorities of ensuring universal coverage of health services.

2 Assessing Quantitative Evidence and Data Sources

Data for the current study is extracted from the 75th round (from July 2017 to June 2018) of NSSO health consumption data, which is a nationwide sample survey conducted by the Government of India. The 75th round survey covered 113,823 sample households and 555,115 individuals (rural: 325,883; urban: 229,232; male: 283,200; female: 271,877) by a two-stage random sampling method. In the first stage, rural villages and urban wards were selected, and in the second stage, households were selected. NSSO collected information related to demographic details, household characteristics, morbidity and mortality, hospitalization in the last 365 days, health insurance coverage, out-of-pocket expenditure (OOPE), health care utilization, immunization coverage, maternal health, and elderly health. The current study focuses on elderly health and indicators related to this group, wherein the multiple chronic conditions (MCCs) variable was defined as a sample having two or more chronic ailments. Variables used in the study were presented in Table 1.

The entire sample included in this study is presented in Tables 2 and 3. An individual is the unit of analysis, and all estimates were adjusted according to their respective weights. In the statistical analysis, bivariate and multivariate analyses have been employed. Binary logistic regression and negative binomial (negbin) regression for count data models were performed to understand the factors associated with the number of chronic conditions. Further, concentration indices were computed, and concentration curves were plotted to understand the inequality between out-of-pocket health expenditure and catastrophic health expenditure.

3 Multiple Chronic Conditions and Other Illnesses Among Elderly

3.1 Prevalence and Distribution of Illnesses

National level estimates suggest the elderly with no illness were 70%, those with acute illness were 5%, those with a single chronic condition were 18%, and those with multiple chronic conditions were 6.2% in the year 2017–2018. The distribution of disease by type suggests that only 16.8% of the elderly were suffering from acute illness, while 83.2% of the elderly population suffered from chronic disease. In the case of MCCs, the estimates for single and multiple chronic conditions were 75% and 25%, respectively. In terms of geographical variations, Kerala reported the highest burden of multiple chronic conditions was reported by the states of Kerala, followed by Andhra Pradesh and Karnataka. The distribution of MCCs by income level reveals that the burden of multiple chronic conditions increased with rising income status as measured through MPCE. Similarly, MCCs by living arrangement

Table 1 Description of outcome variables, their categories, and base population

S. no.	Outcome variable	Categories/information	Base/denominator
1.	Illness status	0-No illness, 1-acute illness, 2-single chronic, 3-multiple chronic	60 and above age-group persons
2.	Disease types	0-Acute illness, 1-chronic illness	60 and above age-group persons having any type of illness
3.	Multiple chronic conditions (mcc1)	0-No multiple chronic, 1-multiple chronic	60 and above age-group persons
4.	Multiple chronic conditions (mcc2)	0-Single chronic, 1-multiple chronic	60 and above age-group persons having any type of chronic illness
5.	Multiple chronic conditions (mcc3)	0-No chronic, 1-single chronic, 2-double chronic, 3-triple chronic, . . . n-having n Chronic.	60 and above age-group persons
6.	Multiple chronic conditions (mcc4)	1-Single chronic, 2-double chronic, 3-triple chronic, . . . n-having n chronic	60 and above age-group persons having any type of chronic illness
7.	Total health expenditure	Total medical and nonmedical health expenditure for any type of illness in rupees	60 and above age-group persons having any type of illness
8.	Medical expenditure	Medical expenditure for any type of illness in rupees	60 and above age-group persons having any type of illness
9.	Nonmedical expenditure	Nonmedical expenditure for any type of illness in rupees	60 and above age-group persons having any type of illness
10.	Out-of-pocket expenditure (OOPE)	Total health expenditure from own pocket (less reimbursement) in rupees	60 and above age-group persons having any type of illness
11.	OOPE share to total household consumption	Percentage of out-of-pocket expenditure (OOPE) in total household consumption expenditure	60 and above age-group persons having any type of illness
12.	Catastrophic health expenditure at 10% threshold (CHE 10)	Catastrophic health expenditure equals or exceeds 10% of a household's consumption expenditure	60 and above age-group persons having any type of illness

Source: Computed from unit-level NSSO 75th round Household Social Consumption in India: Health Survey Data, 2017–18

suggest that elderly living alone have the highest burden of multiple chronic conditions (Tables 2 and 3).

Table 2 Prevalence and distribution of illnesses among elderly by background characteristics in India

Background characteristics	Illness status				Sample size	Disease-type distribution		Multiple chronic conditions Distribution (mcc2)	
	No illness	Acute illnesses	Single chronic	Multiple chronic		Acute	Chronic	Single chronic	Multiple chronic
Place of residence									
Rural	73.5	5.4	16.1	5.0	25,109	20.4	79.6	76.3	23.7
Urban	63.1	4.3	23.9	8.7	20,847	11.6	88.4	73.4	26.6
Social group									
Schedule tribes (STs)	81.5	7.2	9.8	1.5	3956	38.9	61.1	86.8	13.2
Schedule castes (SCs)	74.4	6.2	17.3	2.2	6283	24.2	75.8	88.7	11.4
Other backward classes (OBCs)	71.0	4.9	17.4	6.7	17,295	16.8	83.2	72.1	27.9
Others	63.5	4.5	23.4	8.6	17,132	12.3	87.7	73.1	26.9
Religion									
Hindu	70.9	5.4	18.4	5.4	34,457	18.4	81.6	77.5	22.5
Muslim	68.2	3.6	20.7	7.5	5229	11.3	88.7	73.4	26.6
Sikh	68.2	8.1	23.0	0.7	1162	25.5	74.5	97.2	2.8
Others	50.6	2.9	23.4	23.2	3818	5.9	94.1	50.2	49.8
Household size									
1–3	63.7	5.4	21.6	9.3	9803	15.0	85.0	69.9	30.1
4–6	69.5	4.8	19.5	6.1	21,165	15.9	84.1	76.1	23.9
7+	77.2	5.2	14.7	2.9	13,698	22.8	77.2	83.6	16.4

MPCE quintile									
Lowest	81.9	6.6	10.4	1.1	7249	36.3	63.7	90.2	9.8
Lower	75.5	5.7	15.8	3.1	7287	23.1	76.9	83.5	16.5
Medium	72.3	4.7	18.5	4.5	7825	17.0	83.0	80.4	19.6
Higher	64.9	4.2	23.1	7.7	9733	12.0	88.0	75.0	25.1
Highest	55.1	4.3	26.6	14.0	12,572	9.6	90.4	65.6	34.5
Sex									
Male	70.4	5.1	18.4	6.1	23,634	17.2	82.9	75.0	25.0
Female	69.6	5.0	19.1	6.3	22,319	16.5	83.6	75.2	24.9
Educational attainment									
Not literate	75.4	5.6	16.4	2.7	20,625	22.6	77.5	85.8	14.2
Primary	63.3	5.8	20.8	10.1	9994	15.8	84.2	67.3	32.7
Middle	59.7	4.2	23.1	13.0	3931	10.4	89.6	64.1	35.9
Secondary	61.7	3.5	24.2	10.6	4565	9.2	90.8	69.5	30.5
Higher secondary	66.5	2.6	24.3	6.6	1967	7.9	92.1	78.7	21.3
Graduate and above	65.8	3.6	20.4	10.3	3584	10.4	89.6	66.5	33.5
Age group									
60–65	74.1	4.5	17.0	4.4	22,999	17.3	82.7	79.3	20.7
66–70	69.9	5.6	18.6	6.0	10,880	18.4	81.6	75.5	24.5
71–75	62.1	7.0	21.3	9.6	5813	18.4	81.6	68.9	31.1
76–80	62.6	3.9	24.3	9.2	3406	10.5	89.5	72.5	27.5
>80	57.7	5.3	23.8	13.1	2858	12.5	87.5	64.5	35.5
Living arrangement									
Living alone	51.6	6.1	23.7	18.6	920	12.6	87.4	56.0	44.0
With spouse only	66.0	4.6	21.5	7.9	4868	13.5	86.5	73.1	26.9
With spouse and members	73.2	5.1	16.9	4.9	25,466	18.8	81.2	77.7	22.3

