Catastrophic impact of multimorbidity on households in India: a cross-section analysis of self-reported morbidity from National Sample Survey 2017

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Abstract

Background: The purpose of this research is to generate new evidence on economic consequences of multimorbidity on households in terms of out-of-pocket (OOP) expenditures and its catastrophic impact.

Methods: We analyzed Social Consumption Health data from National Sample Survey Organization (NSSO) 75th round conducted in the year 2017-2018 in India. Prevalence of multimorbidity and related OOP expenditure were estimated. Using Coarsened Exact Matching (CEM) we estimated mean OOP expenditure for individuals reporting multimorbidity and single morbidity for each episode of outpatient visits and hospital admission. We also estimated the catastrophic impact of multimorbidity on households.

Results: Our matched sample analysis suggests that that OOP expenditure is invariably lower in case of outpatient treatment of the selected Non Communicable Diseases(NCDs) whereas in case of hospitalization, the OOP expenditures were mostly higher for the same NCD conditions in the presence of multimorbidity as compared with single conditions, except for cancers and cardiovascular disease. Furthermore, around 46.7% (46.674 - 46.676)households reported incurring catastrophic spending (10% threshold) because of any NCD in standalone disease scenario which rose to 63.3% (63.359-63.361) under multimorbidity scenario. The catastrophic impact of cancer among the individual diseases was the highest.

Conclusions: Implementing financial risk protection measures to reduce the burden of household OOP expenditure is required at the country level.

Introduction

Globally, an unprecedented increase in non-communicable disease (NCD) risks factors[1] has led to rise in chronic health conditions[2]. These chronic conditions interact and tend to cluster together leading to a state of multimorbidity - defined as co-existence of two or more chronic health conditions in an individual, without a defining primary index disease[3]. Multimorbidity becomes progressively more common with ageing and is linked to high mortality and reduced functional status[4]. Multimorbidity is challenging not only to the patient, because of negative health consequences, but also to the healthcare system due to multiple consultations for care [5, 6]. A large retrospective study from England has reported that depending upon the number of NCDs and the age group of participants included, the prevalence of multimorbidity is highly variable. The study suggests that patients with multimorbidity accounted for 52.9% of general practice consultations, 78.7% of prescriptions, and 56.1% of hospital admissions[7]. The situation in the low- and middle-income countries is no different. A systematic review reported that in South Asia, the prevalence of multimorbidity varied between 4.5–83%. The review also highlighted lowered physical functioning and increased healthcare utilization as most frequently reported outcomes. [8] Furthermore, in developing countries where healthcare is overwhelmingly financed by out-of-pocket (OOP) payments, households face significant drain on their resources. Latest evidence from India suggests that an estimated 55 million households experienced catastrophic healthcare expenditure in the year 2014 and non-communicable disease constitutes a significantly large proportion of the total catastrophic expenditure [9].

While a consensus methodology on measurement of economic consequences of multimorbidity is yet to established, literature on costs of treatment of multimorbidity[10, 11] has increased. A systematic review of cost of illness (COI) studies in multimorbidity concluded that despite substantial methodological variations between COI studies across different countries and health system settings, there is consistent evidence of considerable economic burden associated with multimorbidity[12]. Past research has also demonstrated that households incur high OOP expenditure for NCD treatment. [10, 13–17]

However, there is little evidence whether household’s are able to adequately finance healthcare needs of each member of the household for each NCDs in the presence of multimorbidity. In this study, using nationally representative data from India, we estimated households’ OOP expenditure for selected NCDs when reported as standalone disease and for the same NCD in presence of competing NCDs (multimorbidity).

We argue that in the presence of competing NCDs (multimorbidity), households fail to finance treatment and care of all the NCDs adequately that involve large healthcare expenditure. The competing risk and demand for care for each NCD may force households to forego or under finance treatment and care of co-existing morbidities. In general, health conditions such as cancers,

injuries, and cardiovascular diseases are known to involve high healthcare expenditure[9] and in presence of competing NCDs (multimorbidity) even small OOP expenditures may turn catastrophic for the households.

Our main objective is to estimate households' OOP expenditure for selected NCDs when reported as single morbidity and OOP expenditure on the same NCDs in presence of competing NCDs (multimorbidity).. In addition, we also aim to report catastrophic impact of selected NCDs on the households.

Material And Methods

Data source and sample

We analysed the Social Consumption: Health (SCH) data from National Sample Survey Office (NSSO) 75th round (Schedule 25.0; July 2017 to June 2018)[18]. Nationally, ~ **1,13,823** households (**64,552** in rural areas and **49,271** from urban areas) were included in the survey through a multistage stratified random sampling process. The information is collected from selected households using a questionnaire schedule (25.0). The SCH (2017-18) survey was used for disease level classifications of OOP expenditures in outpatient and inpatient care. The survey also collected information on self-reported morbidity status of individual household members in addition to range of socio-economic identifiers.

