Social Science Spectrum ISSN 2454-2806
Vol. 7 , No. 1, Month 2021, pp.28-41

Prevalence of chronic diseases among older adults in EAG and non-EAG states of India and its contextual determinants

Ravi Durga Prasad[1*] and Koustav Ghosh[1]

Abstract

Population aging is an emerging worldwide phenomenon. As a result of demographic and epidemiology transitions, life expectancy has increased across the globe. With the reflection of aging and increasing global population, chronic (non-communicable) diseases have become a global health challenge. Their burden becoming major public health challenges is more pronounced in low-performing states or developed states in India. Therefore, the present study assesses the prevalence of chronic diseases among older adults in Empowered Action Group (EAG) and non-EAG states, and their contextual factors. The study uses the Longitudinal Ageing Study in India (LASI), Wave-1 data, the survey was conducted during 2017-18. Bi-variate, spatial analyses, and logistic regression models have been carried out to assess the prevalence of chronic diseases among older adults. The prevalence of at least one chronic disease among older adults in India was about 55 per cent and it was about 50 per cent and 59 per cent in EAG and non-EAG states respectively. The prevalence of hypertension (26%) was the leading chronic disease among older adults, followed by gastrointestinal problems (18%), arthritis (16%), diabetes (12%) and chronic lung diseases (6%). The odds of chronic diseases among urban older adults were 39 per cent (Odds Ratio [OR]=1.39; 95% CI:1.29-1.50) and 30% (OR=1.30; 95% CI:1.24-1.35) higher than their rural counterparts in both EAG and non-EAG states respectively. The study concludes that major contextual factors of chronic diseases were higher age, smoking and using smokeless tobacco, physical inactivity, never working, lack of education, Muslim religion, poor economic status and residing in urban areas in both EAG and non-EAG states.

Keywords: *Chronic diseases, EAG and non-EAG states, older adults, India.*

I. Introduction

Population ageing is an emerging worldwide phenomenon. As a result of demographic and epidemiology transitions, life expectancy has increased across the globe. With the reflection of ageing and increasing global population, chronic (non-communicable) diseases—mainly cardiovascular diseases, diabetes, cancer, chronic respiratory diseases, arthritis, stroke, gastrointestinal problems, etc., —are becoming a global health challenge (Upadhyay, 2012; Chen et al., 2018; Ding et al., 2016), especially in the ongoing COVID-19 pandemic crisis. Chronic diseases are noteworthy not only because they strike older adult life but also because they may impose a socioeconomic burden in the coming future (Ding et al., 2016; Bloom et al, 2012; Arokiasamy, 2018; Irshad et al, 2022). Non-communicable diseases (NCDs) cause a majority of morbidity and mortality worldwide (Sousa et al., 2010; Bennett et al., 2018) and this is predicted to rise substantially in the coming decades (Bloom et al., 2012).

The Sustainable Development Goals (SDGs) target 3.4 is "By 2030 reduce by one-third premature mortality from NCDs through prevention and treatment and promote mental health and well-being". About 71 per cent of NCDs accounted for an estimated around 40 million out of the 57 million deaths worldwide in 2016 (Bennett et al., 2018; WHOa, 2020). More than 80 per cent of these deaths occurred in low and middle-income countries (Abegunde et al., 2007), and

*[1] Doctoral Student, Gokhale Institute of Politics and Economics (GIPE), Pune, India. Email: ravi.prasad@gipe.ac.in, ORCiD: 0000-0002-2778-0268 (Corresponding author)
[1] Doctoral Student, Gokhale Institute of Politics and Economics (GIPE), Pune, India.
Email: koustav.ghosh-prc@msubaroda.ac.in

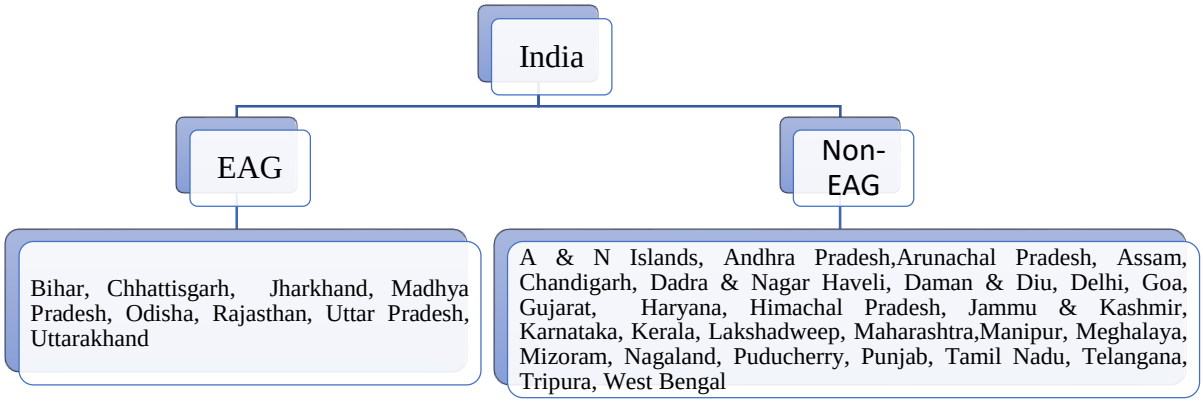
Acknowledgements: Authors thank the Director of IIPS and Principle Investigator(s) of the LASI Project for providing the survey data.

cardiovascular diseases are claimed as the leading NCD cause of death in them including India (WHOb, 2020). The prevalence of NCDs and their risk factors surpassed the communicable diseases in terms of the most common cause of morbidity and mortality in India (Upadhyay, 2012; Kumar & Shankar, 2018). Being an ageing nation, 5.87 million (about 60%) deaths are attributed to NCDs (Shil et al., 2018). Therefore, it becomes important to study the prevalence of at least one chronic disease among those aged 45 years and above in the backdrop of the ongoing demographic and epidemiological transition in India.

Although the rising burden of chronic diseases is severe in India, the resources for treatment are limited. Many chronic conditions are untreated due to the lack of awareness and limited access to healthcare infrastructure in India. To overcome these issues, the Government of India launched the National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS) in 2010. However, the government gives less attention to preventive interventions for chronic diseases, and their burden is far greater than communicable diseases (Abegunde et al., 2007). The National Rural Health Mission (NRHM) was initiated by the government in 2005 to focus on providing accessible, affordable, and high-quality healthcare to the rural population, especially disadvantaged people (MoHFW (GOI), 2005). The Empowered Action Group (EAG) states of India, which include Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Odisha, Rajasthan, Uttarakhand, and Uttar Pradesh, are a part of NRHM. These EAG states are also referred to as low-performing or less developed states. Additionally, Ayushman Bharat, also known as "Healthy India," is a nationwide programme introduced in 2017 the National Health Policy to achieve Universal Health Coverage. However, despite these efforts, there exist significant disparities in access to healthcare utilization and hospitalization (Banerjee, 2021; Akhtar & Saikia, 2022). Geographic region, race, economic position and rural-urban disparities play a significant role in these discrepancies (Banerjee, 2021; Paul et al., 2021). Consequently, it is important to examine how chronic illness and insurance coverage vary among the elderly and whether these variations are more pronounced in low-performing states or developed states in India. Therefore, the present study examines the prevalence of chronic diseases and their associated contextual factors among older adults in EAG and non-EAG states in India. Further, it recommends a comprehensive geriatric policy and practices for older adults.