(continued)

Table 2 (continued)

Background characteristics	Illness status				Sample size	Disease-type distribution		Multiple chronic conditions Distribution (mcc2)	
	No illness	Acute illnesses	Single chronic	Multiple chronic		Acute	Chronic	Single chronic	Multiple chronic
Without spouse-with children	67.6	5.5	20.7	6.2	12,114	16.9	83.1	77.0	23.0
Without spouse-with others	72.9	3.6	18.2	5.4	1298	13.1	86.9	77.2	22.8
Physical mobility									
Physically immobile	58.0	5.3	26.0	10.7	4471	12.5	87.5	70.9	29.1
Physically mobile	70.6	5.1	18.4	6.0	40,188	17.3	82.7	75.6	24.4
Total	**70.0**	**5.0**	**18.7**	**6.2**	**45,956**	**16.8**	**83.2**	**75.1**	**24.9**

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

Table 3 Prevalence and distribution of illnesses among elderly by states in India

Background characteristics	Illness status				Sample size	Disease-type distribution		Multiple chronic conditions distribution (mcc2)	
	No illness	Acute illnesses	Single chronic	Multiple chronic		Acute	Chronic	Single chronic	Multiple chronic
State									
Jammu and Kashmir	72.5	9.1	16.1	2.3	1412	33.0	67.0	87.6	12.4
Himachal Pradesh	71.0	1.9	21.2	5.9	1318	6.7	93.3	78.2	21.8
Punjab	68.4	6.7	23.5	1.4	1542	21.3	78.7	94.5	5.5
Chandigarh	63.5	7.4	25.1	4.0	172	20.4	79.6	86.4	13.6
Uttaranchal	89.5	3.9	6.6	0.0	636	37.3	62.7	100.0	0.0
Haryana	83.2	4.7	11.7	0.4	1400	28.2	71.8	96.8	3.3
Delhi	67.7	19.4	12.7	0.3	487	59.9	40.1	98.1	1.9
Rajasthan	85.7	2.5	10.5	1.3	2239	17.3	82.7	89.3	10.7
Uttar Pradesh	78.9	6.9	14.0	0.2	3944	32.7	67.3	98.5	1.5
Bihar	90.5	4.4	5.1	0.1	1227	46.0	54.1	98.2	1.8
Sikkim	80.8	2.0	17.3	0.0	201	10.2	89.8	100.0	0.0
Arunachal Pradesh	95.0	4.9	0.1	0.0	358	97.5	2.5	100.0	0.0
Nagaland	92.5	5.2	2.3	0.0	289	69.3	30.8	100.0	0.0
Manipur	94.1	4.2	1.7	0.1	803	70.5	29.6	96.7	3.3
Mizoram	91.4	1.8	6.8	0.0	453	21.2	78.9	99.6	0.5
Tripura	95.4	3.9	0.7	0.0	678	85.4	14.6	100.0	0.0
Meghalaya	98.9	1.0	0.2	0.0	228	84.2	15.8	100.0	0.0
Assam	92.2	3.2	3.6	0.9	1092	41.7	58.3	79.3	20.7
West Bengal	50.0	6.2	34.0	9.8	3407	12.5	87.6	77.6	22.4
Jharkhand	83.7	3.5	12.9	0.0	865	21.2	78.8	99.7	0.3
Orissa	75.5	8.5	14.3	1.7	1990	34.8	65.2	89.6	10.4

(continued)

Table 3 (continued)

Background characteristics	Illness status				Sample size	Disease-type distribution		Multiple chronic conditions distribution (mcc2)	
	No illness	Acute illnesses	Single chronic	Multiple chronic		Acute	Chronic	Single chronic	Multiple chronic
Chhattisgarh	83.7	5.8	10.2	0.4	843	35.3	64.7	96.4	3.6
Madhya Pradesh	84.2	4.3	10.3	1.2	1846	27.1	72.9	89.4	10.6
Gujarat	73.2	4.0	18.4	4.4	1635	14.8	85.2	80.6	19.4
Damam and Diu	93.6	0.4	6.0	0.0	39	6.4	93.6	100.0	0.0
Dadar and Nagar Haveli	85.1	11.0	4.0	0.0	36	73.5	26.5	100.0	0.0
Maharashtra	72.2	4.9	19.0	4.0	4564	17.5	82.5	82.6	17.4
Andhra Pradesh	39.0	1.8	36.8	22.5	1890	2.9	97.1	62.1	37.9
Karnataka	78.1	5.3	12.1	4.4	1841	24.4	75.6	73.3	26.7
Goa	65.5	1.2	31.1	2.3	266	3.4	96.6	93.2	6.8
Lakshadweep	37.3	3.1	24.4	35.3	133	4.9	95.1	40.8	59.2
Kerala	30.3	2.7	33.1	33.8	4025	3.9	96.1	49.5	50.5
Tamil Nadu	77.5	4.6	15.1	2.8	2799	20.4	79.6	84.3	15.8
Pondicherry	81.0	0.3	14.6	4.1	247	1.6	98.4	78.1	21.9
A and N Islands	70.4	0.5	27.8	1.4	211	1.7	98.3	95.2	4.8
Telangana	71.7	5.9	20.7	1.8	840	20.7	79.4	91.9	8.1
Total	**70.0**	**5.0**	**18.7**	**6.2**	**45,956**	**16.8**	**83.2**	**75.1**	**24.9**

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

3.2 Factors Influencing Single Chronic and Multiple Chronic Conditions

Logistic regression was performed to understand the factors influencing the chronic disease as well as multiple chronic conditions (Table 4). The results were presented in the form of an adjusted odds ratio (OR). It can be observed that for a single chronic disease, the elderly from rural areas have quite higher chances of suffering from multiple chronic conditions than their urban counterparts. In the case of gender, the female population has a higher likelihood of getting MCCs and single chronic conditions as compared to their male counterpart in 2017–2018. The probability of getting a chronic disease as well as MCCs among the elderly was also influenced by their age structure as the estimates suggest that the likelihood of getting MCCs increases with the age of the individuals, particularly in the years 2017–2018. Further, income status was also observed to be a major influencing factor for MCCs among the elderly in India. For instance, for a single chronic condition, as compared to the richest elderly population, the elderly belonging to other MPCE categories have a lower likelihood of getting a single chronic disease.

