

Extended Abstract

Profile and patterns of chronic non-communicable diseases multimorbidity among older adults in India

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Background and Rationale. Estimates generated by the World Bank suggest that in India life expectancy at birth has increased by 28 years in the past six decades. Despite hypothesizing this increased life expectancy as a byproduct of advancement in the health care infrastructure and health delivery services, the past two decades have been fettered by the increasing morbidity burden, with a preponderance of non-communicable diseases (NCD) in the country. Despite the ever-growing healthcare sector, India is still not adequately positioned to deal with the mounting NCD prevalence. The major reason for this shortfall is that NCDs are an outcome of shared pathophysiologies and risk factors and thus, they tend to interact and coexist, commonly referred to as associative morbidities.

The vast majority of the existing morbidity research in India still explores various realms of single chronic conditions, with scarce focus on simultaneous occurrence of multiple morbid conditions, also known as multimorbidity. Moreover, the studies on multimorbidity in India, are rested on one-dimensional indices like simple count or score, which suffers with the limitation of ill-defined cut-offs. In addition to this ongoing debate, these crude measures specifically focus on quantity rather than the nature of chronic conditions and the way in which they network. Consequently, the evidences generated by the aforementioned method (multimorbidity score) can although be employed to estimate multimorbidity burden, but is not adequate to form policies or design interventions, majorly due to its deficiencies in understanding the complexities related to multimorbidity. In absence of which, it is challenging for a low resource economy like India, to satisfy to the multifaceted service requirements of the multimorbid older adults in the country.

To deal with this, recent studies suggest to harness the advantages of latent class analysis (LCA). These studies propose that chronic NCDs are disproportionately distributed in any community setting, and therefore various sub-groups of the population have varied healthcare priorities and needs. Thus, the disease clusters identified by means of LCA can be utilized in reorienting the existing health care delivery system, from single disease model to a more patient centered approach. Therefore, the present study aims to bridge this knowledge gap and identify frequently occurring multimorbidity pattern among older adults in India.

Data. The analysis is rested on 58,975 individuals aged 45 years or older, obtained from the Longitudinal Ageing Study in India (LASI), 2020.

Measures. The question commissioned to measure each disease based on self-reported medical diagnoses was “Has any health professional ever diagnosed you with the following chronic conditions or diseases?”. The list included information on 16 diseases, namely asthma, musculoskeletal disorder, cancer, chronic bronchitis, chronic renal failure, chronic obstructive pulmonary disease, diabetes, gastrointestinal disorder, chronic heart disease, high cholesterol, hypertension, incontinence, neurological and psychiatric disorder, skin disease, stroke, and thyroid disease. The diseases mentioned above were recoded as no-‘1’ and yes-‘2’.

Statistical Analysis. Descriptive statistics and prevalence of chronic morbidities were reported. To identify the linkages between the selected morbidities, all possible combinations (${}^{16}C_2=120$) were explored, further these were substituted with chi-square p-values to identify statistically significant associations or associative morbidities.

Latent Class Analysis (LCA) was utilized to identify frequently occurring diseases clusters. For this a range of latent class models were fitted before selecting the optimal number of latent classes (say, n classes). The selection criterion was based on the model fit index, Bayesian information criterion (BIC). These ‘n’ classes were stamped with labels based on the item-response probabilities of the selected chronic morbidities included in the study. Once the optimal number of latent classes was selected, the entire study population was segregated into one of the ‘n’ classes (identified disease groups). Additionally, a robustness check analysis was performed on a random sub-sample of the study population (n=47,180). All the estimates generated in the study were presented after suitable application of sampling weights provided by LASI, 2020.

Key Findings. The study exercised LCA to investigate the emerging multimorbidity patterns among older adults in India. Based on a nationally representative sample of 58,975 individuals, the study included information on 16 non-communicable chronic diseases.

LCA identified six multimorbidity classes, including a predominant ‘relatively healthy’ (64.5%) class, ‘hypertensive-diabetics’ (23.7%), ‘gastrointestinal disorders’ (5.7%), ‘metabolic disorders’ (2.7%), ‘hypertension/ musculoskeletal/gastrointestinal disorders’ (2.1%), and ‘complex cardio metabolic disorder’ (1.4%). Considering 347,182 (approx. 0.35 million) older adult population as per World Population Prospects (2019), we are able to infer that approximately 0.12 million individuals belonged to one of the five multimorbidity classes (35.9%).

These resultant classes hinted towards a quantitative distinction, however these patterns were quite similar qualitatively. Considering the quantitative aspect, it is clear that ‘complex cardio metabolic

disorders' followed by 'metabolic disorders' were most complicated type of disease patterns with large number of chronic conditions coexisting simultaneously. Hypertension and diabetes emerged out as the two most prevalent chronic conditions with a high membership probability in at least three of these disease clusters. From a programmatic standpoint, the study findings warrant an urgent need to focus on individuals affected with hypertension and diabetes, as following the similar pathophysiological and risk factor back drop, these individuals are more prone to ensnare other cardio and metabolic ailments, like high cholesterol and heart diseases.

As the present study is first attempt to explore prominent disease patterns among older adults in India, comparison with other studies is taxing, primarily due to the ambiguities in the operational definition of multimorbidity, differences in the age-groups involved, and other methodological differences.

Robustness Check. We replicated the above analysis on a test dataset, which was formed by randomly selecting a subset from LASI wave-1. The results produced were quite similar to those presented by the main analysis.

