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Original article

Cardiovascular disease (CVD) and its associated risk factors among older adults in India: Evidence from LASI Wave 1

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ABSTRACT

Background: With the turn of the century, CVDs have become the leading cause of mortality in India. Despite the wide heterogeneous prevalence of risk factors across different regions, CVD is the major cause of death in all parts of India. Therefore, the study aimed to investigate the prevalence of CVDs and its associated risk factors among older adults in India.

Methods: The current study used data from the LASI, Wave 1, the world's largest and India's first longitudinal aging study. The total sample for the analysis was 65562 (45 and above individuals). The self-reported prevalence of CVDs was calculated by considering any one of the self-reported diagnosed conditions of hypertension, stroke, and chronic heart diseases. Binary Logistic regression was carried out between CVD and its associated risk factors like age, sex, place of residence, physical activity, family history of CVD, Diabetes/blood sugar, high cholesterol. $P < 0.05$ from two-sided statistical tests was regarded statistically significant.

Results: The study indicated that the overall self-reported prevalence of diagnosed CVDs was 29.4% for older adults age 45 and above in India. Age was associated with increased risk of CVD Female older adults were more likely to have CVDs than male.The place of residence also had a stronger association with CVDs.In addition, high cholesterol, diabetes and physical inactivity were key risk factors for CVDs.The study also indicated that Family history was associated with a greater perceived risk for CVDs. The greater prevalence of CVDs risk factors among older adults manifested alarming public health concerns and a future health demand. It creates a threat if health promotion and awareness programs are not well designed.

1. Introduction

India has been experiencing a rapid epidemiological transition in the last few decades. Along with the increase in life expectancy, there is an emergence of non-communicable diseases (NCD) which is becoming a greater public health concern in India. Major four NCDs namely cardiovascular diseases (CVD), chronic respiratory diseases (CRD), cancers and Diabetes account for more than 80% of the total premature NCD deaths .[20] Globally, around 17.9 million people annually die due to CVDs, followed by cancers (9.3 million), respiratory diseases (4.1 million), and diabetes (1.5 million).[21] More than four out of five CVD deaths are due to heart attacks and strokes, and one third of these deaths occur prematurely in people under 70 years of age.[33]The number of people with total CVD nearly doubled from 271 million in 1990 to 523 million in 2019, and deaths due to CVD climbed significantly from 12.1 million in 1990 to 18.6 million in 2019.[28]

The majority of NCD deaths occur in low and middle-income countries including India.[43] As a result of rapid urbanization and change in lifestyle; the epidemiological health transition has taken place; which has led to an overall economic rise, but with certain associated flipsides (risk factors).With growing burden of NCDs and high case fatality rate in the low and middle income countries; the Unites Nations in 2012 acknowledged that the rising burden of NCDs is one of the serious challenges to sustainable development in the 21st century.[3,15,25,37,38]

The country wise statistics of the WHO on non-communicable diseases (NCDs) estimate that in India, the non-communicable diseases account for around 53% of the total deaths, among which CVDs have a major share of 24%.[34] With the turn of the century, cardiovascular diseases (CVDs) have become the leading cause of mortality in India.[26] The Global Status on NCDs Report (2010) reported that there were more than 2.5 million deaths from CVD in India in 2008, two-thirds due to Coronary heart disease (CHD) and one-third due to stroke.[29,35] Studies

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show that compared to the people of European ancestry, CVD affects Indians at least a decade earlier and in their most productive midlife years.[15,37]

CVD prevalence appears to be most closely associated to a country's epidemiological transition stage,[24] particularly when high disease rates in middle age persist into later life. According to a few population based surveys, the prevalence of CVD in 2003 in rural India was estimated to be 3–4% and 8–10% in urban areas.[7,10] As per Global burden of disease study 2010, the age-standardized CVD death rate of 272 per 100 000 population in India is higher than the global average of 235 per 100 000 population.[8] CVD mortality rates vary significantly by age and gender. The WHO's India report shows that age-adjusted CVD mortality rates are higher for men than women (349 per 100,000 among men and 265 per 100,000 among women).[44] These rates are two to three times higher as compared to those in the United States, where mortality rate for men are 170 per 100,000 and 108 per 100,000 among women.[36] In India, more than 10.5 million deaths occur annually, and it was reported that CVD led to 20.3% of these deaths in men and 16.9% of all deaths in women.[9]