The NSSO schedule recorded response of individuals/households to specific questions eliciting information on healthcare utilization and reason for the same. For example- to determine chronic conditions respondents were asked "whether suffering from any chronic/other ailment". In addition, the survey also asked, "What was the nature of the ailment" classified by 60 different health conditions both for inpatient (365 days reference period) and outpatient (15 days reference) treatment. From these health conditions non-communicable diseases and comorbidities for each individual can be identified. Respondent also recorded more than one conditions, if they suffered with during the respective recall periods. We matched the disease condition in the surveys to broad ICD disease classification to distinguish between major non-communicable diseases (including injuries) and communicable diseases [13]. SCH survey also separately records expenses incurred for inpatient and outpatient care with respective reference period for each episode of treatment.

Definition of multimorbidity

We considered individual as having multimorbidity if (i) currently living with two or more non-communicable diseases; or (ii) hospitalized due to multimorbidity in the year preceding the survey, whether or not the affected individual was currently alive.

Outcome measures

We report (a) prevalence of multimorbidity by gender and age groups, (b) prevalence of selected non-communicable diseases, (c) mean OOP expenditure on outpatient care per episode for selected NCDs in the preceding 15 days, (d) mean OOP spending per hospitalization for selected NCDs in the preceding year and (e) proportion of households with selected NCDs related expenditures (outpatient and/or hospitalization) reporting catastrophic expenditure (10% and 20% threshold). All outcomes were estimated and reported for age 40 years and above.

Statistical Analysis

Prevalence of NCDs was standardized to age and sex distribution of the Indian population for the year 2017-18. We prepared a matrix of all NCDs reported in the NSSO survey and reported proportion of individuals with no NCD, single NCD and co-existent NCDs among all individuals in the survey population.

We estimated the cost of treatment of selected NCD by estimating mean OOP expenditure for each episode of outpatient visit and hospital admission. Mean OOP expenditure was estimated for the selected NCD in case of single morbidity as well as multimorbidity. For example, we estimated expenditure on cancer treatment when individual had cancer alone versus expenditure on cancer when an individual had another NCD in addition to cancer.

We also estimated catastrophic expenditure as defined by percentage of households reporting OOP payments being higher to certain thresholds (for example 10% or 20%) of households' total consumption expenditure among the households reporting NCDs related expenditure on account of outpatient care and/or hospitalization. We also used households' non-food expenditure as an alternative to total consumption expenditure.[19, 20]

Since NCDs may be associated with a large number of socio-economic and demographic confounders [21], a direct comparison of individuals reporting single NCD with those reporting more than one NCD may produce a biased result. To address this, we created a matched sample of individuals with single and multimorbidity by controlling a range of observed socio-economic and demographic indicators and estimated the difference in OOP expenditure for treatment of any particular NCD across individuals with and without multimorbidity in the matched sample.

We used Coarsened Exact Matching (CEM) method [22] to create a sub-sample of individuals reporting 2 or more NCDs ('treatment' group) and single NCD ('control') with minimum possible differences in the observed socio-economic and demographic indicators. CEM uses the principle of Exact Matching (EM) and balances each indicator used in the matching by coarsening each variable into groups. The advantage of using CEM, as against other poplar matching methods such as Propensity Score Matching (PSM), is CEM guarantees reduction in basis in each indicator as compared with ex-ante situation [23]. A weighting variable generated by CEM method is used to equalize the number of observations within comparison groups [24,25]. The variables used for CEM included: (i) geographic region (6 categories), (ii) area of residence (rural-urban), (iii) monthly per person consumption expenditure (5 categories), (iv) religion (Hindu, Minority), (v) caste (3 categories), (vi) main source of livelihood (3 categories), (vii) age groups (4 categories), (viii) level of education (3 categories) and (ix) health insurance (insured, not-insured) (Appendix Table AII)

CEM reduced the sample size from 36,873 to 36,632 (from 30,150 to 29,912 in the control group and from 6,723 to 6,720 in the treatment group). The balancing results reflect that although there is a small change in the overall imbalance, many covariates reflect significant reduction in the biases in the matched sample (Annexure Table AIII). The multivariate L1 imbalance after matching reduced from 0.964 to 0.956, whereas among the individual covariates, bias reduced by 93% for geographical region, 29% for monthly per capita expenditure, 67% for household type and 41% in case of insurance.