3.3 Incidence Rate Ratio for Multiple Chronic Conditions

Correlates of MCCs among the elderly have been estimated using incidence rate ratios (IRR) produced by negative binomial (negbin) regression models. Results are presented in Table 5. IRR is the relative difference measure used to compare the incidence rates of events occurring at any given point in time. It is the exponential of the coefficients generated from negative binomial regressions. At the national level, the elderly from rural areas have a slightly higher likelihood of developing multiple chronic diseases as compared to their urban counterpart. Incidence of disease by MPCE quintiles suggests that there has been decreasing probability of getting a number of diseases with lowering income. The probability of getting the highest number of diseases was found to be among the elderly from the richest quintile groups. Gender-wise estimates suggest that the female population have higher chances to get multiple numbers of chronic conditions as compared to their male counterpart. The age-wise incidence rate of disease shows that the probability of incidence of disease among the elderly population was increased with rising age.

3.4 Total Health Expenditure and Out-of-Pocket Expenditure

Total expenditure (medical and nonmedical), along with out-of-pocket (OOP) expenditure and its share of total household consumption incurred by the elderly in India, is presented in Tables 6 and 7. It can be observed that, on average, the total expenditure (combining both outpatient and inpatient expenses, expressed monthly) was INR 735, whereas the OOP expenditure was INR 723. This indicates that health care expenditures for the elderly are almost entirely financed by OOP. The share of

Table 4 Logistic regression for chronic (vs. acute) and multiple chronic conditions (vs. single chronic) in India

Explanatory variables	Odds ratio	
	Chronic vs. acute	MCCs vs. single chronic (mcc2)
Place of residence		
Rural	0.937	1.188***
Urban®	1	1
Social group		
Schedule tribes	0.492***	0.606***
Schedule castes	0.817*	0.955
Other backward classes	0.981	1.358***
Others®	1	1
Religion		
Hindu®	1	1
Muslim	1.575***	1.561***
Sikh	0.492***	0.451***
Others	1.567***	2.330***
Household size		
1–3	1.055	1.789***
4–6	1.082	1.555***
7+®	1	1
MPCE quintile		
Lowest	0.299***	0.329***
Lower	0.505***	0.509***
Medium	0.605***	0.602***
Higher	0.873	0.772***
Highest®	1	1
Sex		
Male®	1	1
Female	1.153*	1.178***
Educational attainment		
Not literate	0.687**	0.615***
Primary	0.9	1.206*
Middle	0.885	1.369***
Secondary	0.991	1.122
Higher secondary	0.944	0.864
Graduate and above®	1	1
Age group		
60–65®	1	1
66–70	1.187*	1.175**
71–75	1.134	1.200**
76–80	1.436***	1.274**
>80	1.281*	1.298**
Living arrangement		
Living alone	0.957	1.232

(continued)

Table 4 (continued)

Explanatory variables	Odds ratio	
	Chronic vs. acute	MCCs vs. single chronic (mcc2)
With spouse only	1.126	0.956
With spouse and members	1.134	1
Without spouse-with children	1.11	1.095
Without spouse- with others®	1	1
Physical mobility		
Physically immobile	1.084	1.067
Physically mobile®	1	1
Observations	**13,673**	**11,985**

Note: *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$
Source: Computed from unit-level NSSO 75th round Household Social Consumption in India: Health Survey Data, 2017–2018

OOP expenditure to total household consumption was about 12% and 9%, respectively, at the national level. The pattern of expenditure by illness status suggests that the elderly with chronic illnesses have higher OOP expenditure as compared to those with acute illnesses. Additionally, the elderly with MCCs have a higher OOP expenditure against single chronic conditions.

The income status of the elderly has a clear and visible impact on OOP expenditure and its share of household consumption. Results suggest that the elderly from the richest quintile group reported the highest amount of OOP expenditure, while the share of OOP expenditure to total household consumption was lowest among the same group of population. The gender-wise distribution shows that the share of OOP expenditure was comparatively lower among the female population as compared to their counterpart. Similarly, those who live alone, are physically immobile, and belong to the lowest wealth quintile have the highest percentage of OOP expenditure to total household expenditure. In terms of the geographical distribution of OOP expenditure, a huge variation can be observed across the states, ranging from the highest in Chandigarh (INR 2684) to the lowest in Jammu and Kashmir (INR 456). In several states such as Delhi, Haryana, Uttarakhand, Uttar Pradesh, Bihar, Chhattisgarh, and Madhya Pradesh, the OOP expenditure was reported to be above INR 1000. The highest share of OOP expenditure to the total consumption of households was recorded in Tripura (26%) and the lowest in Goa (3%) among major states.

3.5 Pattern and Determinants of Catastrophic Health Expenditure

Factors affecting catastrophic health expenditure (CHE) (at the 10% threshold of monthly household consumption expenditure) among the elderly population in India have been depicted in Table 8 in the form of an adjusted odds ratio. It was observed that elderly with single chronic conditions have a higher likelihood of CHE as compared to the elderly with multiple chronic conditions. The rural population has

Table 5 Negative binomial regression-incidence rate ratio (IRR) for multiple chronic disease counts in India

Explanatory variables	No chronic vs. Multiple chronic incidence (0, 1, 2, 3. . .) (mcc3)	Single chronic vs. Multiple chronic incidence (1, 2, 3. . .) (mcc4)
Place of residence		
Rural	1.136***	1.074***
Urban®	1	1
Social group		
Schedule tribes	0.371***	0.881**
Schedule castes	0.948	0.994
Other backward classes	1.050*	1.086***
Others®	1	1
Religion		
Hindu®	1	1
Muslim	1.671***	1.085***
Sikh	0.742***	0.894*
Others	1.785***	1.325***
Household size		
1–3	1.440***	1.090**
4–6	1.279***	1.087***
7+®	1	1
MPCE quintile		
Lowest	0.321***	0.828***
Lower	0.492***	0.869***
Medium	0.602***	0.885***
Higher	0.778***	0.948*
Highest®	1	1
Sex		
Male®	1	1
Female	1.117***	1.054**
Educational attainment		
Not literate	0.782***	0.891***
Primary	1.195***	1.036
Middle	1.163***	1.072*
Secondary	1.170***	1.072*
Higher secondary	1.059	1.005
Graduate and above®	1	1
Age group		
60–65®	1	1
66–70	1.209***	1.032
71–75	1.357***	1.078**
76–80	1.488***	1.103***
>80	1.474***	1.080*

(continued)

Table 5 (continued)

Explanatory variables	No chronic vs. Multiple chronic incidence (0, 1, 2, 3. . .) (mcc3)	Single chronic vs. Multiple chronic incidence (1, 2, 3. . .) (mcc4)
Living arrangement		
Living alone	1.341***	1.051
With spouse only	1.087	1.013
With spouse and members	1.001	0.996
Without spouse-with children	1.120*	1.006
Without spouse-with others®	1	1
Physical mobility		
Physically immobile	1.312***	1.004
Physically mobile®	1	1
Observations	***44,666***	***11,980***

Note: *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$
Source: Computed from unit-level NSSO 75th round Household Social Consumption in India: Health Survey Data, 2017–2018

a higher probability of CHE as compared to their urban counterpart. Expectedly, the poorer elderly have much higher risks of CHE as compared to the richest elderly population. For instance, the odds ratio suggests that the magnitude of CHE expectedly increases with the lowering of economic status. Further, living arrangements and physical mobility are also the major influencing factors for catastrophic health expenditure. It was observed that the physically immobile population reported a twofold higher probability of catastrophic health expenditure as compared to the elderly with physical mobility.

