

Burden of Communicable and Non-Communicable Diseases Among Elderly in India: A Study Based on LASI Survey

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Abstract

Background: While controlling the outbreak of communicable diseases (CDs) remained a priority, non-communicable diseases (NCDs) are placing an unavoidable burden on the health and social security system. India, a developing nation in South Asia, has seen an unprecedented economic growth in the past few years; however, it struggled to fight the burden of communicable and non-communicable diseases. Therefore, this study aimed at examining the burden of CDs and NCDs among elderly in India.

Methods: Data from Longitudinal Ageing Study in India (LASI Wave-I, 2017-18) were drawn to conduct this study. Response variables were the occurrence of CDs and NCDs. The bi-variate and binary logistic regression were used to predict the association between communicable and non-communicable diseases by various socio-demographic and health parameters. Furthermore, to understand the inequalities of communicable and non-communicable diseases in urban and rural areas, the Fairlie decomposition technique was used to predict the contribution toward rural-urban inequalities in CDs and NCDs.

Results: Prevalence of communicable diseases was higher among uneducated elderly than those with higher education (31.9% vs. 17.3%); however, the prevalence of non-communicable diseases was higher among those with higher education (67.4% vs. 47.1%) than uneducated elderly. The odds of NCDs were higher among female elderly (OR=1.13; C.I. = 1-1.27) than their male counterparts. Similarly, the odds of CDs were lower among urban elderly (OR=0.70; C.I. = 0.62-0.81) than rural elderly, and odds of NCDs were higher among urban elderly (OR=1.85; C.I. = 1.62-2.10) than their rural counterparts. Results found that education (50%) contributes nearly half of the rural-urban inequality in the prevalence of CDs among the elderly. Education status and current working status were the two significant predictors of widening rural-urban inequality in the prevalence of NCDs among the elderly.

Conclusion: The burden of both CD and NCD among the elderly population requires immediate intervention. The needs of men and women and urban and rural elderly must be addressed through appropriate effort. In a developing country like India, preventive measures, rather than curative measures of communicable diseases, will be cost-effective and helpful.

Background

Although South-Asian countries are still young regarding their demographic profile, the population in South-Asian countries has also started to age [1]. The ever-increasing aged population in South Asian countries leads to many healthcare-related challenges [1]. While controlling the outbreak of communicable diseases remained a priority, non-communicable diseases are placing an unavoidable burden on the health system [1]. India, a developing nation in South Asia, has seen an unprecedented economic growth in the past few years; however, it struggled to fight the burden of communicable and non-communicable diseases [1]. India, with more than 8 percent of its population being more than 60 + years [2–4], has acquired the level of an ageing nation with the growth of older Indian population in absolute number comparatively faster than other regions of the world [5]. A rising proportion of elderly in India has infused notable challenges to the healthcare system, which is already undeveloped [6]. With a slighter decline in Communicable Diseases (CD) and a steeper increase in Non-communicable disease (NCD), India is currently undergoing the double burden of CDs and NCDs [7].

Communicable diseases (CD) were the prime cause of death worldwide for a very long time [8]. However, with the advent of vaccinations, antibiotics, and improvements in living conditions, non-communicable diseases (NCD) rose [8]. At first, NCD was the burden for healthcare systems in developed countries only as NCD were termed as diseases of the rich [8]. However, off lately, NCD appeared to be sweeping the entire globe, an increasing trend in developing countries [8]. India is also experiencing an increasing burden of NCD among the elderly [9, 10]. Despite an increasing burden of NCD, India still does not have sufficiently detailed data on NCDs for research and policy purposes [9]. On one side, NCDs are increasing among the elderly in India; however, on the other side, CDs are also a cause of concern among the elderly in India [7]. The projected increase in the elderly population in India [11] would bring several repercussions as far as the burden of CDs, and NCDs is concerned [7]. Given the limited literature examining CD and NCD among elderly in South Asian countries, there is a need to examine the burden of CD and NCD in India. Therefore, this study aimed at examining the burden of CDs and NCDs among elderly in India. This study explored prevalence and determinants of CDs and NCDs among elderly in India along with examining the urban-rural inequalities in the prevalence of CDs and NCDs among elderly in India.