As a part of sensitivity analysis, we also used PSM method to create matched sample. (Appendix Table AVI) In addition, we re-estimated our results after excluding households that experienced a death in the previous year. Data were analyzed using Stata software V.15.0 (StataCorp LP, College Station, Texas, USA) and p values of less than 0.05 were considered statistically significant. All analyses were carried out using sampling weight.

Ethical Approval and Consent to Participate

The study uses anonymized secondary data which is publicly available from the NSSO and hence doesn't involve any ethical issues and approval from an ethics committee or consent to participate.

Results

Prevalence of NCD

Table 1: Percentage population reporting no, single and more than one morbidity in age group 40 years and above, by men and women (15 days' recall reference)

Table 1
Percentage population reporting no, single and more than one morbidity in age group 40 years and above, by men and women (15 days' recall reference)

Table 1	Men				Women			
	Number of chronic diseases				Number of chronic diseases			
Age	0	1	2	> 2	0	1	2	> 2
40–44	95.45	4.32	0.23	0.01	91.96	7.53	0.48	0.03
45–49	93.33	5.79	0.73	0.15	89.24	9.19	1.36	0.21
50–54	90.02	8.83	0.91	0.24	86.38	11.1	1.95	0.57
55–59	88.65	10	1.12	0.22	83.23	13.73	2.39	0.66
60–64	74.63	20.58	3.31	1.49	75.78	18.84	4.26	1.12
65–69	74.42	20.14	4.11	1.33	71.28	22.66	3.57	2.48
70–79	66.36	24.91	6.18	2.55	67.92	24.17	4.17	3.75
80&above	59.65	26.83	8.66	4.85	60.62	29.43	6.03	3.92
40&above	80.31	15.18	3.16	1.36	78.30	17.08	3.03	1.59
Source: Authors' estimates using SCH 2017-18								

Our analysis suggests that among men of age 40 years and above, 15.2% reported at least one NCD and 3.2% reported two or more co-existent NCDs whereas among women of the same age group, 17.0% reported at least one NCD and 3% reported two or more co-existent NCDs (Table 1). Although population of all age groups reported presence of NCD and multimorbidity, the prevalence of multimorbidity increased with increasing age, particularly after the age of 40 years (Fig. 1)

Table 2: Percentage of men and women in age groups of 40–59 and 60 + reporting different non-communicable health conditions (15 days recall reference)

Table 2
Percentage of men and women in age groups of 40–59 and 60 + reporting different non-communicable health conditions (15 days recall reference)

	Age 40–59		Age 60 & above	
	Men	Women	Men	Women
	Mean (95% CI)	Mean (95% CI)	Mean (95% CI)	Mean (95% CI)
Cancers	0.08 (0.06–0.10)	0.11 (0.08–0.14)	0.28 (0.22–0.35)	0.20 (0.14–0.26)
Diabetes	2.40 (2.28–2.54)	2.88 (2.75–3.02)	8.70 (8.34–9.06)	8.53 (8.16–8.90)
Mental disorders	0.10 (0.07–0.12)	0.12 (0.09–0.14)	0.27 (0.20–0.33)	0.11 (0.07–0.16)
Epilepsy	0.03 (0.01–0.04)	0.01 (0.00-0.02)	0.11 (0.07–0.16)	0.08 (0.04–0.11)
Other neurological disorders	0.31 (0.27–0.36)	0.40 (0.35–0.45)	1.74 (1.57–1.90)	1.38 (1.23–1.53)
Hypertension	1.94 (1.83–2.05)	3.09 (2.95–3.23)	10.22 (9.83–10.61)	11.34 (10.92–11.76)
Cardiovascular disorders	0.76 (0.69–0.83)	0.68 (0.61–0.74)	4.04 (3.78–4.29)	2.74 (2.52–2.95)
Respiratory disorders	0.62 (0.56–0.69)	1.16 (1.07–1.24)	3.26 (3.03–3.49)	2.66 (2.45–2.88)
Musculoskeletal disorders	0.89 (0.82–0.97)	2.25 (2.14–2.37)	4.49 (4.22–4.75)	6.31 (5.99–6.63)
Genitourinary disorders	0.33 (0.28–0.37)	0.44 (0.39–0.49)	1.08 (0.94–1.21)	0.47 (0.38–0.56)
Injury	0.72 (0.65–0.79)	0.38 (0.33–0.43)	0.94 (0.82–1.07)	0.73 (0.62–0.84)
# of observation	59,073	59,636	23,042	21,985
Source: Authors' estimates using SCH 2017-18				

In Table 2 we present prevalence sex- and age-stratified analysis (for the individuals of age ≥ 40 years) of the most common NCDs. The most common chronic condition among men and women was diabetes followed by hypertension, respiratory and cardiovascular conditions. More than 2.4% men and 2.9% women in the age group of 40–59 reported diabetes while the prevalence was approximately 9% both among men and women of age 60 years and above. Hypertension was reported by approximately 2% men and 3% women in the age group of 40–59 which increased to more than 10% and 11% among men and women respectively of age 60 years and above.