A global CVD epidemic is rapidly evolving, with the burden of disease shifting. CVD currently kills twice as many people in developing countries as it does in developed countries. Conventional risk factors account for the great majority of CVD cases.[41] Many epidemiological studies of cardiovascular risk factors in the mid and late twentieth century found that the risk factors are higher in upper SES persons than in lower SES subjects (Sapru, 2006).However, some studies reported that risk factors could be more in poor, especially where illiteracy is high.[11]Age plays a vital role in the deterioration of cardiovascular functionality, resulting in an increased risk of cardiovascular disease (CVD) in older adults[4] and.[22] However, sex differences are also frequently perceived in aging adults regarding both onset and prevalence of CVD.[6] Diabetes is a major predisposing factor for developing CVD in the aging population.[12] DCM (diabetic cardiomyopathy) describes heart disease, which develops primarily due to diabetes.[32]Adults with diabetes historically have a higher prevalence rate of CVD than adults without diabetes.[30] The risk of CVD increases continuously with rising fasting plasma glucose levels, even before reaching levels sufficient for a diabetes diagnosis.[31]

Some epidemiological evidence also indicates that CVD is associated with behavioural risk factors like smoking, alcohol use, low physical activity levels, and insufficient vegetable and fruit intake. In elderly persons, hypertension has been found to be an independent risk factor for acute myocardial infarction and stroke.[23,39] There is substantial epidemiologic evidence for the familial aggregation of CVD. Researchers from the Framingham Study reported that having CVD in at least one parent doubled the 8-year risk of CVD among men and increased the risk among women by 70%.[17]

In order to develop and implement an effective strategy for prevention and treatment of CVD in older people, it is necessary to have a more comprehensive understanding of a wide range of CVD risk factors and the factors relevant to this population. However, few studies focused on the older people.[2,16] Therefore, the present study tries to assess the prevalence of CVD and its attributable risk factors among the older adults in India.

2. Data & methods

The current study used data from Longitudinal Aging Study in India (LASI Wave 1), a national survey of scientific investigation of the health, economics, and social determinants and consequences of population aging in India. It is the world's largest and India's first longitudinal aging study. The LASI is designed to simultaneously generate data, raise awareness of older people's health issues, and inform public policies in India and its states. The LASI provides a great opportunity to examine how different healthcare policies and institutions influence healthcare utilization and health outcomes using innovative and comparable measures of health, including the direct assessment of biological measures. By the conventional practice for other population-based surveys, the LASI sampling frame included only the household population. The LASI (Wave 1)2017-18 dataset comprised 72,250 individuals aged 18 years. However, a total of 65562 data of participants aged ≥45 years were included in the analysis of this study.

2.1. Variable description

Dependent variable: The dependent variable used for the study was cardiovascular disease for multivariate analysis. Cardiovascular diseases (CVDs) are a group of disorders of the heart and blood vessels. They include hypertension, stroke, and chronic heart diseases such as rheumatic heart disease, congenital/structural disorder. The self-reported prevalence of CVDs presented in this section was calculated by considering any one of the self-reported diagnosed conditions of hypertension, stroke, and chronic heart diseases.

Independent variable: The following variables are used as underlying factors.

Socio-demographic factors: Sex of the respondents (male and female), age (45–54, 55–64,65-69 and 70+years), place of residence (Rural and Urban), religion (Hindu, Muslim, Christian, and others), Caste (SC, ST, OBC, Others), marital status (currently married, widowed, and others (divorced/separated), education Categorized as Not educated, up to Primary, up to Secondary, Secondary and above, working status categorized as currently working worked in the past but currently not working and never worked, the monthly per-capita quintile (MPCE) characterized as poorest, poor, middle, richer and richest.

Genetic factors: Family history of CVD.

Behavioural factors: Physical activity (categorized as every day, at least once a month and never worked).

Other risk factors: Diabetes and high cholesterol.