The patterns of actual as well as predicted catastrophic health expenditure incurred by the elderly population in India have been presented in Tables 9 and 10. It can be observed that 30% of the elderly with acute illness and 20% of the elderly with chronic illness experienced CHE at the 10% threshold. Similarly, 22.5% and 13% of the elderly in 2017–2018 with single and multiple chronic conditions, respectively, faced CHE. Patterns by place of residence suggest that the elderly from rural areas were more susceptible to CHE than their urban counterpart. The social status of the elderly was also evident in the pattern of CHE as Scheduled Tribes reported the highest prevalence of both actual and predicted catastrophic health expenditure. Overall, CHE by MPCE suggests that the share of CHE expectedly increases with decreasing income levels of the population. Similarly, the male population has a higher CHE than their female counterpart. The elderly who live alone and are physically immobile have a much higher percentage of CHE. Overall, at the national level, 22% and 24% of the elderly population share the actual and predicted CHE, respectively.

Table 6 Total expenditure and out-of-pocket expenditure incurred by elderly by background characteristics in India

Background characteristics	Medical expenditure (Rs)	Nonmedical expenditure (Rs)	Total health expenditure (Rs)	OOPE (Rs)	OOPE share (%) to total household consumption
Illness status					
Acute illness	693.3	139.8	766.1	765.2	10.4
Chronic	696.6	120.0	728.6	722.1	8.7
Multiple chronic conditions (MCC2)					
One chronic	764.9	130.2	802.8	795.5	9.6
Multiple chronic	485.3	80.5	498.4	494.2	5.8
Place of residence					
Rural	634.6	135.4	679.7	677.8	10.3
Urban	779.1	106.1	813.3	802.6	7.1
Social group					
Schedule tribes	461.8	130.8	510.6	510.5	10.4
Schedule castes	825.9	127.7	854.7	852.4	13.8
Other backward classes	603.0	120.6	634.3	633.3	8.4
Others	752.5	125.5	807.8	796.3	7.7
Religion					
Hindu	704.6	121.3	740.7	733.9	9.1
Muslim	632.4	147.0	681.8	681.6	7.5
Sikh	813.6	126.8	902.3	901.7	6.4
Others	650.3	119.6	693.6	692.2	9.8
Household size					
1–3	629.8	115.1	654.5	650.3	12.3
4–6	757.3	131.7	804.5	796.4	7.8
7+	668.4	121.9	719.8	718.2	5.0
MPCE quintile					
Lowest	523.4	117.6	581.7	581.7	15.1
Lower	729.2	141.3	764.7	764.7	12.8
Medium	566.5	124.9	611.4	611.1	8.3
Higher	754.6	122.0	772.0	768.6	8.2
Highest	765.3	118.6	810.3	796.4	5.7
Sex					
Male	716.8	131.0	765.7	757.7	8.6
Female	676.0	117.3	706.2	703.1	9.3
Educational attainment					
Not literate	575.2	120.5	611.5	610.3	9.7
Primary	658.1	118.8	690.9	689.8	7.7
Middle	675.5	137.7	730.0	720.8	7.8

(continued)

Table 6 (continued)

Background characteristics	Medical expenditure (Rs)	Nonmedical expenditure (Rs)	Total health expenditure (Rs)	OOPE (Rs)	OOPE share (%) to total household consumption
Secondary	756.6	127.8	817.1	815.1	6.8
Higher secondary	1436.3	150.9	1518.6	1498.0	19.9
Graduate and above	969.8	123.8	1031.7	994.8	7.3
Age group					
60–65	700.8	112.9	728.4	726.3	9.9
66–70	648.6	125.0	698.2	691.6	9.3
71–75	634.2	119.3	666.4	658.7	6.2
76–80	687.0	143.7	747.1	729.8	7.0
>80	945.2	181.3	1012.9	1007.9	10.0
Living arrangement					
Living alone	572.4	84.7	550.3	550.2	20.9
With spouse only	688.4	114.0	719.9	715.1	12.0
With spouse and members	760.1	133.7	813.6	803.0	7.5
Without spouse-with children	627.3	121.8	667.9	667.7	6.7
Without spouse-with others	706.9	141.6	736.3	735.3	9.0
Physical mobility					
Physically immobile	1045.9	182.4	1091.7	1087.8	10.5
Physically mobile	653.2	116.9	691.1	685.3	8.8
Total	**696.0**	**124.0**	**735.1**	**729.6**	**9.0**

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

3.6 Inequality and Burden of Out-of-Pocket Expenditure

Inequality in OOP expenditure at the national level among the elderly in India has been addressed through concentration indices (Fig. 1a) and concentration curves (Fig. 1b). The calculation of the concentration index (CI) equals twice the area between the concentration curve and the line of equality (Quintal, 2019). Where there is no inequality, the CI is zero; a negative (positive) CI indicates a disproportionate concentration of the given variable among the worse-off (well-off). It can be observed that all values of the concentration indices were positive, indicating pro-rich OOP expenditure. However, there are variations when comparing it by place of residence. For instance, the elderly with acute illness share the highest

Table 7 Total expenditure and out-of-pocket expenditure incurred by elderly by states in India

Background characteristics	Medical expenditure (Rs)	Nonmedical expenditure (Rs)	Total health expenditure (Rs)	OOPE (Rs)	OOPE share (%) to total household consumption
State					
Jammu and Kashmir	366.1	109.3	456.4	456.4	5.0
Himachal Pradesh	1027.6	228.3	1154.2	1116.9	10.4
Punjab	774.2	71.7	828.2	827.8	5.9
Chandigarh	2216.6	469.0	2684.0	2488.8	4.4
Uttaranchal	791.3	170.6	946.3	946.3	6.6
Haryana	896.8	116.0	954.2	950.4	7.1
Delhi	1133.9	103.5	1131.2	1084.7	5.4
Rajasthan	1026.3	240.7	1162.1	1157.7	10.2
Uttar Pradesh	891.0	164.5	989.0	988.0	13.5
Bihar	591.2	68.2	636.5	636.5	8.5
Sikkim	432.9	124.6	556.6	552.0	4.6
Arunachal Pradesh	1034.9	685.0	1615.5	1615.5	19.4
Nagaland	483.2	119.1	501.3	501.3	4.8
Manipur	1213.7	311.8	1514.5	1514.5	13.5
Mizoram	654.1	186.4	773.7	750.2	3.4
Tripura	1639.3	413.4	2043.5	2043.5	29.5
Meghalaya	609.7	273.9	700.3	700.3	4.0
Assam	593.1	208.2	677.7	668.2	8.5
West Bengal	862.3	101.2	883.8	869.0	10.3
Jharkhand	624.0	190.1	781.2	779.2	9.7
Orissa	571.9	133.5	666.4	666.4	17.6
Chhattisgarh	449.1	64.6	505.4	505.4	9.1
Madhya Pradesh	890.0	223.8	1042.3	1037.2	13.8
Gujarat	580.6	103.0	596.1	593.5	5.9
Damam and Diu	382.7	47.4	429.9	429.9	5.1
Dadar and Nagar Haveli	1276.9	62.7	325.6	325.6	3.5
Maharashtra	558.7	106.4	625.1	621.4	8.5
Andhra Pradesh	499.6	87.0	528.8	527.3	8.5
Karnataka	722.1	143.2	747.4	746.8	7.1
Goa	524.7	209.1	500.2	499.0	3.7
Lakshadweep	265.2	316.4	379.9	379.9	2.8
Kerala	567.6	115.5	603.3	598.9	5.9
Tamil Nadu	693.5	130.4	529.7	529.7	8.0
Pondicherry	745.7	255.7	588.4	588.4	4.5

(continued)

Table 7 (continued)

Background characteristics	Medical expenditure (Rs)	Nonmedical expenditure (Rs)	Total health expenditure (Rs)	OOPE (Rs)	OOPE share (%) to total household consumption
A and N Islands	3001.0	82.7	862.8	862.8	3.0
Telangana	679.5	128.2	699.3	698.2	6.0
India	**696.0**	**124.0**	**735.1**	**729.6**	**9.0**

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

amount of OOP expenditure followed by single chronic and MCCs. The concentration curve for OOP expenditure was also plotted to understand its burden (Fig. 1b). The concentration curve plots the cumulative percentage of OOPE (y-axis) against the cumulative percentage of the population (in this case, households), ranked by MPCE, beginning with the poorest and ending with the richest (x-axis). The curve lay below the 45° straight line, indicating that at the national level, a larger share of the burden of OOP expenditure was borne by the elderly who belong to richer quintile groups.