We also identified most commonly associated NCDs in case of multimorbidity by cross classifying NCDs at individual reporting levels (see Appendix Table AV). Most frequently associated NCD is Hypertension followed by diabetes and cardiovascular. For example, among all persons reporting hypertension, approximately 73.5% reported hypertension as standalone morbidity, whereas approximately 15% reported diabetes and 4% reported cardiovascular disease in addition to hypertension. Similarly, among all persons reporting diabetes approximately 77.4% reported diabetes alone, whereas around 16.1% reported hypertension and 3.3% reported cardiovascular disease in addition to the diabetes.

Cost Of Treating Ncds And Multimorbidity

Mean OOP expenditures on the treatment of selected NCDs as inpatient and outpatient for all reported cases are presented in Fig. 2A and 2B. For hospitalized cases, multimorbidity led to higher OOP expenditure for diabetes, hypertension, cardiovascular, neurological disorder and genitourinary disorder in comparison when the same NCD was reported as single morbidity. However,

mean OOP expenditure for cancer treatment is far lower in the presence of multimorbidity (INR 79 thousand) as compared with when cancer was reported as single multimorbidity (INR 111 thousand) (Fig. 2A). For outpatient care, OOP expenditures on treatment of selected NCDs in the presence of multimorbidity are mostly equal or lower to expenditure for treatment of same conditions in the absence of multimorbidity (Fig. 2B).

Since these estimates may be correlated with a range of socio-economic and demographic factors, we present the results from the matched sample (Table 3). Along with OOP expenditure on outpatient and inpatient care, we also present results with and without including deceased individuals because of the selected NCDs. The results in Table 3 reflect that for outpatient care, the OOP expenditure is invariably lower for the treatment of the selected NCDs in the presence of multimorbidity as compared with no multimorbidity. However, in case of hospitalization, the OOP expenditures are mostly higher for the same NCD conditions in the presence of multimorbidity as compared with single morbidity, except for cancers and cardiovascular conditions. For the hospital based treatment of cancers, the mean OOP expenditures are INR 119 thousand and INR 94.8 thousand in the absence and presence of multimorbidity respectively. For cardiovascular conditions, the decline in OOP expenditure is from INR 63.3 thousand in case of single morbidity to INR 60.9 thousand in the presence of multimorbidity. Including or excluding deceased individuals in the sample of any NCD does not make difference to the overall trend, except in case of cancer where excluding deceased individuals lowers the OOP expenditure in single morbidity case. Appendix Table AIV presents more detailed results.

Table 3
Mean outpatient (15 days) and inpatient (365 days) expenditure (INR) for various NCD's in the matched sample

		Excluding deaths				Including deaths			
		Outpatient		hospitalization		Outpatient		hospitalization	
		N	OOP (INR)	N	OOP (INR)	N	OOP (INR)	N	OOP (INR)
Cancer	Single morbidity	218	5344	469	91,430	224	5652	634	119,160
	Multimorbidity	90	1277	84	91,628	97	1894	90	94,798
	Difference		4068 (1708 -6427.6)		-198 (-47546.2– 47150.6)		3758 (1294.0 - 6222.3)		24362 (-21229.4– 69953.4)
Diabetes	Single morbidity	4,060	783	1,330	25,900	4,060	783	1,374	26,003
	Multimorbidity	3,362	637	2,017	48,321	3,363	652	2,022	48,292
	Difference		146 (93– 199.8)		-22422 (-27357.1– 17486.1)		131 (70.7- 191.2)		-22289 (-27152.6– 17425.3)
Hypertension	Single morbidity	3,736	557	1,183	23,784	3,736	557	1,231	24,797
	Multimorbidity	3,715	550	2,106	43,410	3,721	550	2,115	43,485
	Difference		7 (-52.9– 66.1)		-19626 (-24222.4 – -15029.6)		7 (-52.5– 66.5)		-18688 (-23239.8– 14136.1)
Cardiovascular	Single morbidity	1,240	1385	2,582	63,201	1,241	1379	2,852	63,276
	Multimorbidity	1,507	747	1,167	60,670	1,507	747	1,173	60,877
	Difference		637 (508.5– 766.1)		2531 (-4143.1– 9204.3)		632 (504.4 -759.5)		2399 (-4204.6– 9004.6)
Neurologic disorders	Single morbidity	818	1286	1,377	43,606	830	1281	1,554	46,425
	Multimorbidity	614	879	568	48,979	622	872	577	48,967
	Difference		407 (205.1– 608.8)		-5373 (-14340.4– 3594.9)		409 (208.4 -609.5)		-2542 (-12013.6– 929.6)
Genitourinary disorders	Single morbidity	309	1818	1,632	43,393	309	1779	1,698	45,925
	Multimorbidity	518	1066	521	60,139	518	1066	522	60,334