Methods

Data:

The study utilizes data from Longitudinal ageing study of India (LASI), first wave: 2017-18, conducted by the collaboration of International Institute for Population Sciences (IIPS), Harvard T.H. Chan School of Public Health (HSPH), and University of Southern California (USC), and several other national and international institutions. [12]. The survey has been funded by the Ministry of Health and Family Welfare (MoHFW), the Government of India, the National Institute on Aging (NIA), and the United Nations Population Fund, India (UNFPA). The survey included the older adults (men and women) age 45 years and above across all the states (exclude Sikkim) and union territories in India. The LASI wave-I covers comprehensive aspects of chronic health conditions, functional and mental health, healthcare utilization, family and social networks, work and employment and life expectations.

The LASI has utilized a multistage stratified area probability sampling design to reach out a representative sample. In addition, the three stage sampling design used for rural areas while four-stage sampling design used for urban areas. Further, the first stage engaged to selection of primary sampling units (PSUs) i.e. Tehsils and Talukas. The second stage considered the selection of villages in rural areas and wards in urban areas. In the third stage, household were selected from pre-selected villages in rural areas where census enumeration blocks (CEBs) were selected in urban areas. In additional and final stage of sampling in urban areas, the process of selection of household was made through selected CEBs.

The LASI featured with 72, 250 individuals, including 31, 434 age 60 years and above and 6,749 individuals age 75 years and above. However, this study taken up 60 years and above population.

The Double Burden Of Communicable And Non-communicable Diseases

Double burden of disease refers to the situation where an individual suffers from both non-communicable and infectious diseases. A study classified the burden of diseases in three broad clusters: communicable diseases, non-communicable diseases, and injuries [7]. Our study examines the responses of communicable and non-communicable diseases only. Following diseases were included as communicable disease: Jaundice/ Hepatitis, Tuberculosis (TB), Malaria, Diarrhoea/gastroenteritis, Typhoid, Urinary Tract Infection, Chikungunya and Dengue. Within non-communicable diseases, following conditions were included: Hypertension or high blood pressure, diabetes or high blood sugar, Cancer or a malignant tumour, Chronic lung diseases such as asthma, chronic obstructive pulmonary disease/Chronic bronchitis or other chronic lung problems, Chronic heart diseases such as Coronary heart disease (heart attack or Myocardial Infarction), congestive heart failure, or other chronic heart problems, Stroke, Arthritis or rheumatism, Osteoporosis or other bone/joint diseases, Any neurological, or psychiatric problems such as depression, Alzheimer's/Dementia, unipolar/bipolar disorders, convulsions, Parkinson's, etc. and High cholesterol. All communicable and non-communicable diseases are diagnosed by the health professional.

Study Variables

Response variable

The response variables for this study are communicable diseases and non-communicable diseases. Communicable diseases are diagnosed by health professionals and asked as "In the past 2 years, have you had any of the following diseases?" and responses have been recorded in 'yes' and 'no.' Similarly, non-communicable diseases are also diagnosed by health professionals and asked in the form of 'yes' and 'no.'

Predictors

The predictors for this study are considered as sex (male and female); age (60–69 and 70 years and above); marital status (currently married, never married, Divorced/Separated/Deserted/Widowhood), education (No education, below primary, primary, secondary, and higher); living arrangements (living alone, with spouse and with others); place of residence (rural and urban); currently working (yes and no); wealth index (poorest, poorer, middle, richer and richest); self-rated health (poor and good; physical activity (yes and no); tobacco use (no and yes); alcohol use (yes and no); ADL disability (severe, moderate and no disability), and IADL disability (severe, moderate and no disability). Furthermore, ADL and IADL disability constructed from five (bathing, dressing, mobility, feeding, and toileting) and seven (preparing a hot meal (cooking and serving), shopping for groceries, making telephone calls, taking medications, doing work around the house or garden, managing money, such as paying bills and keeping track of expenses and getting around or finding an address in an unfamiliar place) activities. Both the ADL and IADL disability was categorized into the three categories as "severe," "moderate," and "no disability" based on the scale given in previous studies [13, 14].