India has been classified into EAG and non-EAG states based on overall development (Figure 1). To achieve area-specific national health interventions, the Government of India constituted the EAG states in 2001. The eight EAG states—namely Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Orissa, Rajasthan, Uttarakhand and Uttar Pradesh—constitute 45 per cent of the total population of the country with poorer socio-economic status and demographically lagging behind states. Therefore, the present study compares the status of chronic diseases among EAG and non-EAG states.

Figure 1: Classification of EAG and non-EAG states in India



II. Materials and methods

Data

The study based on the secondary data which was extracted from the Longitudinal Ageing Study in India (LASI) Wave-1, a nationally represented survey conducted across 35 states/Union Territories (UTs) (excluding Sikkim) from April 2017 to December 2018. The LASI collected a sample of 72,250, consisting of all age-eligible (≥45 years) persons and their spouses. The LASI is India's first and the world's largest study that provides reliable national-level estimates of social and economic well-being and health outcomes for eligible older adults and their spouses irrespective of age (IIPS,2020).

The LASI survey adopted a multistage stratified area probability cluster sampling design to arrive at the eventual units of observation. Within each state, it adopted a three-stage sampling design (identification of primary sampling units, villages and households) in rural areas and a four-stage sampling design (identification of primary sampling units, wards, census enumeration blocks and households) in urban areas.

Outcome variable

The study used 'prevalence of chronic diseases' as the dependent variable. There is a question asked in the LASI survey: "Has any health professional ever diagnosed you with chronic conditions or diseases?" To measure the prevalence of a chronic disease, we reconstruct a dichotomous variable ('1' and '0') from the set of chronic condition variables (Supplementary Information: table S1); where '1' is considered as "elderly suffering from at least one chronic disease" and '0' is considered as "elderly not suffering".

Explanatory variables

A set of background variables of households along with factors associated with elderly chronic diseases have been employed in this study such as sex (male and female), age group (45–59, 60–74 and 75 years & above), education level (no schooling, primary, middle, secondary and higher and above), marital status (currently married and widowed/divorced/separated/others), religion (Hindu, Muslim, Christian and others), social group (Scheduled Tribes, Scheduled Castes, Other Backward Classes and none of the above), living arrangements (living alone, living with spouse and/or others, living with spouse and children, living with children and others, and living with others only), work status (currently working, worked in past but currently not working, and never worked), wealth quintile (poorest, poorer, middle, richer, and richest), place of residence (rural and urban), physical activity (daily or more than one a week, weekly once or sometimes in a month, and hardly ever or never), ever smoked or used smokeless tobacco (yes and no), and ever consumed any alcoholic beverages (yes and no).

Statistical analysis

The study used descriptive statistics and bivariate analysis to find the preliminary results. To understand the geographical variation among states in the prevalence of at least one chronic disease among older adults (≥45 years), spatial analysis has been used. Finally, we used the logistic regression models to establish the factors associated with the prevalence of chronic diseases. The mathematical expression of the logistic regression analysis is:

$$logit(P) = [\ln P/(1-P)] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots\ldots\ldots\ldots + \beta_k X_k$$

Where, P is the probability of occurrence of the event (at least one chronic disease) which is influenced by a set of predictor variables in the manner specified with parameters β_0, β_1, β_2 ------ β_k as the coefficients and X_1, X_2, --------X_k are predictor variables. Where P/(1-P) is the measure of odds, hence the ratio of P/(1-P) is the log of odds or the *logit* of P. We estimate dichotomous logit

for the dependent variables and considered 1 per cent, 5 per cent, and 10 per cent of the significant levels for all statistical tests. All analyses have been carried out using STATA version 16.

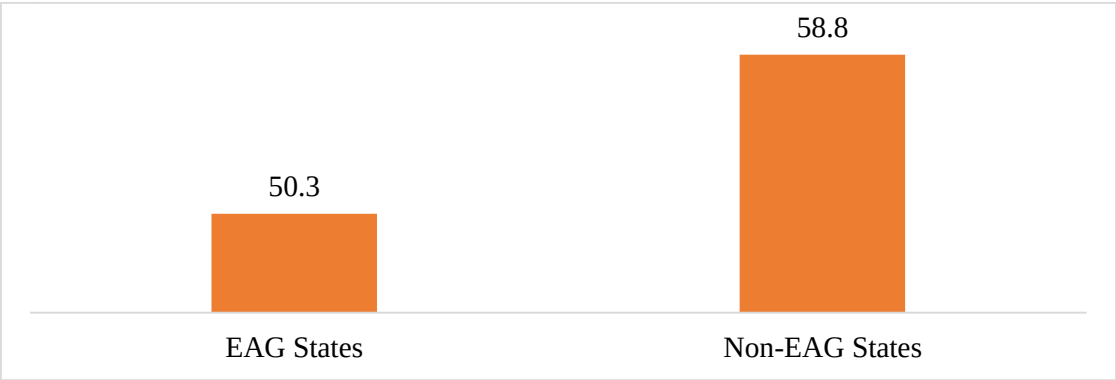
III. Results

Prevalence of chronic diseases and EAG and non-EAG state differentials

Figure 2 shows the prevalence of at least one chronic disease among older adults in EAG and non-EAG states in 2017-18. The results show that 50.3 per cent of the elderly people living in EAG states suffer from at least one chronic disease, while 58.8 per cent of adults from non-EAG states suffer from at least one chronic disease.

Moreover, the prevalence of hypertension, arthritis and diabetes in EAG states was 30 per cent, 19 per cent and 14 per cent higher than in non-EAG states, i.e., 22 per cent, 10 per cent and 7 per cent respectively. Further, the prevalence of gastrointestinal problems (16%) in EAG states was lower than in non-EAG states (22%). Overall, the prevalence of hypertension (26%) was the leading chronic disease among older adults, followed by gastrointestinal problems (18%), arthritis (16%), diabetes (12%), and chronic lung diseases (6%). Moreover, there are notable differences in the prevalence of chronic diseases among older adults (≥45 years) by sex (Table S1). Older females had a higher prevalence of hypertension (29%) and arthritis (18%) compared with their male counterparts (23% and 13% respectively) (Supplementary Information: Figure S1).