Note: N is number of episodes in the sample

Source: Authors' estimates using SCH 2017-18

		Excluding deaths			Including deaths				
	Difference		752 (354–1150.2)		-16747 (-24096.4 – -9396.8)		713 (321.3 -1104.6)		-14409 (-21883.9–6934.0)
Any NCD	Single morbidity	16,151	909	17,372	38,193	16,156	910	18,454	40,452
	Multimorbidity	5,975	718	3,970	49,144	5,978	726	3,991	49,301
	Difference		191 (130.3-251.6)		-10951 (-13777.5–8125.2)		184 (122.5-245.4)		-8849 (-11832.6--5865.3)
Note: N is number of episodes in the sample									
Source: Authors' estimates using SCH 2017-18									

Table 3: Mean outpatient (15 days) and inpatient (365 days) expenditure (INR) for various NCD's in the matched sample

Table 4: Mean per capita OOP payments and household consumption expenditure, and percentage of households reporting OOP payment being higher to 10% and 20% of households' total consumption expenditure

Table 4
Mean per capita OOP payments and household consumption expenditure, and percentage of households reporting OOP payment being higher to 10% and 20% of households' total consumption expenditure

		Mean per capita monthly OOP expenditure (Rs)	Mean OOP share	Catastrophe (10%)*	Catastrophe (20%)**	# Observations
Acute illness		330 (321.74- 338.81)	15.62 (15.25- 15.99)	39.763 (39.762– 39.764)	20.184 (20.183– 20.185)	34,437
Any NCD		528 (512.59- 543.64)	21.49 (20.82- 22.15)	46.675 (46.674– 46.676)	27.896 (27.895– 27.897)	36,026
Multimorbidity		1203 (1120.53- 1286.69)	33.13 (31.21- 35.04)	63.360 (63.359– 63.361)	40.872 (40.871– 40.873)	3,953
Cancer	Single	2326 (2006.58- 2646.74)	84.28 (74.75- 93.80)	88.947 (88.946– 88.948)	70.399 (70.398– 70.400)	897
	Multimorbidity	2116 (853.36- 3380.33)	61.90 (41.56- 82.24)	80.106 (80.105– 80.108)	77.869 (77.868– 77.871)	80
Diabetes	Single	591 (558.32- 625.25)	20.04 (18.92- 21.15)	46.539 (46.538– 46.540)	27.973 (27.972– 27.974)	4,417
	Multimorbidity	1271 (1134.47- 1407.72)	31.10 (28.19- 34.00)	55.386 (55.385– 55.387)	38.095 (38.094– 38.096)	1,831
Cardiovascular	Single	948 (883.96- 1012.41)	31.96 (30.16- 33.75)	61.791 (61.790- 61.792)	43.049 (43.048– 43.050)	3,584
	Multimorbidity	1831 (1597.25- 2065.75)	46.98 (42.56- 51.40)	79.800 (79.799– 79.801)	54.451 (54.450- 54.452)	930
Respiratory	Single	516 (470.24- 563.07)	24.25 (22.48- 26.00)	54.499 (54.498– 54.500)	34.068 (34.067– 34.069)	2,316
	Multimorbidity	1137 (914.17- 1361.08)	35.52 (30.76- 40.26)	67.214 (67.213– 67.216)	45.107 (45.106– 45.109)	474
Notes: * at 10% cut-off of total household consumption expenditure; ** at 20% cut-off of household consumption expenditure.						
Source: Authors' estimates using SCH 2017-18						

We also estimated catastrophic impact of OOP expenditure incurred for healthcare on the households (Table 4). Our analysis suggests that around 46.7% households had incurred catastrophic spending (10% threshold) because of any NCD when it presented as standalone disease. However under multimorbidity scenarios, households reporting catastrophic spending rose to 63.3%.

Furthermore, our analysis also suggests that the proportion of households reporting catastrophic expenditure (10% threshold) was higher for all NCDs, when reported in multimorbidity situation in comparison to when reported as standalone diseases except for cancer where catastrophic expenditure was lower in multimorbidity situation in comparison to cancer as standalone disease (80% versus 89%).