Statistical Measures

The analyses were carried out with statistical software STATA version 16th. The bi-variate technique was used to understand the prevalence of communicable diseases and non-communicable diseases by socio-demographic and health parameters and across the states in India. Further, binary logistic regression was used to predict the association between communicable and non-communicable diseases and socio-demographic and health parameters. The equation for binary logistic regression is given below,

$$\log \left(\frac{p_i}{1 - p_i} \right) = \text{logit}(p_i) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_n x_n$$

In the above regression equation, p_i is the probability of being perceived as communicable or non-communicable diseases, $x_1, x_2 \dots x_n$ are the predictors, β_0 is the intercept and $\beta_1, \beta_2 \dots \beta_n$ are the coefficients.

Furthermore, to understand the inequalities of communicable and non-communicable diseases in urban and rural areas, the Fairlie decomposition technique was used to predict the contribution toward rural-urban inequalities in CDs and NCDs. The Fairlie technique was first initiated by Fairlie in 1999 which used to estimate from a logit or probit model. The equation for Fairlie decomposition can be written as,

$$\bar{Y}^U - \bar{Y}^R = \left[\sum_{i=1}^{N^U} \frac{F(X_i^U \hat{\beta}^U)}{N^U} - \sum_{i=1}^{N^R} \frac{F(X_i^R \hat{\beta}^R)}{N^R} \right] + \left[\sum_{i=1}^{N^R} \frac{F(X_i^R \hat{\beta}^U)}{N^R} - \sum_{i=1}^{N^R} \frac{F(X_i^R \hat{\beta}^R)}{N^R} \right]$$

Where N^U and N^R is the sample size for urban and rural respectively, \bar{Y}^U and \bar{Y}^R are the average probability of a binary outcome of interest for group urban and rural, F is the cumulative distribution function from the logistic distribution, X_i^R and X_i^U are the set of the average value of the independent variable and $\hat{\beta}^U$ and $\hat{\beta}^R$ are the coefficient estimates for the urban and rural, respectively.

Results

Figure 1 depicts the prevalence of CDs among the elderly in India. Almost 15 percent of the elderly reported Diarrhoea and another 8.6 percent reported Malaria. Almost 5.5 percent of the elderly reported Typhoid.

Figure 2 depicts the prevalence of NCDs among the elderly in India. Almost one-third of the elderly reported hypertension (32.8%), and another one-fifth (19.7%) reported Arthritis. In addition, nearly 14.3 percent reported Diabetes, and 8.5 percent reported chronic lung diseases.

Table 1 depicts the prevalence of communicable and non-communicable diseases among the elderly by various socioeconomic and health characteristics of the elderly. Results found that more elderly females reported communicable (26.8% vs. 26.2%) and non-communicable diseases (55.6% vs. 50.3%) than their male counterparts. Prevalence of communicable diseases was higher among uneducated elderly than those with higher education (29.8% vs. 16.6%); however, the prevalence of non-communicable diseases was higher among those with higher education (67.4% vs. 47.1%) than uneducated elderly. Those who reported good self-rated health had a lower prevalence of communicable (24.9% vs. 36.9%) and non-communicable diseases (50% vs. 70.4%) than those who reported poor self-rated health. Similarly, communicable and non-communicable diseases were higher among those who had severe ADL and IADL disabilities.

Table 1
Proportion of communicable diseases (CDs) and non-communicable diseases (NCDs) among elderly by socio-economic and health parameters

	Communicable Diseases (%)	Non-communicable Diseases (%)	Total (N)
Sex			
Male	26.2	50.3	14,931
Female	26.8	55.6	16,533
Age			
60–69	26.7	50.8	18,410
70+	26.4	56.2	13,054
Marital Status			
Currently married	26.9	51.7	19,536
Never Married	30.9	45.7	225
Divorced/Separated/Deserted	25.9	55.4	11,703
Education			
No education	29.8	47.1	17,782
Below primary	24.9	58.4	3,598
Primary	24.2	60.2	3,520
Secondary	20.5	61.2	5,285
Higher	16.6	67.4	1,278
Living arrangements			
Living alone	26.5	55.3	1,787
With spouse	27.0	51.6	19,176
With others	25.7	55.3	10,501
Place of residence			
Rural	29.9	47.3	22,196
Urban	18.4	66.9	9,268
Currently working			
Yes	28.0	29.4	9,483
No	26.2	28.1	13,197
Wealth Index			
Poorest	27.4	44.8	6,829
Poorer	28.8	49.9	6,831
Middle	24.7	51.3	6,590
Richer	25.1	58.4	6,038
Richest	26.5	64.0	5,175
Self-rated health			
Poor	36.9	70.4	4,630
Good	24.9	50.0	26,181
Physical activities			
Yes	29.2	44.4	9,704
No	25.6	57.4	21,494
Tobacco Use			
No	24.7	56.9	18,665