Figure 2: Prevalence of at least one chronic disease among older adults in EAG and non-EAG States, India, LASI 2017–18



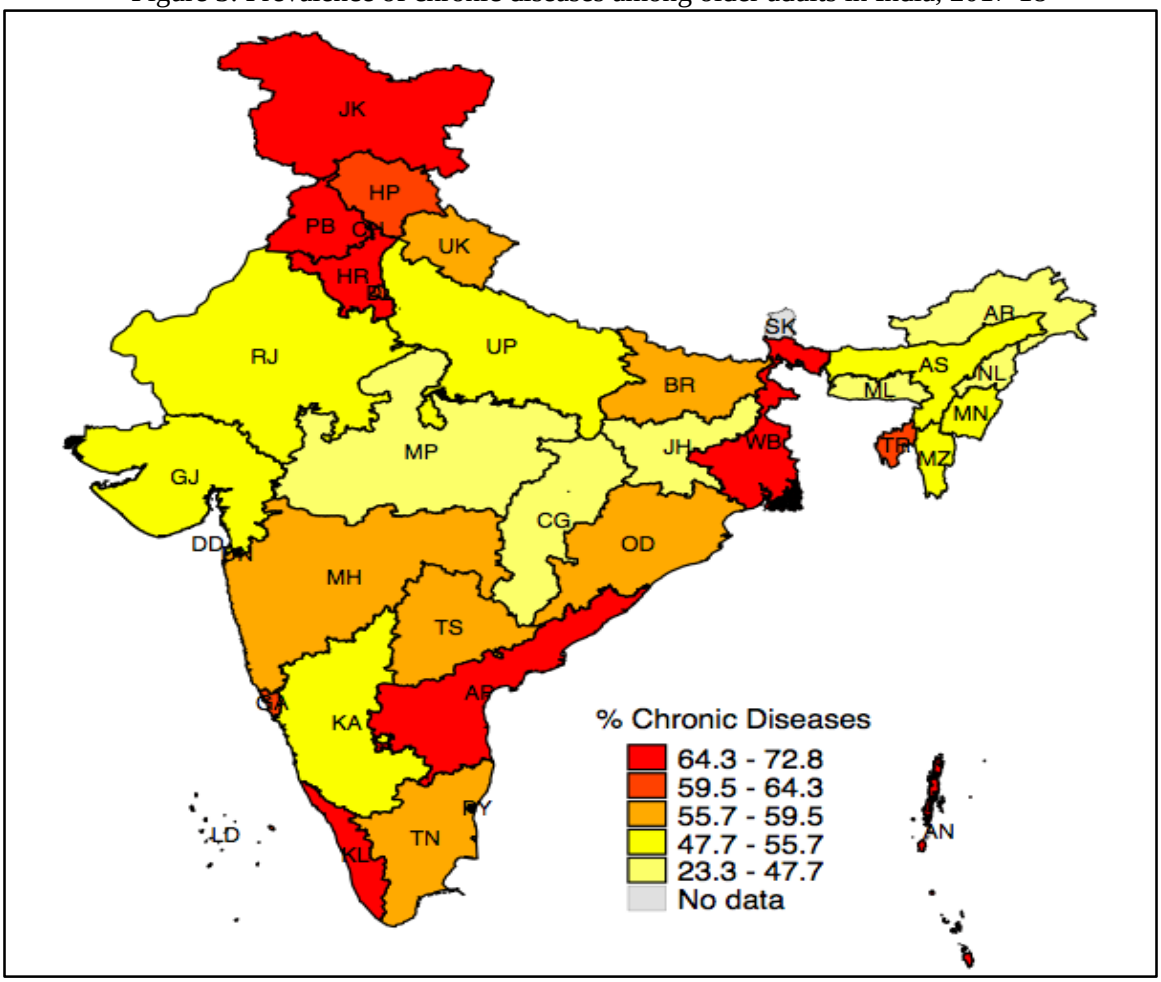
Source**:** Authors estimated from LASI Wave-I (2017-18).

Figure 3 illustrates the prevalence of chronic diseases among older adults (≥45 years) by the state/UT level in India. Overall, the prevalence of at least one chronic disease among older adults was about 55 per cent, and 22 out of 35 states/UTs reported more prevalence than the national average. Kerala has the highest prevalence of chronic diseases (73%), followed by Panjab (70%), Jammu & Kashmir (69%) and Haryana (67%) and, on the other hand, Nagaland (23%), Meghalaya (33%), Chhattisgarh (37%) and Arunachal Pradesh (38%) have the lowest prevalence of chronic diseases in India. Figure 4 presents the prevalence of chronic diseases among older adults by residence and sex. Concerning the place of residence and sex, the rural prevalence (54%) was slightly higher than urban (56%) and the prevalence among older males (53%) was lower than among older females (63%). However, the results showed prominent differences within the states/UTs (Figure 4).

The prevalence of at least one chronic disease among older adults in EAG states was about 50 per cent and about 59 per cent in non-EAG states (Table S2). Among EAG states, Uttarakhand (58%) shows the highest prevalence and Chhattisgarh (37%) the lowest prevalence. Interestingly, this prevalence is higher in urban areas (about 60%) compared with rural areas (about 48%). On the other hand, among non-EAG states, the prevalence of chronic diseases among older adults was about 57 per cent in rural areas and about 62 per cent in urban areas. Further, in rural areas the prevalence ranged from the lowest in Arunachal Pradesh (about 22%) to the highest in Jammu & Kashmir (about

73%) among non-EAG states and it ranges in Nagaland (about 21%) and Kerala (about 73%) in urban areas (Table S2).