Discussion

This study, using a nationally representative data on morbidity and cost of treatment, presents prevalence and OOP expenditure on treatment of different NCDs among 40 + years population. The study also presents extent of multimorbidity and the related cost of treatment incurred by households. To the best of our knowledge, ours is the first study to report the OOP treatment cost for selected NCD in standalone scenario and in presence of another competing NCDs (multimorbidity scenario) and also the catastrophic impact of selected NCDs.

Our estimates suggest that except for the cancer and CVD related hospitalization, the OOP expenditure on selected NCDs was higher when the same NCDs were reported and treated as part of multimorbidity as compared to standalone diseases, after controlling for several socio-demographic and economic household characteristics. This essentially implies that disease conditions with high propensity to cause catastrophic expenditure at household level are inadequately treated in the presence of multimorbidity.

Our estimates of self-reported prevalence and multimorbidity from NSSO survey data are relatively lower as compared to previously published estimates from India [8, 17, 26, 27]. This could be due to differences in survey design, study population, method of data collection and number and type of diseases included in the studies[28]. Studies by Ramakrishna et al. and Gelsetzer et al. have estimated the prevalence of hypertension but due to the difference in survey design and method of data collection (self-reported to measurement of blood pressure), our estimates of prevalence are relatively lower than estimated in those studies. While there are several key strength of the NSSO survey data - national level representativeness, large sample size and robust estimates on household level healthcare expenditure [9], under reporting of morbidity is one of its limitations of NSSO. However, this doesn't affect our estimates on the OOP expenditure of NCDs and their catastrophic impact of households.

Like earlier studies from India and South Asia [17, 29], our analysis also suggests high proportion of co-existence of NCDs like diabetes, and hypertension, diabetes and cardiovascular disease, cardiovascular disease and hypertension. The co-existence of diabetes, hypertension and cardiovascular diseases has been documented widely and has been explained through commonality in their risk factors [30–33]. Literature suggests that strategies for the prevention, control, and management of multimorbidity should take into account the interaction effects of co-existent NCDs [34], unfortunately there is fragmentation of primary care and absence of referral pathways in LMICs [35, 36].

It is widely recognized that multimorbidity is associated with higher healthcare utilization rates and increased healthcare expenditure [12, 17, 37]. However, we found no research evidence on financial implications of co-existing NCDs in terms of OOP expenditures between competing NCDs and their catastrophic impact at the household level. The key contribution of our study is to highlight households' inability to maintain requisite healthcare expenditure in presence of competing priority NCDs (multimorbidity) especially in cancer and cardiovascular diseases related hospitalization. This is also reflected in high proportion of catastrophic expenditures in households who reported cancer and cardiovascular diseases and multimorbidity.

It is recognized that cancer often requires relatively expensive, and complex, treatment for extended periods, which may lead to household impoverishment, treatment abandonment, and poor outcomes, if the disease is detected at a later stage [38]. This is also true to some extent for cardiovascular diseases, which requires medicines for lifetime and may require expensive cardiac interventions such as angiography and angioplasty at the later stages of illness. Such situations may lead to reduction in expenditure on competing NCDs and/or catastrophic expenditure and may lead to distress sale of assets and borrowing. Literature also suggests that cancer affected households had to rely on borrowing or asset sale for financing treatment to a greater extent than matched controls [15]. Mehlis et al reported that 40% of the cancer patients saved money by cutting back on nutrition, living, and medication that is not reimbursed by their health insurance. [39]. Mahal et al. has reported that out-of-pocket health expenditures are significantly higher in households with cancer compared to control households, both in inpatient and outpatient settings[16] while Engelgau et al. reported that odds of catastrophic hospitalization expenditure for cancer were nearly 170% greater than that due to the communicable diseases [13]. Our analysis also suggest that around 46.7% households had incurred catastrophic spending (10% threshold) because of any NCD, which increased to around 63.3% in presence of multimorbidity as compared to around 39.4% for any communicable disease.

However, we also observed that OOP expenditure on NCDs such as diabetes and hypertension was not compromised in presence of another NCD and were higher (may be due to increased risk or severe symptoms) in multimorbidity situation both in outpatient

setting as well as during hospitalization. These observations were consistent with the previous research. A systematic review indicated that multimorbidity was associated with higher OOP expenditures on medicines and with an increase in number of NCDs from 0 to 1, 2, and ≥3, the annual OOP expenditure on medicines increased by an average of 2.7 times, 5.2 times and 10.1 times, respectively[40] which was especially true for NCDs like diabetes and hypertension that require lifelong medication for disease management [41, 42].