2.2. Statistical methods

Statistical analyses conducted using STATA version 14.2 include bivariate analysis and multivariate analysis. The prevalence of self-reported diagnosed CVD is presented by sex, place of residence, age, level of education, social group, religion, marital status, monthly per capita expenditure, Physical activity, family history of CVD in India for 2017–18 pertaining to the Longitudinal aging study in India (LASI), Wave 1.

Binary Logistic regression was carried out between CVD and its associated risk factors. The dependent variable, CVD is was dichotomous (yes/no), and the independent variables were the associated risk factors of CVD like Sex, place of residence, age, physical activity, family history of CVD etc. to check the independent effect on CVD. The logistic regression model is as follows:

$$Logit\,(Y) = ln\,(p\ /\ 1-p) = \alpha + \beta 1x1 + \beta 2x2 +$$

Where p is the probability of the event and α is the intercept, β1 are regression coefficients; xi is set of predictors, and ε is an error term.

3. Results

Table 1 presents the self-reported prevalence of diagnosed CVDs among older adults in India by background characteristics. Overall, the self-reported prevalence of diagnosed CVDs was 29.4% for older adults age 45 and above. The prevalence rate increased with age from 22% in 45–54 to 38% in age 70 and above. Among the older adults, the self-reported prevalence of diagnosed CVDs was higher among women (32%) than men (26%), and it is much higher among those residing in urban areas (40%) than in rural areas (25%). The self-reported prevalence of diagnosed CVDs increased with the level of education from 26% among those with no schooling to 34% in those with secondary and above education.

Table 1
Prevalence of Cardiovascular disease of (45+) older adult population in India by its background characteristics, LASI (Wave 1, 2017–18), (N = 65562).

Background Characteristics	CVD		Total	Chi-square
	Yes	No		p value
Age-group				
45–54	4979 (21.7)	17936 (78.3)	22,914	
55–64	5778 (29.5)	13784 (70.5)	19,562	
65–69	3373 (35.8)	6050 (64.2)	9,423	0.000
70+	5158 (37.8)	8505 (62.3)	13663	
Sex				
Male	7812 (25.9)	22307 (74.1)	30119	0.000
Female	11476 (32.4)	23967 (67.6)	35443	
Place of residence				
Rural	11104 (24.7)	33826 (75.3)	44,930	0.000
Urban	8184 (39.7)	12448 (60.3)	20,632	
Religion				
Hindu	15087 (28.1)	38651 (71.9)	53,738	0.000
Muslim	2769 (36.7)	4780 (63.3)	7,549	
Christian	569 (28.2)	1420 (71.4)	1990	
Others*	863 (37.8)	1422 (62.2)	2285	
Social group				
Schedule caste	3318 (26.7)	9119 (73.3)	12,437	0.0000
Schedule tribe	905 (16.2)	4676 (83.8)	5,581	
Other backward class (OBC)	8715 (29.5)	20784 (70.5)	29,499	
None of the above	5471 (34.8)	10245 (65.2)	15,715	
Marital Status				
Currently married	13196 (27.4)	34893 (72.6)	48,089	
Widowed	5668 (36.4)	9885 (63.6)	15,553	0.000
Others**	424 (22.1)	1496 (77.9)	1,920	
Education Level				
No schooling	8679 (26.2)	24505 (73.9)	33184	
Up to primary	4707 (31.3)	10352 (68.7)	15058	
Up to secondary	3629 (34.0)	7044 (66.0)	10673	
Secondary & above	2273 (34.2))	4371 (65.8)	6643	0.000
Working status				
Currently working	6116 (20.2)	24142 (79.8)	30,258	
worked in past but currently not working	6823 (37.5)	11371 (62.5)	18,194	0.000
never worked	6349 (37.1)	10761 (62.9)	17,110	
MPCE				
Poorest	3117 (22.8)	10561 (77.2)	13,678	
Poorer	3659 (26.3)	10263 (73.7)	13,923	0.000
Middle	3850 (28.7)	9582 (71.3)	13,432	
Richer	4147 (32.6)	8587 (67.4)	12,734	
Richest	4514 (38.2)	7281 (61.7)	11,796	
Ever diagnosed diabetes				
Yes	5349 (66.3)	2721 (33.7)	8,070	0.000
No	13970 (24.4)	43341 (75.6)	57,311	
Ever diagnosed high cholesterol				
Yes	1015 (68.0)	478 (32.0)	1,493	0.000
No	18304 (28.7)	45593 (71.4)	63,897	
Physical activity				
Everyday	3613 (22.1)	12763 (77.9)	16,377	
Atleast once a month	2227 (21.8)	7970 (78.2)	10,197	0.000
Never	13351 (34.8)	25069 (65.3)	38,419	
Family history of CVD				
Yes	1251 (43.8)	1608 (56.2)	2859	
No	17973 (28.9)	44223 (71.1)	62196	0.000
India	**19288 (29.4)**	**46274 (70.6)**	**65562**	