Figure 3: Prevalence of chronic diseases among older adults in India, 2017-18

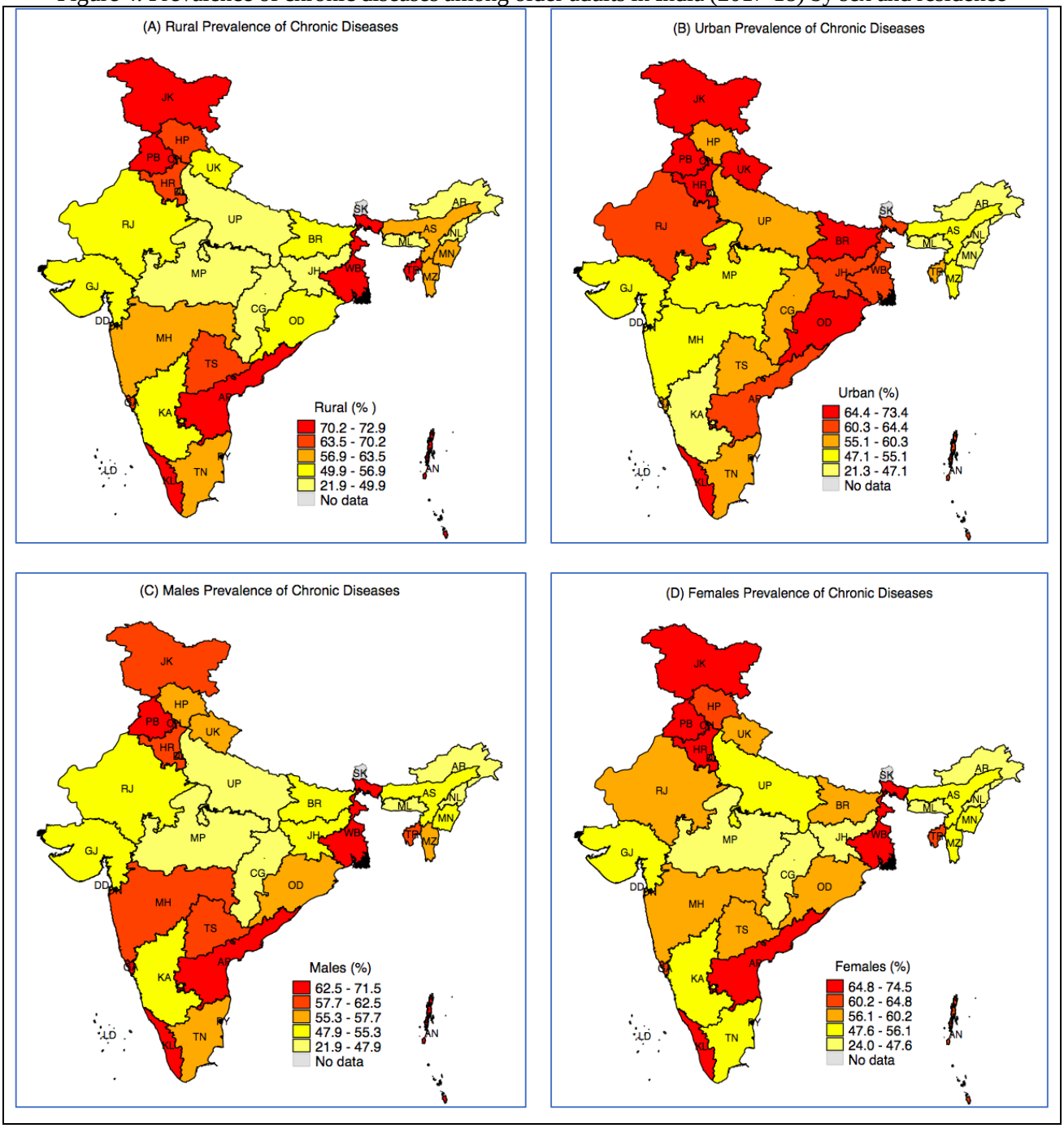


Source: Authors estimated from LASI Wave-I (2017-18).

Differentials in EAG and non-EAG States by background characteristics

Table 1 presents the prevalence of chronic diseases among older adults in EAG and non-EAG states by background characteristics. The results suggest that the prevalence of chronic diseases was higher in the people aged 75 years and above compared with those aged 45-59 years in both EAG and non-EAG states. The prevalence was more among higher and above-educated respondents (62%) in EAG states compared with illiterates (47%). In the case of non-EAG states, more or less a similar picture occurred at all educational levels. About 60 per cent and 65 per cent of the richest wealth quintile suffer from chronic diseases more than about 43 per cent of the poorest wealth quintile in EAG and non-EAG states respectively and this prevalence increased with an improvement in their wealth status. Moreover, the highest prevalence of chronic conditions among older adults was observed in widowed/divorced (52% and 64%), Muslims (56% and 66%), other social groups (57% and 64%), who never worked (58% and 70%), residing in urban areas (60% and 62%), and never having a physical activity (54% and 64%) in EAG and non-EAG states respectively.

Figure 4: Prevalence of chronic diseases among older adults in India (2017-18) by sex and residence



Source: Authors estimated from LASI Wave-I (2017-18).

Determinants of chronic diseases in EAG and non-EAG states

Table 2 illustrates the results of logistic regression estimates of chronic diseases among older adults in EAG and non-EAG states in India (2017–18) after controlling all the background variables. For instance, the odds ratio (OR) of at least one chronic condition among older females was 19 per cent (OR=1.19; 95 per cent CI:1.10-1.29) and 14 per cent (OR=1.14; 95% CI:1.09-1.20) higher than their male counterparts in both EAG and non-EAG states respectively. The results show that the likelihood of chronic diseases among aged 60–74 years and 75 years and above were 39 per cent (OR=1.39; 95% CI:1.30-1.48) and 42 per cent (OR=1.42; 95% CI:1.27-1.59) more in EAG states and 65 per cent (OR=1.65; 95% CI:1.57-1.72) and 63 per cent (OR=1.63; 95% CI:1.51-1.76) non-EAG states, as compared with the aged 45–59 years the result was highly significant ($p<0.01$).

Table 1: Prevalence of at least one chronic diseases among older adults in EAG and non-EAG states by background characteristic in India, LASI 2017–18

Background characteristics	Prevalence of at least one chronic disease			
	EAG states		Non-EAG states	
	% (n)	Chi-square P-value	% (n)	Chi-square P-value
Sex				
Male	49.6 (9,690)	0.033	58.0 (20,879)	<0.001
Female	50.9 (12,349)		59.4 (29,332)	
Age group				
45-59 years	45.9 (11,845)	<0.001	51.7 (28,941)	<0.001
60-74 years	54.3 (8,057)		67.1 (16,658)	
75 years & above	57.2 (2,137)		71.0 (4,612)	
Education				
No schooling	47.2 (12,735)	<0.001	56.6 (20,477)	<0.001
Less than 5 years (primary)	54.1 (3,572)		62.7 (9,492)	
5-9 years (middle)	52.5 (2,670)		60.4 (9,230)	
10-12 years (secondary)	54.6 (2,020)		59.4 (7,826)	
13 years & above (higher)	61.5 (1,042)		57.7 (3,186)	
Marital status				
Currently married	49.7 (17,311)	0.005	57.2 (38,085)	<0.001
Widowed/divorced/separated & others	49.7 (4,728)		63.6 (12,122)	
Religion				
Hindu	49.5 (19,292)	<0.001	57.8 (33,681)	<0.001
Muslim	56.4 (2,093)		65.5 (6,574)	
Christian	50.8 (376)		54.1 (6,839)	
Others	53.4 (278)		61.9 (3,117)	
Social group				
Schedule tribes	47.9 (4,260)	<0.001	58.2 (7,786)	<0.001
Schedule castes	37.5 (2,800)		42.3 (9,709)	
Other backward classes	51.0 (9,882)		57.8 (17,302)	
None of the above (others)	57.1 (5,069)		64.4 (12,818)	
Missing/not reported	43.3 (28)		66.6 (2,596)	
Living arrangement				
Living alone	52.3 (616)	<0.001	66.7 (1,697)	<0.001
Living with spouse and/or others	50.9 (3,512)		60.2 (7,326)	
Living with spouse and children	49.3 (13,518)		56.3 (30,145)	
Living with children and others	53.0 (3,581)		65.3 (8,913)	
Living with others only	51.3 (812)		52.6 (2,130)	
Work status				
Currently working	53.5 (6,113)	<0.001	65.3 (15,183)	<0.001
Worked in past but currently not working	44.1 (10,477)		48.6 (22,526)	
Never worked	58.0 (5,449)		70.1 (12,502)	
Wealth Quintile				
Poorest	43.4 (5,994)	<0.001	52.7 (8,164)	<0.001
Poorer	48.9 (5,354)		57.6 (9,176)	
Middle	50.9 (4,337)		56 (10,200)	
Richer	54.8 (3,606)		61.4 (11,080)	
Richest	60.4 (2,748)		64.9 (11,591)	
Place of residence				
Rural	48.0 (17,619)	<0.001	56.5 (28,915)	<0.001
Urban	59.9 (4,420)		62.4 (21,296)	
Physical activities				
Daily or more than once a week	44.7 (7,548)	<0.001	50.4 (14,660)	<0.001
Weekly once or sometimes a month	48.4 (2,381)		59.8 (3,802)	
Hardly ever or never	53.8 (12,001)		63.9 (31,221)	
Ever smoked or used smokeless tobacco				()
Yes	49.9 (9,177)	0.648	57.5 (15,600)	<0.001
No	50.7 (12,751)		59.9 (34,085)	
Ever consumed any alcoholic beverages				()
Yes	46.5 (3,645)	<0.001	56 (8,277)	<0.001
No	51.0 (18,283)		59.7 (41,426)	
Total	50.3 (22,039)		58.8 (50,211)	