Our study has few limitations. Recall bias is one of them. NSSO survey relies on self-reported multimorbidity, hence recall bias cannot be ruled out. Similarly, recall bias for expenditure estimates related to inpatient care is also possible because of one-year recall period for hospitalization expenditures. However, outpatient expenditure estimates remain robust since the recall period is only of 15 days. Another limitation pertains to matching methods; we couldn't account for unobservable factors that drive household's risk of NCDs and multimorbidity. The NSSO data do not include information on certain common risk factors for NCDs like tobacco and alcohol consumption, dietary history or obesity in the household. Also, while capturing multimorbidity we couldn't factor the severity of the disease.

Conclusions

Our analysis and resulting estimates clearly demonstrate that irrespective of number of co-existing NCDs, households face catastrophic OOP expenditures. In addition, in presence of two or more co-existent NCDs (multimorbidity), the number of households reporting catastrophic OOP expenditure increases. Even more important finding pertains to reduction in household expenditure in cancer and CVD related hospitalization in presence of competing NCDs (multimorbidity) which reflects household budgetary constraints. The situation can be considered as competing risk situation for the households and may result into probable under-treatment and poor health outcome for one or many NCDs under consideration. In this context, it is important to design and implement such financial risk protection measures that explicitly reduces the burden of household OOP expenditure but also rewards individuals to reduce risk factors for NCDs.

Declarations

Authors' Contributions

Authors' contributions: AK and HHF conceived the idea. HHF and AK designed the analysis, SH conducted data analysis. AK, HHF and MAH conducted the literature review and drafted the manuscript; AK, HHF, SH, SS and MAH critically revised the manuscript for intellectual content. All authors read and approved the final manuscript.

Competing Interests

We declare no conflict of interest.

Ethical approval

Ethical approval for this study was not needed. The study used only anonymised data from secondary sources. All methods were carried out in accordance with relevant guidelines and regulations.

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 of basic details at https://www.mospi.gov.in/web/mospi/download-tables-data/-/reports/view/templateTwo/16202?q=TBDCAT