Conclusions. These findings can be employed in recognizing associated diseases during hospital visits by the patients affected with one or more morbidities. This can assist physicians and policy makers in devising treatment and management strategies for individuals belonging to explicit disease clusters, in a way that they do not accumulate additional chronic conditions. Thus, advocating policies to reorganize the existing healthcare services in a way to accommodate the raising requirements of the older adult population (45 years and older) which is estimated to reach 0.66 million by 2050.¹⁸ Alternatively, targeted interventions in form of equitable prevention strategies, are essential to reduce the burden on the high-risk '*Relatively Healthy*' older adult population in the country.

Table. Prevalence and association between combinations of selected chronic morbidities among older adults, Longitudinal Ageing Study in India (LASI), wave-1, 2020.

Chronic Morbidities	Chronic Morbidities														
	AS	MKS	CA	CB	CRF	COPD	DM	GD	CHD	HC	HYP	INC	NPD	SD	ST
MKS	1.26***	-													
CA	0.03	0.11	-												
CB	0.23***	0.48***	0.58	-											
CRF	0.05	0.18***	0.01***	0.02	-										
COPD	0.30***	0.52***	0.02***	0.31***	0.04***	-									
DM	0.70***	2.73***	0.12***	0.38***	0.14***	0.39*	-								
GD	1.02***	3.88***	0.15***	0.26***	0.23***	0.27***	2.22***	-							
CHD	0.32***	1.11***	0.04***	0.28***	0.06***	0.31***	1.24***	0.85***	-						
HC	0.13***	0.63***	0.04***	0.04***	0.04***	0.05***	0.70***	0.56***	0.40***	-					
HYP	1.68***	6.40***	0.26***	0.63***	0.31***	0.69***	7.83***	6.05***	2.49***	1.47***	-				
INC	0.29***	0.89***	0.04***	0.09***	0.12***	0.12***	0.62***	1.19***	0.19***	0.14***	1.18***	-			
NPD	0.21***	0.92***	0.03*	0.06***	0.04***	0.08***	0.37***	0.65***	0.21***	0.18***	0.99***	0.19***	-		
SD	0.36***	1.14***	0.03	0.07***	0.06	0.09***	0.81	1.54***	0.18***	0.19***	1.72***	0.28***	0.17***	-	
ST	0.11*	0.49***	0.03***	0.02	0.04***	0.04***	0.49***	0.43***	0.24***	0.09***	1.18***	0.16***	0.18***	0.13***	-
THY	0.23*	0.79***	0.05***	0.09***	0.07***	0.10***	0.71***	0.73***	0.19***	0.32***	1.47***	0.19***	0.21***	0.24***	0.07

Note: *p<0.05, **p<0.01, ***p<0.001 AS: Asthma; MKS: Musculoskeletal CA: Cancer; CB: Chronic Bronchitis; CRF: Chronic Renal Failure; COPD: Coronary Obstructive Pulmonary Disorder; DM: Diabetes Miletus; GD: Gastrointestinal Disorder; CHD: Chronic Heart Disease; HC: High Cholesterol; HYP: Hypertension; INC: Incontinence; NPD: Neurological and Psychiatric Disorder; SD: Skin Disease; ST: Stroke; THY: Thyroid Disorder

Table. Class Proportions and item-response probabilities from six latent class model of chronic morbidities, Longitudinal Ageing Study in India (LASI), wave-1, 2020.

Assigned label	1-Relatively Healthy	2-Complex Cardio Metabolic Disorder	3-Hypertension-Musculoskeletal - Gastrointestinal disorders	4-Metabolic Disorder	5-Hypertensive-Diabetics	6-Gastrointestinal Disorder
Class Proportion	38047 (64.51)	825 (1.40)	1232 (2.09)	1576 (2.67)	13944 (23.65)	3351 (5.68)
Item-response probabilities						
Asthma	0.021	0.125	0.201	0.031	0.034	0.054
Bones and Joints	0.082	0.506	0.370	0.192	0.165	0.287
Cancer	0.004	0.034	0.006	0.013	0.006	0.012
Chronic Bronchitis	0.003	0.055	0.079	0.012	0.004	0.009
Chronic Renal Failure	0.003	0.061	0.013	0.007	0.007	0.026
Coronary Obstructive Pulmonary Disorder	0.003	0.060	0.101	0.009	0.008	0.007
Diabetes	0.036	0.512	0.055	0.479	0.292	0.114
Gastrointestinal Disorder	0.122	0.429	0.231	0.191	0.152	0.636
Chronic Heart Disease	0.007	0.282	0.074	0.176	0.059	0.025
High Cholesterol	0.004	0.283	0.035	0.602	0.000	0.018
Hypertension	0.043	0.864	0.320	0.755	0.749	0.376
Incontinence	0.007	0.189	0.063	0.011	0.018	0.123
Neurological and Psychiatric Disorder	0.009	0.162	0.100	0.006	0.018	0.038
Skin Diseases	0.035	0.132	0.089	0.048	0.029	0.171
Stroke	0.004	0.152	0.015	0.030	0.037	0.011
Thyroid Disease	0.011	0.173	0.046	0.138	0.031	0.052
Multimorbidity (two or more chronic conditions) (in %)	2.88	100.00	100.00	100.00	63.13	100.00
Average number of chronic conditions reported (S.E.)	0.37 (0.00)	5.17 (0.04)	2.73 (0.02)	3.16 (0.02)	1.82 (0.01)	2.73 (0.01)