By education level, the chance of chronic diseases was 45 per cent (OR=1.44; 95% CI:1.25-1.69) higher among those higher and above than those who do not have formal education in EAG states, but this was 31 per cent (OR=1.31; 95% CI:1.24-1.38) higher for those who have primary level education in non-EAG states. However, all education groups are almost statistically highly significant ($p<0.01$). According to the household wealth quintile, the chance of chronic diseases among older adults who belonged to the richest wealth quintile was about double higher in EAG states and 1.72 times higher in non-EAG states as compared with older adults who belonged to the poorest quintile and the result were highly significant ($p<0.01$).

Table 2: Factors associated with chronic diseases (at least one) among older adults in EAG and non-EAG states in India, LASI 2017–18

Background characteristics	EAG states		Non-EAG states	
	OR	[95% CI]	OR	[95% CI]
Sex				
Male	1.00		1.00	
Female	1.19***	(1.099 1.291)	1.14***	(1.085 1.200)
Age group				
45-59 years	1.00		1.00	
60-74 years	1.39***	(1.302 1.483)	1.65***	(1.572 1.722)
75 years & above	1.42***	(1.273 1.586)	1.63***	(1.509 1.764)
Education				
No schooling	1.00		1.00	
Less than 5 years (primary)	1.31***	(1.212 1.424)	1.31***	(1.244 1.384)
5-9 years (middle)	1.31***	(1.194 1.439)	1.20***	(1.138 1.272)
10-12 years (secondary)	1.27***	(1.138 1.418)	1.19***	(1.119 1.267)
13 years & above (higher)	1.45***	(1.245 1.685)	1.12**	(1.027 1.226)
Marital status				
Currently married	1.00		1.00	
Widowed/divorced/separated & others	0.86	(0.669 1.105)	1.30***	(1.096 1.548)
Religion				
Hindu	1.00		1.00	
Muslim	1.34***	(1.214 1.476)	1.37***	(1.287 1.456)
Christian	2.02***	(1.619 2.530)	0.88***	(0.821 0.937)
Others	1.02	(0.798 1.316)	1.15***	(1.064 1.251)
Social group				
Schedule tribes	1.00		1.00	
Schedule castes	0.60***	(0.538 0.665)	0.56***	(0.525 0.604)
Other backward classes	0.98	(0.913 1.061)	0.97	(0.916 1.029)
None of the above (others)	1.10**	(1.005 1.204)	1.10***	(1.033 1.171)
Missing/not reported	1.45	(0.626 3.336)	0.91*	(0.827 1.006)
Living arrangement				
Living alone	1.00		1.00	
Living with spouse and/or others	1.02	(0.765 1.371)	1.39***	(1.144 1.687)
Living with spouse and children	1.11	(0.835 1.478)	1.29***	(1.068 1.560)
Living with children and others	1.28***	(1.075 1.535)	1.18***	(1.054 1.320)
Living with others only	1.10	(0.884 1.368)	0.99	(0.864 1.140)
Work status				
Currently working	1.00		1.00	
Worked in past but currently not working	0.78***	(0.719 0.850)	0.73***	(0.693 0.771)
Never worked	1.17***	(1.074 1.273)	1.29***	(1.220 1.369)
Wealth Quintile				
Poorest	1.00		1.00	
Poorer	1.24***	(1.146 1.336)	1.18***	(1.106 1.254)
Middle	1.44***	(1.330 1.567)	1.26***	(1.185 1.341)
Richer	1.67***	(1.529 1.824)	1.45***	(1.367 1.547)
Richest	2.01***	(1.822 2.228)	1.72***	(1.616 1.836)
Place of residence				
Rural	1.00		1.00	

Urban	1.39***	(1.293	1.501)	1.30***	(1.243	1.351)
Physical activities						
Daily or more than once a week	1.00			1.00		
Weekly once or sometimes a month	1.18***	(1.070	1.296)	1.19***	(1.102	1.281)
Hardly ever or never	1.07**	(1.002	1.151)	1.17***	(1.123	1.228)
Ever smoked or used smokeless tobacco						
Yes	1.00			1.00		
No	0.87***	(0.817	0.932)	0.95**	(0.909	0.996)
Ever consumed any alcoholic beverages						
Yes	1.00			1.00		
No	1.00	(0.916	1.087)	0.90***	(0.852	0.957)
Constant	0.51***	(0.371	0.703)	0.55***	(0.443	0.682)
Number of observations	21927			49645		
LR chi2(30)	1344.1			4196.9		
Prob. > chi2	0.000			0.000		
Pseudo R2	0.044			0.0621		
Log-likelihood	-14524.9			-31686.9		

Note: OR=Odds Ratio; CI=Confidence Interval; Significance levels: ***p<0.01, **p<0.05, *p<0.1.

The odds of chronic diseases in non-EAG states were 30 per cent (OR=1.30; 95% CI:1.10-1.55) higher among widowed/divorced older compared with currently married counterparts and the results were statistically significant. However, this was 14 per cent (OR=0.86; 95% CI:0.70-1.10) lower compared with the reference category in EAG states and the difference was not significant. The odds of chronic conditions among Muslims (OR=1.34; 95% CI: 1.21-1.48) and Christians (OR=2.02; 95% CI: 1.62-2.53) were higher compared with Hindu and other religious groups in EAG states. On the other hand, the odds of chronic diseases among Muslims (OR=1.37; 95% CI: 1.29-1.46) and other religious groups (OR=1.15; 95% CI: 1.06-1.25) were higher and this was lower among Christians (OR=0.88; 95% CI: 0.82-0.94) as compared with Hindus in non-EAG states. However, all were statistically highly significant (p<0.01). Further, older adults who were never worked have more odds and currently not working but worked in the past have fewer odds of chronic conditions as compared with those currently working and the differences are statistically significant.

Overall, the results show that the odds of chronic diseases among urban older were 39 per cent (OR=1.39; 95% CI:1.29-1.50) and 30 per cent (OR=1.30; 95% CI:1.24-1.35) higher than their rural counterparts in both EAG and non-EAG states respectively. Moreover, the odds of physical activity were more in older adults who hardly ever or never and sometimes do physical activity compared with performing a physical activity daily or more than once a week. The likelihood of chronic conditions among older adults who never smoked or used smokeless tobacco was lower in EAG states (OR=0.87; 95% CI: 0.82-0.93) and non-EAG states (OR=0.95; 95% CI: 0.91-1.00) as compared with those who smoked or consumed smokeless tobacco.