Consent for Publication

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Figures

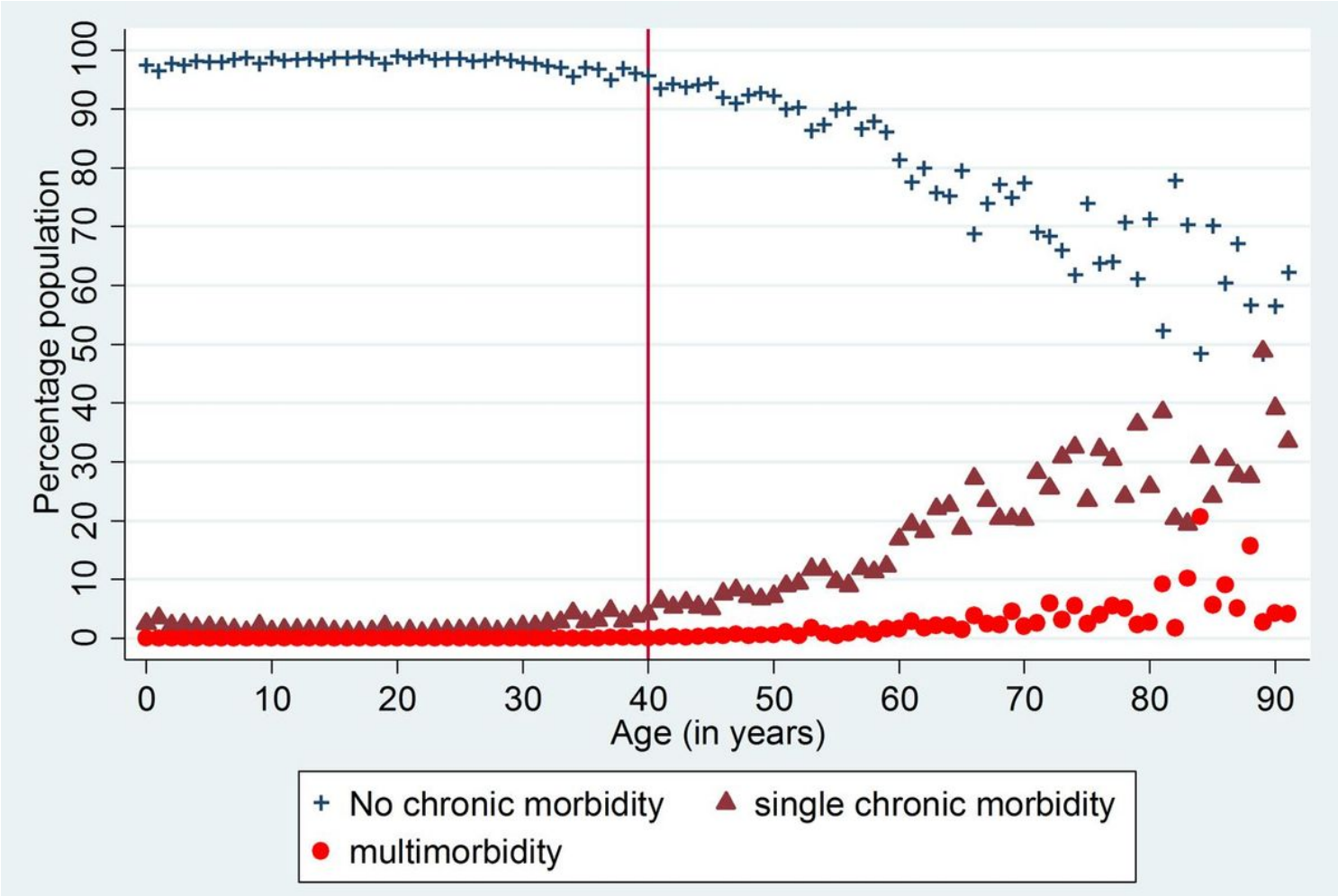

Figure 1

Percentage of population with no, single and multi-chronic conditions

Source: Authors' estimates using SCH 2017-18

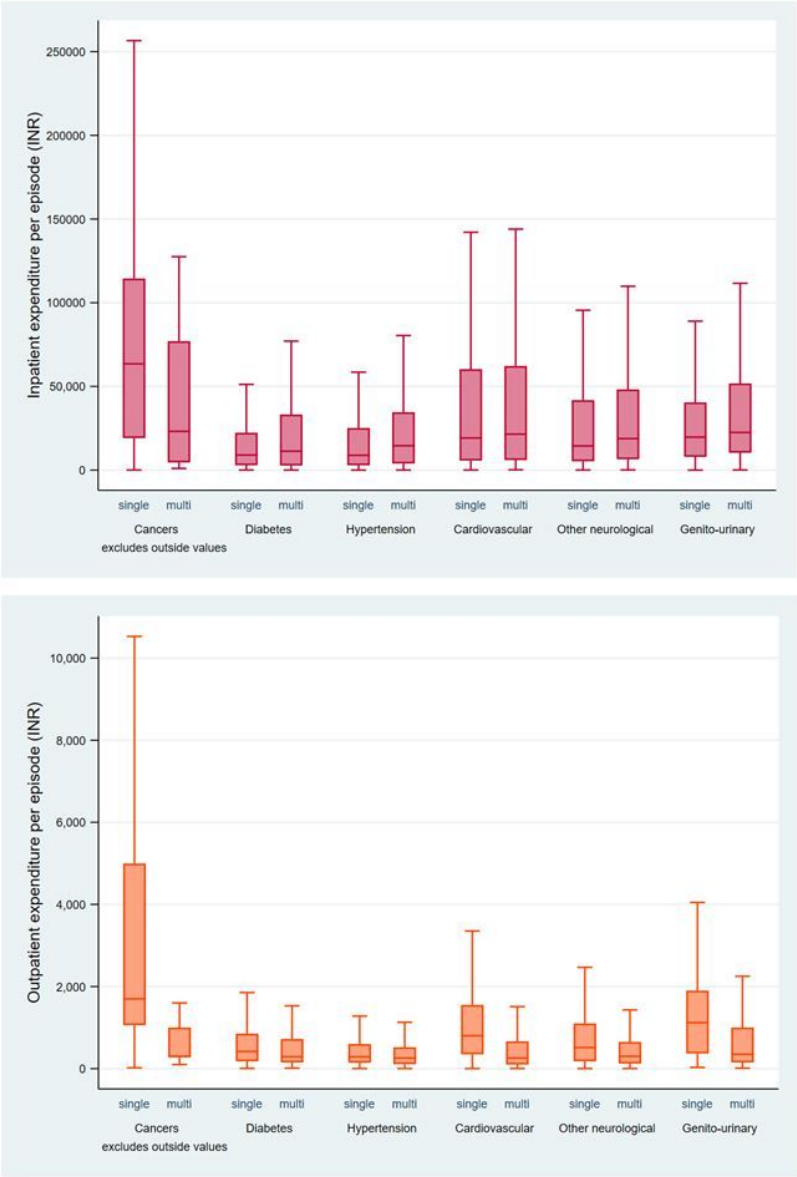

Figure 2

2A: Mean OOP expenditures (INR '000') on the treatment of selected NCDs as inpatient

Source: Authors' estimates using SCH 2017-18

2B: Mean OOP expenditures (INR '000') on the treatment of selected NCDs as outpatient

Source: Authors' estimates using SCH 2017-18

Supplementary Files

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