Note: Religion; others *(Sikh, Buddhist/neo-Buddhist, Jain, Jewish, Parsi/Zoroastrian, others) Marital status; others** (Divorced, Separated, Deserted, Live-in-relationship, never-married.

Similarly, the prevalence of CVD increased with the MPCE quintile from 23% in the poorest quintile to 38% in the richest quintile. The prevalence of Cardiovascular disease was higher among the other caste (35%) compared to scheduled caste, scheduled tribes, and other backward castes (OBC). Inconsistency with the result of Table 1, the prevalence of self-reported diagnosed CVD was higher among other religions (38%) than Hindu, Muslim, and Christians. For instance, the prevalence of CVD is significantly low among respondents who reported currently working (20%). The analysis revealed that older adults with diabetes (66%) and cholesterol (68%) had a higher prevalence of CVD. However, there is a graded inverse association between physical activity and the prevalence of the cardiovascular disease. The prevalence of CVD was comparatively high among those individuals who never engage in any activity (35%). However, the analysis revealed that older adults with a family history of CVD have a higher prevalence of diagnosed CVD (44%).

Table 2 shows the Odds ratios for the likelihood of CVD by risk factors. Analysis reveals that respondents of 55–64 age groups were 1.5 times (OR 1.48, 95% CI 1.418–1.553), and respondents of 65–69 and 70+ age groups are 2 (OR 2.04, 95% CI 1.932–2.163) and 2.3 times (OR2.256, 95% CI2.144–2.375) more likely to suffer from CVD than 45–54 age groups. Sex is another inherent risk factor in aging adults, given that older females are reported to 1.3 times (OR1.35, 95% CI 1.303–1.403)more likely to suffer from CVD than age-matched men. The analysis also revealed that respondents in the urban area had a significantly greater risk factor for CVD. Older adults belong to urban area were 1.5 times (OR 1.46, CI 95% 1.407–1.517)more likely to suffer from CVD. Physical inactivity has been revealed to be a major cause of CVD. Diabetes (OR 0.24,95% CI 0.23–0.26)and high cholesterol (OR 0.22, CI 95% CI 0.206–0.253)had a stronger association with CVD among older adults supporting the finding that patients with diabetes have approximately twice the risk of stroke than the non-diabetics.[13] Additionally, the study also revealed that the risk of having CVD was 0.5 times (OR 0.507,95% CI 0.466–0.552) less among individuals without a family history of CVD.

Table-2
Results of Binary Logistic regression of risk factors of Cardiovascular disease of (45+) older adult population in India, LASI (WAVE-1,2017–18), (N = 65562).

Risk factors of cardiovascular	Odds ratio	95% confidence interval
Age- group		
45–54 ®		
55-64	1.484***	[1.418,1.553]
65-69	2.045***	[1.932,2.163]
70+	2.256***	[2.144,2.375]
Sex		
Male ®		
Female	1.353***	[1.303,1.403]
Place of residence		
Rural ®		
Urban	1.461***	[1.407,1.517]
Diabetes or blood sugar		
Yes ®		
No	0.246***	[0.234,0.259]
High cholesterol		
Yes®		
No	0.228***	[0.206,0.253]
Physical activity		
everyday ®		
Once in a month	1.073*	[1.008,1.142]
never	1.379***	[1.315,1.445]
Family history of cardiovascular disease		
Yes®		
No	0.507***	[0.466,0.552]

Note: ® Reference category,*p < 0.05, **p < 0.01, ***p < 0.001.