IV. Discussion

The findings of this study confirm that there are notable differences between chronic diseases among older adults and their contextual variables in EAG and non-EAG states in India. It appears that the lower health insurance coverage at the national level may be due to the fact that only 16.76 per cent of EAG states have health insurance coverage compared with about 22.37 per cent of non-EAG states. This suggests that there are variations in health insurance coverage across states and sociodemographic, economic and health characteristics. Additionally, EAG states, which are typically larger, may have weaker public health infrastructure, higher primary health burden, a greater need for primary care services and lack of additional central government funding (Bowser et al., 2019; Keshri & Ghosh, 2019). Overall, the study found that the prevalence of hypertension was a leading chronic disease among older adults in both EAG and non-EAG states and it was higher among older females than older males and the findings were also similar in another study (Mini & Thankappan, 2017). Overall, non-EAG states like Kerala, Punjab, Haryana, Andhra Pradesh and

West Bengal were having the highest burden of chronic diseases as compared with all EAG states. This suggests a need for priority-based policies and programmes in these states. It has been proven that economic dependency can worsen the occurrence and seriousness of chronic illnesses due to factors like limited access to healthcare, inadequate nutrition and increased stress. Research shows that elderly individuals in non-EAG states are more likely to be economically dependent compared with those in EAG states (Kumar & Kumar, 2019).

Further, this study found some interesting insights concerning demographic and socio-economic factors. A majority of older females were suffering from chronic diseases than older males in both EAG and non-EAG states. It may be due to gender inequalities in resource allocation such as income, education and healthcare, which would explain a higher incidence of chronic diseases among females than in males (Chauhan et al., 2022). This finding aligns with previous studies (Krishnan et al., 2016; Chauhan et al., 2022).

The prevalence of at least one chronic disease was higher among aged people having the least education level and wealth quintile, and it increased sharply with increasing the individuals' age, education level and wealth quintile. Similar results found that older age, lower education and household wealth are significant determinants of chronic illness among older adults (Sousa et al., 2010; Singh et al., 2019; Banjare & Pradhan; 2014). Older adults who were residing in urban areas have more prevalence of chronic illness as compared with their rural counterparts (Singh et al., 2019; Thakur et al., 2021) and our study also saw similar estimates in both EAG and non-EAG states.

Moreover, the lifestyle risk factors such as smoking and using smokeless tobacco, alcohol consumption and physical inactivity are key determinants for developing chronic diseases (Singh et al., 2019; Maimela et al., 2016; Wu F., et al., 2015). Tobacco use is a large contributor to the burden of chronic ailments among older adults, causing 5.9 per cent of the total DALYs in 2016 (ICMR, 2017), suggesting that remains a major targeted preventive measure of lifestyle risk factor. Our results also provide preliminary evidence that tobacco use including smoking and used smokeless tobacco is a significant determinant of developing chronic diseases in both EAG and non-EAG states. Earlier studies also support our findings (Banjare & Pradhan; 2014; Patel et al., 2017). Further, physical inactivity is another important lifestyle risk factor of chronic diseases and this prevalence was more in physically inactive compared with those who were physically active (Singh et al., 2019) and our results also confirm the previous studies. Regular physical activity is linked to lower rates of heart problems, breathing issues, type 2 diabetes, and obesity in both men and women. This supports the notion that physical activity is a healthy behaviour (Marques et al., 2018). Chronic diseases have a negative impact on the quality of life due to their physical and psychological consequences (Marques et al., 2018).

Overall, this study suggests a need to bolster public health policies to improve care for NCDs. Achieving healthy aging in India will require enhanced infrastructure, greater health care awareness and improved health information systems. Thus, this is crucial to identify individuals at higher risk for chronic diseases, invest in health insurance programmes, and promote knowledge and better health behaviour related to these conditions. Consequently, policies and programmes should also focus more on older adults to address ongoing chronic conditions (Shil et al., 2018).

V. Conclusion

The study concludes that the risk factors of chronic conditions are higher age, smoking and using smokeless tobacco, physical inactivity, never working, lack of education, Muslim religion, poor economic status and residing in urban areas in both EAG and non-EAG states in India. Especially, education and wealth preventive interventions should be prioritised because the higher status of education and wealth play a crucial role in the deterrent of lowering chronic diseases in India. Further, India needs comprehensive strategies to reduce deaths from chronic diseases more effectively to achieve the SDG target of 3.4 by 2030. Finally, these findings can be used to explore econometric methods in assessing further determinants affecting the health of older adults in India.

Limitations

The study covered limited contextual determinants. However, some other contextual determinants such as anthropometric measurements (height, weight, waist and hip measurements), biomarkers, dietary and others were not included due to inconsistency in data. Another limitation is that all chronic conditions were assessed based on the self-reporting of respondents which may lead to recall bias. However, our findings are consistent with earlier studies (Mini & Thankappan, 2017; Singh et al., 2019).

Supplementary information

A supplementary material file (additional files Table S1 and Table S2) is attached for supporting the finding of the study.

References

Abegunde, D. O., Mathers, C. D., Adam, T., Ortegon, M., & Strong, K. (2007). The burden and costs of chronic diseases in low-income and middle-income countries. *The Lancet*, *370*(9603), 1929-1938. DOI: https://doi:10.1016/S0140-6736(07)61696-1.

Akhtar, S. N., & Saikia, N. (2022). Differentials and predictors of hospitalisation among the elderly people in India: Evidence from 75th round of National Sample Survey (2017–2018). WWOP, 26, 325. https://doi.org/10.1108/WWOP-11-2021-0055

Arokiasamy, P. (2018). India's escalating burden of non-communicable diseases. *The Lancet global health*, *6*(12), e1262-e1263. DOI: https://doi.org/10.1016/S2214-109X(18)30448-0

Banerjee, S. (2021). Determinants of rural-urban differential in healthcare utilization among the elderly population in India. *BMC Public Health*, *21*(1), 939. https://doi.org/10.1186/s12889- 021-10773-1

Bowser, D. M., Jha, R., Bhawalkar, M., & Berman, P. (2019). The challenge of additionality: the impact of central grants for primary healthcare on state-level spending on primary healthcare in India. *International Journal of Health Policy and Management*, *8*(6), 329. DOI: https://doi.org/10.15171/ijhpm.2019.06

Bennett, J. E., Stevens, G. A., Mathers, C. D., Bonita, R., Rehm, J., Kruk, M. E., ... & Ezzati, M. (2018). NCD Countdown 2030: worldwide trends in non-communicable disease mortality and progress towards Sustainable Development Goal target 3.4. *The Lancet*, *392*(10152), 1072-1088 DOI: https://doi.org/10.1016/S0140-6736(18)31992-5

Bloom, D. E., Cafiero, E., Jané-Llopis, E., Abrahams-Gessel, S., Bloom, L. R., Fathima, S., ... & Weiss, J. (2012). *The global economic burden of noncommunicable diseases* (No. 8712). Program on the Global Demography of Aging. Available from: https://ideas.repec.org/p/gdm/wpaper/ 8712.html

Banjare, P., & Pradhan, J. (2014). Socio-economic inequalities in the prevalence of multi-morbidity among the rural elderly in Bargarh District of Odisha (India). *PloS one*, *9*(6), e97832. DOI: https://doi.org/10.1371/journal.pone.0097832.