	Communicable Diseases (%)	Non-communicable Diseases (%)	Total (N)
Yes	29.6	48.0	12,539
Alcohol use			
Yes	27.4	47.3	4,555
No	26.6	54.4	26,655
ADL disability			
Severe ADL	32.5	71.7	999
Moderate ADL	30.3	62.5	6,045
No ADL	25.6	50.3	24,291
IADL disability			
Severe IADL	31.4	61.9	1,859
Moderate IADL	29.6	58.5	13,281
No IADL	23.8	48.2	16,164
Total	26.7	53.1	31,464

Table 2 depicts the state-wise prevalence of communicable and non-communicable diseases among the elderly. The highest prevalence of CDs was recorded in Dadra & Nagar Haveli (48.3%), followed by Chhattisgarh (47.2%), Rajasthan (46.2%), Haryana (45.8%), Madhya Pradesh (43.5%), Mizoram (41.5%), and Uttar Pradesh (41.1%). Similarly, the highest prevalence of NCDs was recorded in Kerala (78.8%), Goa (72.2%), Andaman & Nicobar Island (68.5%), Lakshadweep (67.9%), Punjab (67.3%), Telangana (66.9%), Puducherry (66.8%), Jammu & Kashmir (66.4%), and Chandigarh (65.7%). It is worth mentioning that Goa and Kerala are among the two states with the highest NCDs; however with the lowest CDs among the elderly.

Table 2
State-wise prevalence of communicable and non-communicable disease among elderly

States	CDs	NCDs
Jammu & Kashmir	12.9	66.4
Himachal Pradesh	31.7	56.2
Punjab	27.5	67.3
Chandigarh	20.9	65.7
Uttarakhand	16.8	50.4
Haryana	45.8	58.6
Delhi	33.7	62.1
Rajasthan	46.2	51.9
Uttar Pradesh	41.1	38.8
Bihar	39.9	43.5
Arunachal Pradesh	33.1	37.4
Nagaland	4.8	22.6
Manipur	25.9	44.3
Mizoram	41.5	49.4
Tripura	17.0	53.4
Meghalaya	14.1	39.6
Assam	14.2	48.3
West Bengal	16.6	65.4
Jharkhand	29.0	39.1
Odisha	20.1	43.4
Chhattisgarh	47.2	33.9
Madhya Pradesh	43.5	36.8
Gujarat	30.3	54.1
Daman & Diu	20.8	63.6
Dadra & Nagar Haveli	48.3	47.4
Maharashtra	15.8	62.5
Andhra Pradesh	11.9	65.2
Karnataka	14.7	53.7
Goa	7.6	72.8
Lakshadweep	4.2	67.9
Kerala	9.3	78.8
Tamil Nadu	11.0	63.4
Puducherry	7.3	66.8
Andaman & Nicobar Island	28.4	68.5
Telangana	14.4	66.9

Table 3 depicts the multiple logistic regression of CDs and NCDs among the elderly in India. The odds of NCDs were higher among female elderly (OR = 1.13; C.I. = 1-1.27) than their male counterparts. The odds of CDs decreased with an increase in education; however, the odds of NCDs increased with an increase in education. The results found that the odds of CDs were lower among higher educated elderly (OR = 0.62; C.I. = 0.47-0.81) than uneducated elderly, and odds of NCDs were higher among higher educated elderly (OR = 1.80; C.I. = 1.37-2.35) than their uneducated counterparts. Similarly, the odds of CDs were lower among urban elderly (OR = 0.67; C.I. = 0.59-0.76) than rural elderly, and odds of NCDs were higher among urban elderly (OR = 1.85; C.I. = 1.62-2.10) than their rural counterparts. The results were insignificant for the association between CDs and wealth index; however, the odds of NCDs were higher among the richest elderly (OR = 1.93; C.I. = 1.63-2.28) than the poorest elderly. The odds of CDs (OR = 0.59; C.I. = 0.51-0.68) and NCDs (OR = 0.47; C.I. = 0.41-0.54)