The unequal economic impact experienced due to disproportionate OOP expenditure can be better understood once levels of expenditure (or income) are adjusted. This is carried out by estimating the concentration indices and concentration curves by using the share of OOP expenditure as a proportion of total household consumption (Fig. 2a). Along expected lines, the burden can be now clearly observed to have shifted to those elderly who belong to poor MPCE quintile groups, as indicated by negative values of concentration indices. A larger share of the burden of OOP expenditure was borne by the elderly suffering from multiple chronic conditions and living in rural India. In Fig. 2b, the concentration curve plots the cumulative percentage of the share of OOPE (y-axis) against the cumulative percentage of the households, ranked by MPCE, beginning with the poorest and ending with the richest (x-axis). Concentration curves (Fig. 2b) also depicted the same pattern of OOP burden as the lines of all categories of illness were above the 45° straight line, indicating the burden of OOP expenditure was borne by households from lower economic strata.

3.7 Inequality and Burden of Catastrophic Health Expenditure

Concentration indices for actual catastrophic health expenditure at the 10% threshold were plotted in Fig. 3a. It can be observed that the larger share of actual CHE was born by the elderly who belong to lower economic strata and live in rural India. Particularly at the national level, the highest CHE is shared by the rural population with multiple chronic conditions. In Fig. 3b, the concentration curve plots the cumulative percentage of CHE (y-axis) against the cumulative percentage of the households, ranked by MPCE, beginning with the poorest and ending with the

Table 8 Logistic regression for catastrophic health expenditure in India

Explanatory variables	Odds ratio (OR)
Illness status	
Acute	1.351***
Single chronic®	1
Multiple chronic	0.419***
Place of residence	
Rural	1.108
Urban®	1
Social group	
Schedule tribes	0.689**
Schedule castes	0.884
Other backward classes (OBCs)	0.971
Others®	1
Religion	
Hindu®	1
Muslim	0.848*
Sikh	0.96
Others	0.912
Household size	
1–3	4.254***
4–6	1.840***
7+®	1
MPCE quintile	
Lowest	5.539***
Lower	3.339***
Medium	2.386***
Higher	1.732***
Highest®	1
Sex	
Male®	1
Female	0.899*
Educational attainment	
Not literate	0.629***
Primary	0.677***
Middle	0.713**
Secondary	0.865
Higher secondary	1.18
Graduate and above®	1
Age group	
60–65®	1
66–70	0.973
71–75	0.831*
76–80	0.967
>80	0.863

(continued)

Table 8 (continued)

Explanatory variables	Odds ratio (OR)
Living arrangement	
Living alone	2.072***
With spouse only	1.442*
With spouse and members	0.906
Without spouse-with children	0.892
Without spouse-with others®	1
Physical mobility	
Physically immobile	1.911***
Physically mobile®	1
Observations	**12,917**

Note: *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$
Source: Computed from unit-level NSSO 75th round Household Social Consumption in India: Health Survey Data, 2017–2018

richest (x-axis). The concentration curve (Fig. 3b) also suggests a visible pattern of inequality in the burden of CHE for all type of illness where the poor suffers more. Inequality is higher among poor-rich in the case of MCCs.

The concentration indices for the probability of CHE at 10% were plotted to understand the inequalities at the national level (Fig. 4a). The burden of CHE was highest across all categories of illness wherein again elderly from rural India shared the highest CHE compared to their urban counterpart. Further, the concentration curve in Fig. 4b plots the cumulative percentage of predicted probability of CHE (y-axis) against the cumulative percentage of households with the elderly, ranked by MPCE, beginning with the poorest and ending with the richest (x-axis). It can be seen that there is a persistent inequality among poor-rich in catastrophic health expenditure for all illnesses, and the lower MPCE quintiles suffer more as the representing line is above the 45° straight line in the plots. The concentration curve for multiple chronic conditions shows that there is more inequality among poor-rich.

4 Summary of the Key Findings

Understanding how to effectively care for persons with multiple chronic conditions is one of the most important challenges facing India's health care system. Despite a considerable amount of research into specific chronic conditions, there is little information about the prevalence of MCCs. This study highlights the issue of the growing prevalence of multiple chronic conditions and co-morbidities, particularly among the elderly, in countries like India with stretched public primary health care systems. Countries like India face a pressing need to establish adequate, effective, equitable service coverage, replacing mixed, fragmented systems with regressive financing practices (out-of-pocket) which increases risks of inequity in coverage and unmet needs. Earlier evidence indicates that the higher burden of MCCs is

Table 9 Catastrophic health expenditure incurred by elderly by background characteristics in India

Background characteristics	Catastrophic health expenditure (CHE) at 10% threshold	
	Actual	Predicted*
Illness status		
Acute illness	30.3	32.9
Chronic	20.2	22.1
Multiple chronic conditions (MCC2)		
One chronic	22.5	24.8
Multiple chronic	12.9	13.6
Place of residence		
Rural	25.4	27.7
Urban	17.0	18.7
Social group		
Schedule tribes	29.8	30.0
Schedule castes	28.5	27.2
Other backward classes	20.6	24.1
Others	20.2	22.2
Religion		
Hindu	22.7	25.1
Muslim	19.5	20.4
Sikh	19.6	18.1
Others	17.5	18.7
Household size		
1–3	32.5	35.2
4–6	17.3	18.5
7+	11.9	14.6
MPCE quintile		
Lowest	36.0	39.5
Lower	30.2	30.7
Medium	20.2	23.9
Higher	19.7	20.5
Highest	15.1	17.3
Sex		
Male	22.3	24.5
Female	21.6	23.4
Educational attainment		
Not literate	24.1	26.6
Primary	20.6	21.2
Middle	20.7	22.1
Secondary	17.5	21.5
Higher secondary	30.4	27.7
Graduate and above	16.5	22.4
Age group		
60–65	22.8	25.8
66–70	25.0	25.3

(continued)

Table 9 (continued)

Background characteristics	Catastrophic health expenditure (CHE) at 10% threshold	
	Actual	Predicted*
71–75	18.1	19.4
76–80	19.2	23.0
>80	18.1	19.4
Living arrangement		
Living alone	40.1	43.5
With spouse only	33.1	36.5
With spouse and members	17.8	19.5
Without spouse-with children	17.6	19.0
Without spouse-with others	23.7	26.2
Physical mobility		
Physically immobile	25.0	28.9
Physically mobile	21.5	23.4
Total	**21.9**	**24.0**

Note: Predicted CHE (Probability of CHE) at 10% threshold is based on logistic regression result in Table 8

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

concentrated among the better SES – higher expenses on treatment for MCCs, but cushioned due to a proportionately adequate ability to pay. However, some primary evidence on unreported conditions such as undiagnosed and untreated cases suggests that there is a gradient skewed against poor SES. The elderly population experiences a disproportionally high OOP expenditure burden. Based on a comprehensive assessment of a national survey dataset on elderly health in India, this study identified the major correlates of MCCs among the elderly in India. Also, it extended the literature by considering alternative functional forms of the outcome variable, different econometric specifications, and comparing the coefficients across models for any chronic condition risks, and similarly for multiple chronic conditions.