Chen, S., Kuhn, M., Prettner, K., & Bloom, D. E. (2018). The macroeconomic burden of noncommunicable diseases in the United States: Estimates and projections. *PloS one*, *13*(11), e0206702. DOI: https://doi.org/10.1371/journal.pone.0206702.

Chauhan, S., Kumar, S., Nath, N. J., Dosaya, D., & Patel, R. (2022a). Gender differential in chronic diseases among older adults in India: Does living arrangement has a role to play? *Aging and Health Research*, 2(4), 100106. https://doi.org/10.1016/j.ahr.2022.100106

Ding, D., Lawson, K. D., Kolbe-Alexander, T. L., Finkelstein, E. A., Katzmarzyk, P. T., Van Mechelen, W., & Pratt, M. (2016). The economic burden of physical inactivity: a global analysis of major non-communicable diseases. *The Lancet*, *388*(10051), 1311-1324. DOI: https://doi: 10.1016/S0140-6736(16)30383-X.

Ghaffar, A., Reddy, K. S., & Singhi, M. (2004). Burden of non-communicable diseases in South Asia. *Bmj*, *328*(7443), 807-810. DOI: https://doi.org/10.1136/bmj.328.7443.807

ICMR, PFHI, IHME. India : Health of the Nation's States Burden. Ministry of Health and Family Welfare, Government of India, New Delhi. 2017; pp.1–220. Available from: https://www.healthdata.org/sites/default/files/files/policy_report/2017/India_Health_of_the_Nation%27s_States_Report_2017.pdf.

IIPS, NPHCE, and MoHFW. Longitudinal Ageing Study in India - India Report. National Programme for Health Care of Elderly- LASI. 2020. Available from: http://iipsindia.org/research_lasi.htm

Irshad, C. V., Dash, U., & Muraleedharan, V. R. (2022). Healthy ageing in India; a quantile regression

approach. *Journal of Population Ageing*, *15*(1), 217-238. DOI: https://doi:10.1007/S12062-021-09340-8/TABLES/3.

Keshri, V. R., & Ghosh, S. (2019). Health insurance for universal health coverage in India: A critical analysis based on coverage, distribution and predictors from national family health survey–4 data.

Krishnan, M. N., Zachariah, G., Venugopal, K., Mohanan, P. P., Harikrishnan, S., Sanjay, G., ... & Thankappan, K. R. (2016). Prevalence of coronary artery disease and its risk factors in Kerala, South India: A community-based cross-sectional study. *BMC cardiovascular disorders*, *16*, 1-12. DOI: https://doi.org/10.1186/s12872-016-0189-3

Kumar, D., & Shankar, H. (2018). Prevalence of chronic diseases and quality of life among elderly people of rural Varanasi. *International Journal of Contemporary Medical Research*, *5*(7), 2454-7379. DOI: http://dx.doi.org/10.21276/ijcmr.2018.5.7.16

Kumar, S., & Kumar, K. A. (2019). Living arrangement and economic dependency among the elderly in India: A comparative analysis of EAG and non EAG states. *Ageing International*, *44*(4), 352–370. https://doi.org/10.1007/s12126-019-9344-3

Maimela, E., Alberts, M., Modjadji, S. E., Choma, S. S., Dikotope, S. A., Ntuli, T. S., & Van Geertruyden, J. P. (2016). The prevalence and determinants of chronic non-communicable disease risk factors amongst adults in the Dikgale health demographic and surveillance system (HDSS) site, Limpopo Province of South Africa. *PloS one*, *11*(2), e0147926. DOI: https://doi:10.1371/JOURNAL.PONE.0147926.

Marques, A., Santos, T., Martins, J., Matos, M. G. D., & Valeiro, M. G. (2018). The association between physical activity and chronic diseases in European adults. *European Journal of Sport Science*, *18*(1), 140-149.Mini, G. K., & Thankappan, K. R. (2017). Pattern, correlates and implications of non-communicable disease multimorbidity among older adults in selected Indian states: A cross-sectional study. *BMJ open*, *7*(3), e013529.DOI: http://doi:10.1136/BMJOPEN-2016-013529.

Paul, R., Srivastava, S., Muhammad, T., & Rashmi, R. (2021). Determinants of acquired disability and recovery from disability in Indian older adults: Longitudinal influence of socio-economic and health-related factors. *BMC Geriatrics*, *21*(1), 426. https://doi.org/10.1186/s12877-021- 02372-x

Patel, S. A., Dhillon, P. K., Kondal, D., Jeemon, P., Kahol, K., Manimunda, S. P., ... & Prabhakaran, D. (2017). Chronic disease concordance within Indian households: A cross-sectional study. *PLoS medicine*, *14*(9), e1002395.DOI: https://doi:10.1371/JOURNAL.PMED.1002395.

Shil, A., Puri, P., & Prakash, R. (2018). A geospatial analysis of noncommunicable disease (NCD) burden in Indian agro-climatic and political regions. *Journal of Public Health*, *26*, 391-398. DOI: https://doi.org/10.1007/s10389-017-0876-2

Singh, P. K., Singh, L., Dubey, R., Singh, S., & Mehrotra, R. (2019). Socioeconomic determinants of chronic health diseases among older Indian adults: a nationally representative cross-sectional multilevel study. *BMJ open*, *9*(9), e028426. DOI: http://dx.doi.org/10.1136/bmjopen-2018-028426.

Sousa, R. M., Ferri, C. P., Acosta, D., Guerra, M., Huang, Y., Jacob, K. S., ... & Prince, M. (2010). The contribution of chronic diseases to the prevalence of dependence among older people in Latin America, China and India: a 10/66 Dementia Research Group population-based survey. *BMC geriatrics*, *10*, 1-12. DOI: https://doi.org/10.1186/1471-2318-10-53

Thakur, J. S., Nangia, R., & Singh, S. (2021). Progress and challenges in achieving noncommunicable diseases targets for the sustainable development goals. *FASEB BioAdvances*, *3*(8), 563. DOI: https://doi:10.1096/FBA.2020-00117.

Upadhyay, R. P. (2012). An overview of the burden of non-communicable diseases in India. Iranian journal of public health, 41(3), 1. Available from:/pmc/articles/PMC3481705/.

WHOa. Decade of Healthy Ageing: baseline report: summary [Internet]. World Health Organization. Geneva. 2020. Available from: https://apps.who.int/iris/bitstream/handle/10665/341488/9789240023307eng.pdf?sequence=1

WHOb. World health statistics 2020: monitoring health for the SDGs, sustainable development goals. World Health Organization. Geneva. 2020. Available from: https://www.who.int/publications/i/item/9789240005105

Wu, F., Guo, Y., Chatterji, S., Zheng, Y., Naidoo, N., Jiang, Y., ... & Kowal, P. (2015). Common risk factors for chronic non-communicable diseases among older adults in China, Ghana, Mexico, India, Russia and South Africa: the study on global AGEing and adult health (SAGE) wave 1. *BMC public health*, *15*, 1-13. DOI: https://doi:10.1186/s12889-015-1407-0.