were lower among those with good self-rated health than those with poor self-rated health. The odds of NCDs (OR = 1.16; C.I. = 1.03–1.29) were higher among the elderly with no physical activity than their counterparts. The odds of NCDs were lower among the elderly who had no ADL (OR = 0.52; C.I. = 0.35–0.78) than those who had severe ADL limitations.

Table 3
Multiple logistic regression of communicable diseases (CDs) and non-communicable diseases (NCDs) among elderly by socio-economic and health parameters

	Communicable Diseases		Non-communicable Diseases	
	OR	CI at 95%	OR	CI at 95%
Sex				
Male				
Female	0.97	0.88–1.10	1.13**	1.00-1.27
Age				
60–69				
70+	0.93	0.83–1.03	1.03	0.93–1.14
Marital Status				
Currently married				
Never Married	1.42	0.79–2.54	0.69	0.38–1.21
Divorced/Separated/Deserted	1.11	0.74–1.64	0.91	0.62–1.32
Education				
No education				
Below primary	0.85**	0.72–0.99	1.52***	1.30–1.77
Primary	0.80**	0.67–0.94	1.64***	1.41–1.92
Secondary	0.77***	0.67–0.90	1.75***	1.52–2.02
Higher	0.62***	0.47–0.81	1.80***	1.37–2.35
Living arrangements				
Living alone				
With spouse	1.23	0.79–1.91	0.88	0.58–1.32
With others	1.08	0.85–1.36	0.84	0.68–1.02
Place of residence				
Rural				
Urban	0.67***	0.59–0.76	1.85***	1.62–2.10
Currently working				
Yes				
No	1.01	0.90–1.13	1.60***	1.44–1.79
Wealth Index				
Poorest				
Poorer	1.07	0.93–1.23	1.34***	1.17–1.53
Middle	0.93	0.79–1.07	1.48***	1.28–1.71
Richer	0.92	0.79–1.06	1.68***	1.45–1.95
Richest	1.05	0.88–1.23	1.93***	1.63–2.28
Self-rated health				
Poor				
Good	0.59***	0.51–0.68	0.47***	0.41–0.54
Physical activities				
Yes				
No	0.82***	0.73–0.91	1.16***	1.03–1.29
Tobacco Use				

	Communicable Diseases		Non-communicable Diseases	
No				
Yes	1.18***	1.06–1.31	0.86***	0.78–0.95
Alcohol use				
Yes				
No	1.07	0.94–1.21	1.03	0.91–1.15
ADL disability				
Severe ADL				
Moderate ADL	1.03	0.69–1.51	0.69	0.46–1.03
No ADL	1.00	0.67–1.46	0.52***	0.35–0.78
IADL disability				
Severe IADL				
Moderate IADL	1.09	0.81–1.45	1.50*	1.12–2.02
No IADL	0.92	0.68–1.24	1.06	0.78–1.43
*** <i>p</i> < 0.001; ** <i>p</i> < 0.05; * <i>p</i> < 0.10				

Table 4 depicts the rural-urban inequality in the prevalence of CDs among the elderly by various characteristics. Results found that education (50%) contributes nearly half of the rural-urban inequality in the prevalence of CDs among the elderly. Self-rated health was another significant predictor that explained nearly one-sixth (16.01%) of the rural-urban inequality in the prevalence of CDs among the elderly in India.