The association between MCCs and SES reflects that there have been steady increases in MCCs with income measured through MPCE. Further, there was a weaker correlation between education and MCC. In terms of contextual factors, the MCCs were found to be higher in urban areas; however, one in every four rural elderlies in India reportedly suffers from MCCs. A negative binomial (negbin) regression model for "counts" of MCCs reaffirms the descriptive patterns. It was observed that there has been an increase in MCCs with rising ages; however, it narrows across the sexes. There was an interesting pattern across the welfare indicators such as MPCE, but education appeared weakly associated with MCCs. Rural areas exceed urban areas in overall chronic disease, providing enough indication of the rowing (and equalizing) burden of MCCs among the elderly in rural India.

Unconditional logit models predict higher risks of any chronic conditions, as well as multiple conditions among the wealthy, the better-educated, and expectedly older people. In addition to that, low-SES individuals are more likely to have undiagnosed

Table 10 Catastrophic health expenditure incurred by elderly by states in India

Explanatory variables	Catastrophic health expenditure (CHE)	
	Actual	Predicted*
State		
Jammu and Kashmir	9.5	21.1
Himachal Pradesh	25.4	21.0
Punjab	19.5	16.8
Chandigarh	3.1	15.2
Uttaranchal	29.4	24.1
Haryana	13.5	21.8
Delhi	19.9	15.9
Rajasthan	31.0	21.6
Uttar Pradesh	34.9	28.0
Bihar	29.6	30.8
Sikkim	12.9	18.7
Arunachal Pradesh	75.1	30.7
Nagaland	0.1	15.6
Manipur	56.6	23.2
Mizoram	4.0	13.5
Tripura	64.3	25.3
Meghalaya	13.0	26.0
Assam	28.8	26.3
West Bengal	21.1	24.9
Jharkhand	18.3	27.7
Orissa	47.4	39.1
Chhattisgarh	33.6	39.1
Madhya Pradesh	29.8	27.0
Gujarat	16.7	19.4
Damam and Diu	–	43.7
Dadar and Nagar Haveli	13.9	41.8
Maharashtra	17.1	25.1
Andhra Pradesh	19.9	24.2
Karnataka	18.2	23.0
Goa	4.4	18.3
Lakshadweep	3.1	6.3
Kerala	14.2	16.9
Tamil Nadu	25.4	28.8
Pondicherry	7.3	17.0
A and N Islands	4.5	21.2
Telangana	12.7	22.6
India	**21.9**	**24.0**

Note: Predicted CHE (Probability of CHE) at 10% threshold is based on logistic regression result in Table 8

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

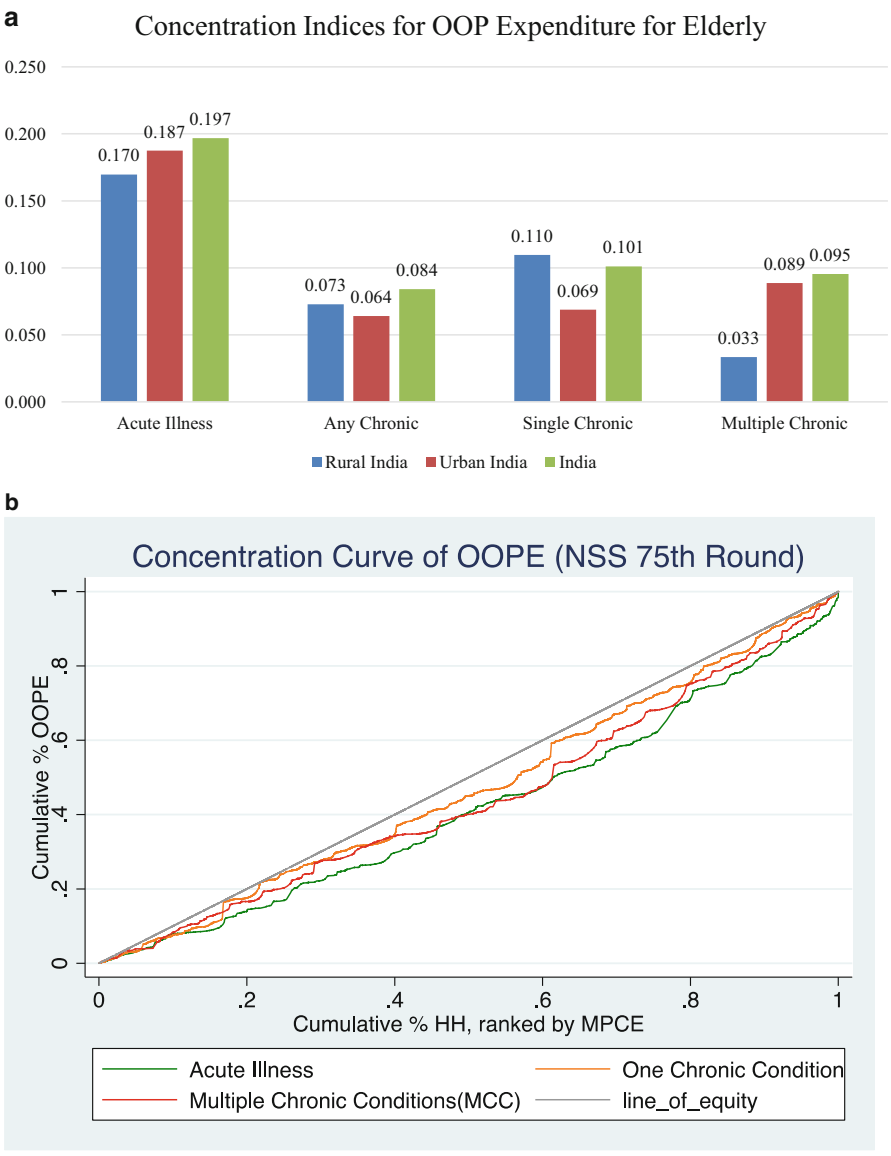

Fig. 1 (**a**) Concentration indices for OOP expenditure for elderly in India, NSS 75th round data 2017–2018. (**b**) Concentration curve for OOP expenditure for elderly in India, NSS 75th round data (2017–2018)

and untreated health conditions. This probably leads to positive concentration indices. NSSO data reveals a strong significance of household income in distinguishing higher counts for chronic conditions, compared to those with none, but the significance withers away in state samples that only consider chronic patients