Supplementary Information

Table S1: Prevalence of chronic diseases among older population in India by sex, LASI 2017-18

Type of diseases	Prevalence of chronic diseases (%)			Sample size (N=72,250)
	Males	Females	Total	
Hypertension	23.4	28.6	26.4	19,877
Diabetes	12.5	10.9	11.6	8,714
Cancer	0.5	0.7	0.6	472
Chronic lung disease	7.3	5.6	6.3	3,901
Chronic heart diseases	4.2	3.2	3.6	2,441
Stroke	2.5	1.3	1.8	1,220
Arthritis	12.9	17.8	15.7	10,162
Any neurological or psychiatric problems	2.5	2.3	2.4	1,569
High cholesterol	2.3	2.1	2.2	2,424
Thyroid disorder	1.2	4.4	3.1	2,326
Gastrointestinal problems	18.4	17.4	17.8	13,223
Skin diseases	5.9	4.6	5.2	3,591
Other diseases	0.2	0.2	0.2	132

Source: Authors estimated from LASI Wave-I (2017-18).

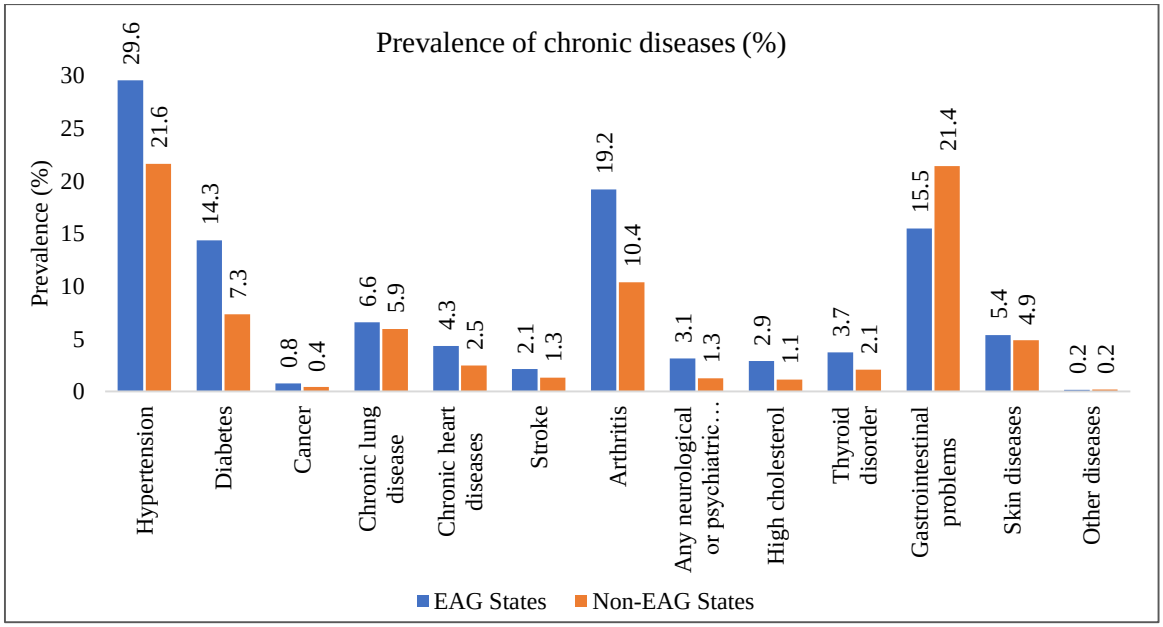
Table S2: Prevalence of chronic diseases among older population in India by sex and residence, 2017–18

State/UT	Prevalence of chronic diseases (%)					Sample Size (N)
	Rural	Urban	Males	Females	Total	
EAG states						
Bihar	55.4	64.5	55.2	57.6	56.6	3,520
Chhattisgarh	31.5	57.6	39.2	36.1	37.4	2,055
Jharkhand	42.0	64.3	48.4	45.5	46.7	2,464
Madhya Pradesh	39.0	51.6	42.2	42.3	42.3	2,914
Odisha	55.2	70.6	57.1	57.7	57.4	2,917
Rajasthan	53.2	63.6	54.8	56.2	55.6	2,244
Uttar Pradesh	46.1	59.0	47.5	49.6	48.6	4,567
Uttarakhand	55.3	68.0	57.5	58.9	58.3	1,358
EAG States Total	48.0	59.9	49.6	50.9	50.3	22,039
Non-EAG states						
A & N Islands	72.4	64.4	66.5	64.1	65.2	1,244
Andhra Pradesh	70.4	63.5	64.9	65.5	65.3	2,679
Arunachal Pradesh	21.9	40.4	40.9	35.2	37.8	1,215
Assam	62.7	51.9	52.1	54.5	53.6	2,366
Chandigarh	63.4	63.6	55.9	69.6	63.4	1,026
Dadra & Nagar Haveli	54.2	33.6	41.6	43.1	42.4	1,090
Daman & Diu	63.7	60.7	65.7	60.6	62.6	991
Delhi	59.6	46.7	58.7	60.4	59.6	1,319
Goa	65.2	59.7	65.4	60.6	62.5	1,427
Gujarat	56.6	47.4	50.3	53.1	51.9	2,341
Haryana	70.0	65.3	62.0	69.6	66.5	1,898
Himachal Pradesh	68.0	60.0	56.9	62.6	60.3	1,388
Jammu & Kashmir	72.9	66.8	62.1	74.2	69.1	1,613
Karnataka	56.6	43.2	53.2	50.2	51.3	2,420
Kerala	72.7	73.4	71.6	73.5	72.8	2,497
Lakshadweep	65.2	51.5	58.8	61.1	60.2	1,139
Maharashtra	60.9	55.1	57.9	57.1	57.5	3,973
Manipur	59.4	43.7	52.7	50.7	51.6	1,369
Meghalaya	46.6	29.8	21.9	39.4	32.7	969

Mizoram	58.0	49.9	55.6	50.2	52.7	1,246
Nagaland	33.7	21.3	22.4	24.0	23.3	1,316
Puducherry	63.7	52.1	56.1	59.8	58.4	1,428
Punjab	71.2	69.2	63.5	74.5	69.7	2,124
Tamil Nadu	57.1	55.2	55.5	56.1	55.9	3,530
Telangana	67.7	56.4	58.5	60.1	59.4	2,475
Tripura	72.8	58.2	58.9	63.9	61.9	1,195
West Bengal	72.7	62.2	62.9	66.7	65.1	3,933
Non-EAG states: total	56.5	62.4	58.0	59.4	58.8	50,211
India: total	54.5	56.2	52.5	62.8	55.5	72,250

Source: Authors estimated from LASI Wave-I (2017-18).

Figure S1: Prevalence of chronic diseases among older adults in EAG and non-EAG states, India, LASI 2017–18



Source: Authors estimated from LASI Wave-I (2017-18).