Table 4
Decomposition results for rural-urban differentials for communicable diseases (CDs) among elderly by socio-economic and health parameters

	Coefficient	Standard Error	Lower limit at 95%	Upper limit at 95%	Percent contribution
Sex	0.0011	0.0017	-0.0022	0.0043	-3.72
Age	0.0006	0.0006	-0.0006	0.0018	-2.04
Marital Status	0.0002	0.0008	-0.0014	0.0019	-0.80
Education**	-0.0145	0.0068	-0.0278	-0.0013	49.95
Living arrangements	0.0008	0.0012	-0.0016	0.0032	-2.64
Currently working	-0.0037	0.0028	-0.0091	0.0018	12.65
Wealth Index	0.0002	0.0005	-0.0008	0.0013	-0.84
Self-rated health***	-0.0047	0.0010	-0.0067	-0.0026	16.01
Physical activities	0.0009	0.0026	-0.0042	0.0061	-3.24
Tobacco Use**	-0.0063	0.0027	-0.0116	-0.0009	21.52
Alcohol use	0.0004	0.0006	-0.0007	0.0015	-1.47
ADL disability	-0.0006	0.0006	-0.0018	0.0006	2.10
IADL disability	-0.0035	0.0032	-0.0099	0.0029	12.05
*** <i>p</i> < 0.001; ** <i>p</i> < 0.05; * <i>p</i> < 0.10					

Table 5 depicts the rural-urban inequality in the prevalence of NCDs among the elderly by various characteristics. Education status and current working status were the two significant predictors of widening rural-urban inequality in the prevalence of NCDs among the elderly. On the other hand, wealth index, Self-rated health, and IADL disability were the three factors narrowing down the rural-urban inequality in the prevalence of NCDs among the elderly in India.

Table 5
Decomposition results for rural-urban differentials for non-communicable diseases among elderly by socio-economic and health parameters

NCDs	Coefficient	Standard error	Lower limit at 95% CI	Upper limit at 95% CI	Percent contribution
Sex	-0.0020	0.0022	-0.0064	0.0023	-5.6
Age	-0.0010	0.0007	-0.0024	0.0003	-2.8
	0.0010				
Marital Status		0.0007	-0.0004	0.0025	2.9
Education***	0.0370	0.0099	0.0176	0.0565	102.6
Living arrangements	-0.0008	0.0010	-0.0028	0.0011	-2.3
Currently working***	0.0108	0.0038	0.0034	0.0183	30.0
Wealth Index**	-0.0018	0.0009	-0.0035	-0.0001	-5.0
Self-rated health***	-0.0053	0.0011	-0.0075	-0.0031	-14.6
Physical activities	0.0035	0.0038	-0.0039	0.0108	9.6
Tobacco Use	0.0039	0.0037	-0.0033	0.0110	10.7
Alcohol use	0.0004	0.0006	-0.0009	0.0016	1.0
ADL disability	-0.0016	0.0010	-0.0035	0.0003	-4.4
IADL disability**	-0.0081	0.0041	-0.0160	-0.0001	-22.3
*** $p < 0.001$; ** $p < 0.05$; * $p < 0.10$					

Discussion

Our study attempts to assess the prevalence of CDs and NCDs among the elderly and its associated factors. The finding of this study shows that a substantial proportion of the elderly population in India is facing the burden of CD and the long-neglected NCD. From the beginning of the 21st century, the NCDs has been recognized as an emerging global health challenge [15], and also it has already started sweeping extensively all over the world with an exceedingly increasing trend in developing countries [8, 15, 16]. However, India does not recognize it as an important public health challenge till the second decade of this millennium [17]. In the National Health Policy 2002, the NCDs were not given a significant position among public health issue, but later in Draft National Health policy 2015, the chronic disease with non-communicable nature drew special attention [17].

This paper envisages the prevalence of both types of diseases among the elder population and found that more than half of the elderly population suffers from NCD, and nearly one-third suffers from CD. A study based on wave one of the world Health organization's study on global ageing and adult health also found the same pattern of NCD's prevalence and reported that 50% of total aged population is suffering from at least one type of chronic non-communicable disease [18]. Furthermore, in a report released by Ministry of Health and Family Welfare (MOHFW), Government of India (GOI), "India: Health of the Nation's States" reveal that NCDs' contribution to total disease burden-'disability-adjusted life years' (DALYs) increased from 30% in 1990 to 55% in 2016, as well as the proportion of fatalities owing to NCDs (in total deaths) increased from 37% in 1990 to 61 percent in 2016. This demonstrates a rapid epidemiological shift in illness burden to NCDs.