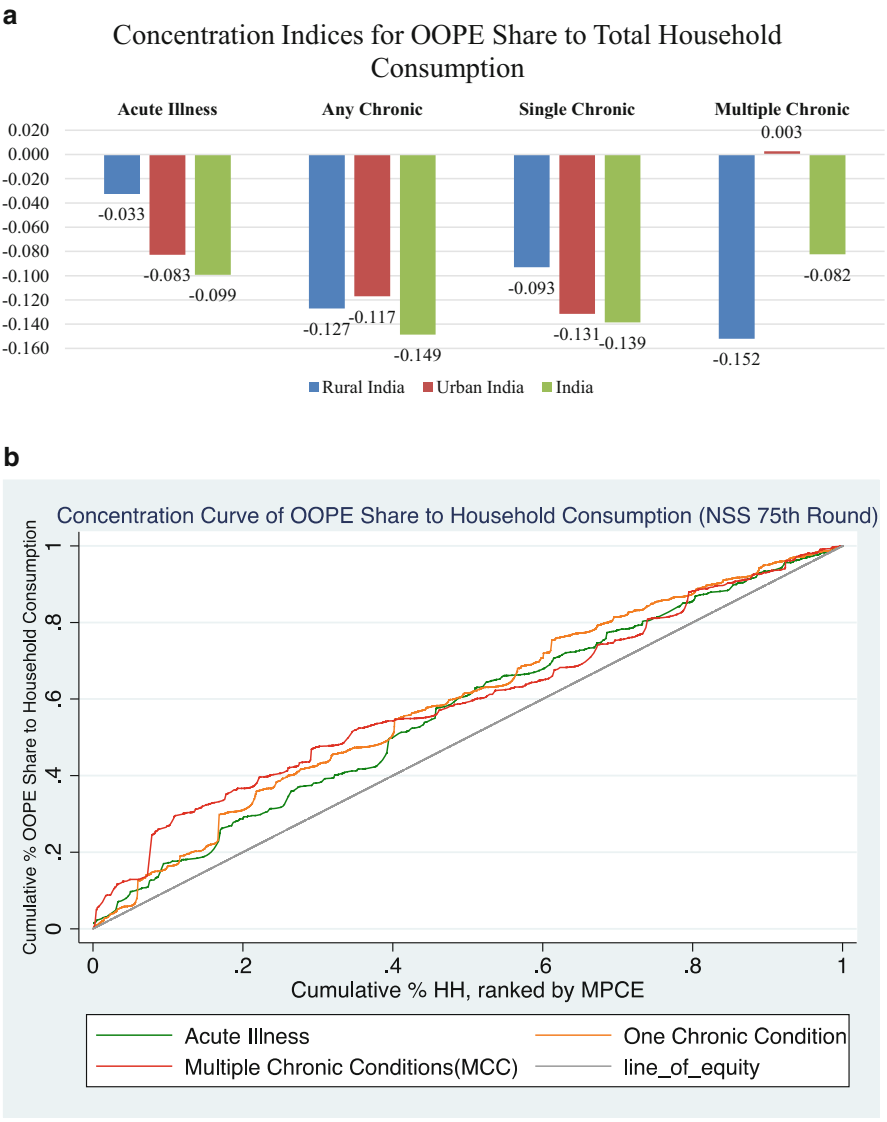

Fig. 2 (**a**) Concentration indices for OOPE share to total household consumption in India, NSS 75th round data (2017–2018). (**b**) Concentration curve for OOPE share to total household consumption in India, NSS 75th round data (2017–2018)

and assess the marginal risks of a higher multiple chronic disease count. OOP health expenditure varies significantly among the elderly with and without MCCs – a pro-rich pattern is evident but inequity is evident in the disproportionate share of household budgets borne by the elderly from poor households. The poor spend less, but often a larger share of the family's purse, on treating MCCs. For standard household-level welfare indicators, inequalities are pro-rich, and MCCs don't make a big difference,

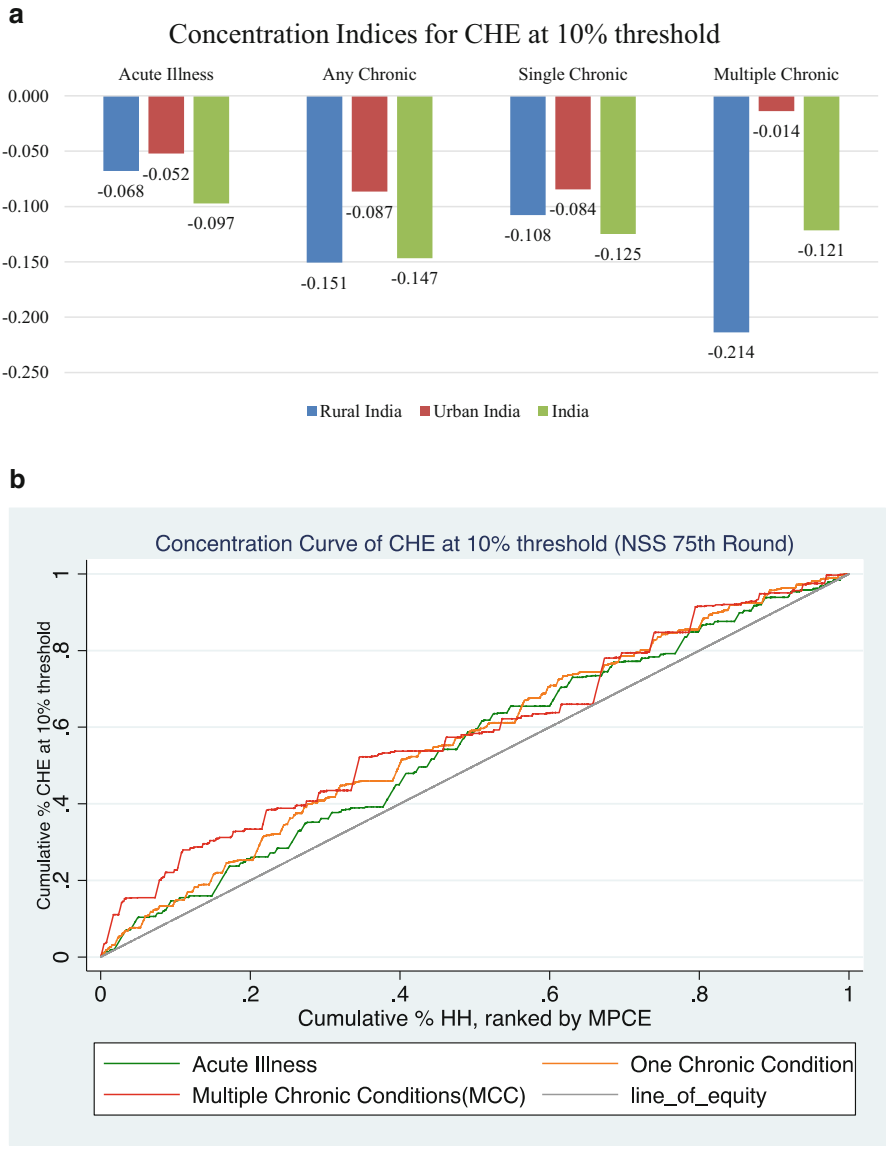

Fig. 3 (**a**) Concentration indices for CHE in India, NSS 75th round data (2017–2018). (**b**) Concentration curve for CHE in India, NSS 75th round data (2017–2018)

but with individual welfare measures, inequalities are biased against the poor in all states, but that's a similar story with any chronic conditions as well.

A limitation of this study was that it had not dealt with supply-side issues in the selected states, for example, the public-private mix of service providers, their location, quality, and costs, which could be important determinants of the quantum of OOP health expenditure and its variation.