4. Discussion

The present study tries to present the prevalence of cardiovascular diseases and (hypertension, heart disease, and stroke) and the pertinent risk factors among older adults in India. The study indicated that the prevalence of CVD tended to increase with age. With aging, there is an incremental acquisition of several CVD risk factors in an individual's lifespan.[5] Although CVD remains the leading cause of death of both women and men in India, there are considerable gender differences in the prevalence of CVDs. The study indicated that women were more likely to have CVD than men.This is also line with the study by[40] that females have died from cardiovascular disease at a higher rate than males. Despite the fact that women develop heart disease 10 years later than males, they are more likely to suffer from a heart attack. It is estimated that 35% of heart attacks in women go unrecognised or unreported.

This is further supported by the researcher who state that Women outnumber men in terms of living with and dying from CVD and stroke, as well as the number of hospital discharges for heart failure and stroke.[27]Sex differences in CVD prevalence largely reflect sex differences in Indian demographics. Because female sex is related to a longer life expectancy than male, women comprised a larger share of the elderly population in which the prevalence of CVD is greatest. Along with that the risk of cardiovascular disease in women is often underestimated due to the misperception that women are more 'protected' than men against CVD. The neglect of CVD among women leads to less aggressive treatment strategies.[18]

The present study showed that the place of residence is significantly related to the prevalence of CVD. Older adults residing in rural areas had a lower chance of having CVD than urban areas. This is further supported by researchers who state that urban population had higher prevalence of CVDs as compared to rural population. Risk factor prevalence from slum/peri-urban areas lay somewhere in between the urban and rural population, but more inclined towards urban trends.[42]

The study also revealed that high cholesterol, diabetes, were key risk factors for CVD supporting the finding that adults with diabetes are about twice as likely to die from heart disease or stroke as people without diabetes (National diabetes statistical report, 2014).Further studies have also indicated that Cardiovascular disease (myocardial infarction, stroke, and peripheral vascular disease) is twofold more common in people with type 2 diabetes (T2D), and it is the leading cause of death in T2D patients.[19]

The study showed that CVD prevalence was higher among the physically inactive older adults, and this difference was statistically significant (p < 0.001).This is line with the study by[1] who stated that physical inactivity increases a person's chances of being overweight, of having high blood pressure and of developing other conditions that make cardiovascular disease more likely.Regular, moderate to vigorous physical activity assists in reducing the risk of cardiovascular disease. Participation in 150 min of physical activity of moderate intensity per week was estimated to alleviate Ischemic heart disease by about 30% and diabetes risk by 27% (WHO.2007). The study indicated that most of the individuals with a significant family history of heart disease/stroke/hypertension were more likely to develop CVD themselves.[14] in their study found that the individuals with a family history (FH), perceived their risk for heart disease to be about twice as high as individuals without a FH (p < 0.001).

5. Conclusion

In conclusion, the study provided a representative prevalence of CVD and relevant risk factors among older adult population in India. The high prevalence of CVD risk factors among older adults manifested alarming public health concerns and a future health demand. Implementational strategies are required for reducing CVD risk among elderly by focussed promotion of physical activities and early detection of CVDs based on family history. It creates a threat if health promotion and awareness programs are not well designed.

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Availability of data and material

This research work was performed based on secondary data which is freely available upon request at IIPS, India website (Source of data:https://www.iipsindia.ac.in/lasi).

Ethics approval & consent to participate

This research does not have an ethical code because this research work was performed based on secondary data which is freely available upon request at IIPS, India website (Source of data:https://www.iipsindia.ac.in/lasi) and thus author does not require any ethical clearance and consent to participate.

Consent for publication

Not applicable.

CRediT authorship contribution statement

Jhumki Kundu: Conceptualization, Methodology, Formal analysis, Resources, Writing – original draft, Visualization. **Sampurna Kundu:** Writing – review & editing, All authors read and approved the final manuscript.

Declaration of competing interest

The authors declared no potential conflicts of interest concerning the research, authorship and/or publication of this article.

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