Also, the prevalence of these diseases varies with the socio-economic and bio-demographical backgrounds of the elderly. The percentage of elderly suffering from NCD is higher among those who are highly educated, richest, living in the urban area, taking alcohol, having severe ADL and IADL, whereas CD is common among the elderly those who are uneducated and lower educated, living in rural areas, poorer, taking tobacco, having severe ADL and IADL. The CD and NCD are also found to be higher among those elderly who are living alone. The living arrangements of the older population have a significant impact on their health. The percentage of elders with CDs and NCDs is higher among those who are living alone. The fertility decline has a direct association with the declining co-residence of the elders [19], and as a consequence, the elderly are not getting the care that is required for their better health status.

The study also presents the state-wise variation in CDs and NCDs among the elderly. The NCDs are found to be more common in south Indian states, and UTs and Kerala have exceptionally highest percentage of elderly with NCDs across all states of India. The high burden of NCD in Kerala among the elderly is primarily due to the increase in the proportion of their population and the adoption of a sedentary lifestyle [20]. The burdens of CDs are found to be higher in Chhattisgarh, Rajasthan, Haryana, Madhya Pradesh, Uttar Pradesh, and Bihar. The geographical pattern of CDs and NCDs manifests the north-south divide in the burden of these diseases. The less-developed north India with a lower percentage of urbanization has more burden of CDs, whereas the more developed southern India has a higher percentage of the urban population, has a greater burden of NCDs. As reported by the previous literature, the urban population has a greater burden of NCD and related risk [21]. Furthermore, region-wise variation in the diseases could be attributed to the region-specific food habits and harmful dietary practices, tobacco consumption, and sedentary habits [22].

The present study also shows the proportion of CDs and NCDs among the elderly in India. Among CDs, diarrhea, Malaria and Typhoid have the highest proportion, and Chikungunya, tuberculosis, and dengue have the lowest proportion. The most common NCDs are hypertension, arthritis, diabetes, and chronic lung diseases. The hearth diseases and cancer have a comparatively lower prevalence than above-mentioned NCDs, but they are found to be most

fatal across countries. Globally, the heart diseases (cardiovascular diseases) has the highest fatality rate among all NCDs and account for nearly 17.9 million death annually which is followed by death because of cancers (9.3 million), chronic lung diseases (4.1 million), and diabetes (1.5 million) [23]. In India, these four NCDs, including stroke, account for nearly 5.8 million deaths annually [15, 24]. On the other hand, with these NCDs, the CDs continue to pose a significant challenge to India's elderly life.

Corroborating with previous findings [25, 26], the study noted a higher likelihood of NCDs among the female elderly than their male counterparts. In developing countries, including India, women report more about symptoms of their illness than men, which could be attributed to their higher prevalence of disease as outlined in this study[27, 28]. Also, it has been noted that females tend to suffer from chronic debilitating conditions but not fatal ones, and this explains the paradox of high morbidity and less mortality among them compared to men [29]. In line with previous studies [26, 30], the study noted a higher odds of CDs among rural elderly, whereas the risk of NCDs was higher among urban elderly than their respective counterparts. A sedentary lifestyle and physical inactivity could expose the urban population to a high risk of NCDs [31, 32]. Furthermore, nuclear family setup causing loneliness lack of care could be another reason of high NCDs among the urban population [33]. The findings of higher odds of NCDs among highly educated and richest elderly agree with previous literature [30]. Educated and richest elderly are more likely to follow sedentary lifestyles, which could be a plausible reason for higher NCDs.

Strengths And Limitations

The study has some potential limitations. The study has attempted to fill in the literature gap by examining the CDs and NCDs in a single study among the elderly in India using an extensive nationally representative sample survey-based data. Despite its considerable strength, the study has few significant limitations. The cross-sectional nature of data limits our understanding of causal interferences. Moreover, the reporting of NCDs could be affected by the recall bias.

Conclusion

The burden of both CD and NCD among the elderly population requires immediate intervention. Among both types of diseases, the NCD is recognized as a more fatal and long-duration disease resulting from a combination and role of physiological, environmental, behavioural, and genetic factors throughout the life cycle. Although NCDs are treatable once diagnosed but as a prolonged health condition due to the sedentary lifestyle, it cannot be halted by providing treatment. The needs of men and women and urban and rural elderly must be addressed through appropriate effort. In a developing country like India, preventive measures, rather than curative measures of communicable diseases, will be cost-effective and helpful.