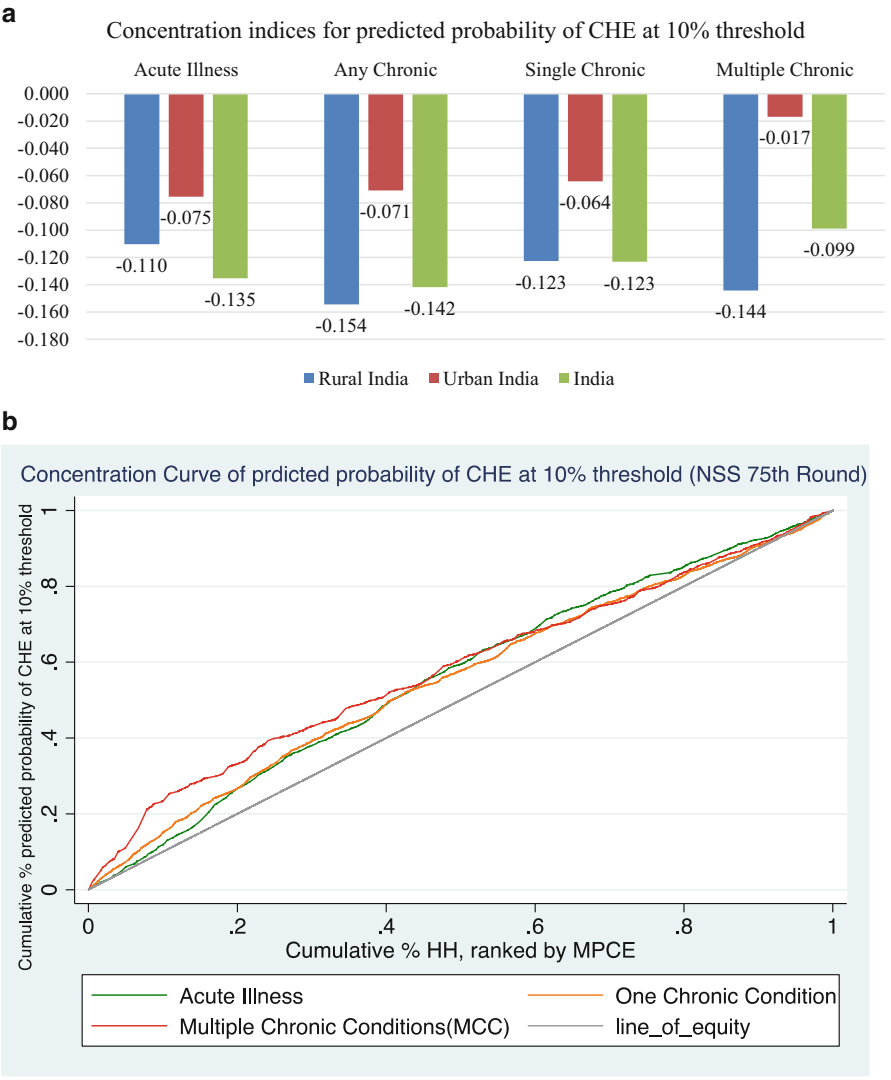

Fig. 4 (**a**) Concentration indices for predicted probability of CHE in India, NSS 75th round data (2017–2018). (**b**) Concentration curve for predicted probability of CHE in India, NSS 75th round data (2017–2018)

5 Conclusion

This study brings out distinct dissimilarities in the equity aspect and incidence of the burden from OOP expenses as well as catastrophic health expenditure on health care across the states and at the national level. Multiple chronic conditions among the elderly emerge as important predictors of overall inequality in health care use and

access. Moreover, these conditions create a higher predisposition to incur disproportionately higher medical expenditures. The population, especially the elderly suffering from MCCs, intensifies more structural inequalities in the welfare distribution, acknowledging its typical gradient and patterns among the elderly. Future studies pertaining to elderly health dynamics could help in building a body of evidences, thereby leading to a more comprehensive, targeted, and robust policy environment in India's health system.

References

Alam, M., Mazumdar, S., & Yadav, P. (2015). *Inequalities in elderly health and wellbeing in India: An exploration* (BKPAI Working Paper Series).

Baker, T. A., Clay, O. J., Johnson-Lawrence, V., Minahan, J. A., Mingo, C. A., Thorpe, R. J., Ovalle, F., & Crowe, M. (2017). Association of multiple chronic conditions and pain among older black and white adults with diabetes mellitus. *BMC Geriatrics*. https://doi.org/10.1186/s12877-017-0652-8

Balarajan, Y., Selvaraj, S., & Subramanian, S. (2011). Health care and equity in India. *The Lancet*. https://doi.org/10.1016/S0140-6736(10)61894-6

Barnett, K., Mercer, S. W., Norbury, M., Watt, G., Wyke, S., & Guthrie, B. (2012). Epidemiology of multimorbidity and implications for health care, research, and medical education: A cross-sectional study. *The Lancet*. https://doi.org/10.1016/S0140-6736(12)60240-2

Bhan, N., Rao, K. D., & Kachwaha, S. (2016). Health inequalities research in India: A review of trends and themes in the literature since the 1990s. *International Journal for Equity in Health*. https://doi.org/10.1186/s12939-016-0457-y

Buttorff, C., Ruder, T., & Bauman, M. (2017). Multiple chronic conditions in the United States. *Multiple Chronic Conditions in the United States*. https://doi.org/10.7249/tl221

Diederichs, C., Berger, K., & Bartels, D. B. (2011). The measurement of multiple chronic diseases – A systematic review on existing multimorbidity indices. *Journals of Gerontology – Series A Biological Sciences and Medical Sciences*. https://doi.org/10.1093/gerona/glq208

Hajat, C., & Stein, E. (2018). The global burden of multiple chronic conditions: A narrative review. *Preventive Medicine Reports*. https://doi.org/10.1016/j.pmedr.2018.10.008

Lefèvre, T., d'Ivernois, J. F., De Andrade, V., Crozet, C., Lombrail, P., & Gagnayre, R. (2014). What do we mean by multimorbidity? An analysis of the literature on multimorbidity measures, associated factors, and impact on health services organization. *Revue d'Epidemiologie et de Sante Publique*. https://doi.org/10.1016/j.respe.2014.09.002

Marengoni, A., & Vetrano, D. L. (2021). Multimorbidity: Disease of society? *The Lancet Healthy Longevity*. https://doi.org/10.1016/S2666-7568(21)00167-7

Marengoni, A., Angleman, S., Melis, R., Mangialasche, F., Karp, A., Garmen, A., Meinow, B., & Fratiglioni, L. (2011). Aging with multimorbidity: A systematic review of the literature. *Ageing Research Reviews*. https://doi.org/10.1016/j.arr.2011.03.003

McPhail, S. M. (2016). Multimorbidity in chronic disease: Impact on health care resources and costs. *Risk Management and Healthcare Policy*. https://doi.org/10.2147/RMHP.S97248

Parekh, A. K., Goodman, R. A., Gordon, C., & Koh, H. K. (2011). Managing multiple chronic conditions: A strategic framework for improving health outcomes and quality of life. *Public Health Reports*. https://doi.org/10.1177/003335491112600403

Quintal, C. (2019). Evolution of catastrophic health expenditure in a high income country: Incidence versus inequalities. *International Journal for Equity in Health, 18*(1), 1–11.

World Health Organization. (2014). *World Health Organization – Noncommunicable Disease (NCD) country profile, 2014*. World Health Organisation.

World Health Organization. (2021). *World Health Organization – Ageing and health fact sheet, 2021*. World Health Organization.