Abbreviations

ADL

Activity of Daily Living

CD

Communicable Disease

CEB

Census Enumeration Block

CI

Confidence Interval

DALYs

Disability-adjusted Life Years

GoI

Government of India

HRS

Health and Retirement Study

HSPH

Harvard T.H. Chan School of Public Health

IADL

Instrumental Activity of Daily Living

IIPS

International Institute for Population Sciences

LASI

Longitudinal Ageing Study in India

MoHFW

Ministry of Health and Family Welfare

NCD

Non-communicable disease

NIA

National Institute on Aging

OR

Odds Ratio

TB
Tuberculosis
UNFPA
United Nations Population Fund
USC
University of Southern California
UTs
Union Territories

Declarations

Ethics approval and consent to participate: The authors were not involved in data collection process and therefore they did not require any ethical approval or consent to participate. The LASI data is secondary in nature. The data is freely available on request and survey agencies that conducted the field survey for the data collection have collected a prior consent from the respondent. The ethical clearance was provided by Indian Council of Medical Research (ICMR), India. The survey agencies that collected data followed all the protocols. To maximize the cooperation of the sampled HHs and individuals, participants were provided with information brochures explaining the purpose of the survey, ways of protecting their privacy, and the safety of the health assessments as part of the ethics protocols. As per ethics protocols, consent forms were administered to each HH and age-eligible individual. In accordance with Human Subjects Protection, four consent forms were used in the LASI: Household Informed Consent, Individual Informed Consent, Consent for Blood Samples Collection for Storage and Future Use (DBS), and Proxy Consent. For each survey participant, the study protocol was described and the steps of each biomarker test were demonstrated by the trained health investigators. Participant's consent (signed/oral) was obtained for the interviews. Since, the survey obtained either signed or oral consent, it was feasible for each participant to provide his/her consent.

Consent for publication: Not applicable

Availability of data and materials: The datasets generated and/or analysed during the current study are available with the International Institute for Population Sciences, Mumbai, India repository and could be accessed from the following link: https://iipsindia.ac.in/sites/default/files/LASI_DataRequestForm_0.pdf. Those who wish to download the data have to follow the above link. This link leads to a data request form designed by International Institute for Population Sciences. After completing the form, it should be mailed to: datacenter@iips.net for further processing. After successfully sending the mail, individual will receive the data in a reasonable time.

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Figures

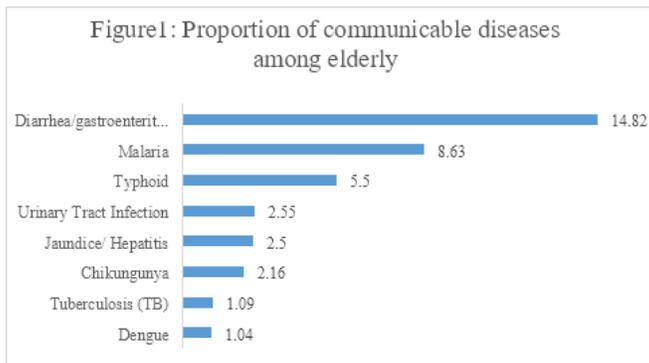


Figure 1

Proportion of communicable diseases among elderly Communicable diseases

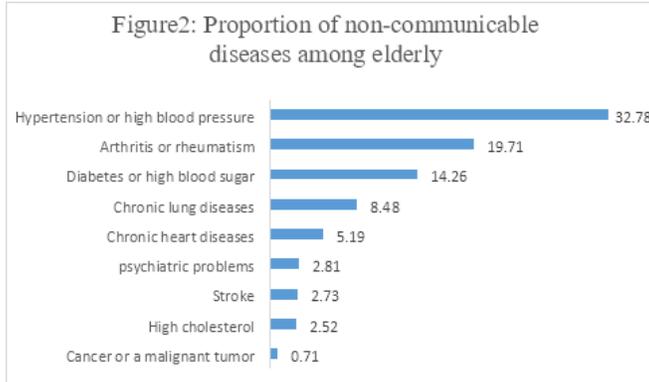


Figure 2

Proportion of non-communicable diseases among elderly Non-communicable diseases