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Prevalence and associated factors of physical inactivity among middle-aged and older adults in India: results of a national cross-sectional community survey

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ABSTRACT

Objective This study aimed to determine the prevalence and associated factors of physical inactivity in middle-aged and older adults in India.

Design Population-based cross-sectional study.

Setting Nationally representative sample of general community-dwelling middle-aged and older adult population in India.

Participants The sample included 72 262 adults (45 years and older, mean age 58.8 years, SD=11.8), from the longitudinal ageing study in India wave 1 in 2017–2018.

Primary and secondary outcome measures Self-reported physical activity, along with physical measurements, health status and health behaviour, and sociodemographic covariates. Multivariable logistic regression calculated OR with 95% CI for physical inactivity.

Results Overall, 36.7% were physically inactive, 42.6% among men, and 32.4% among women (p<0.001). In the adjusted logistic regression analysis, among both men and women, older age (70 years and older), being Sikh, impaired vision and depressive symptoms were positively and cognitive functioning, current tobacco use and social participation were negatively associated with physical inactivity. In addition, among men, higher socioeconomic status, urban residence, functional disability and heart disease or stroke were positively associated with physical inactivity, and among women being married and higher education were negatively, and insomnia symptoms and poor or fair self-rated health status were positively associated with physical inactivity.

Conclusions Almost 4 in 10 middle-aged and older adults in India had inadequate physical activity. Overall and gender specific risk factors for physical inactivity were identified. Interventions may operate at multiple levels and consider gender-related physical inactivity patterns.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ The study used a large nationally representative community-based sample of middle-aged and older adults in India.
⇒ A large number of covariates, including sociodemographic factors, health status, chronic diseases and health behaviour variables were included in the logistic regression model.
⇒ The study assessed physical activity by self-report, which may bias the physical inactivity prevalence.
⇒ Physical activity was not assessed with objective measures.

INTRODUCTION

Physical inactivity has been associated with morbidity and mortality.[1 2] In 2016, among adults, the prevalence of inadequate physical activity was 27.5% globally, and 17.3% in East and Southeast Asia.[3] We lack recent national data on physical inactivity in middle-aged and older adults in India. In various local studies in India, for example, in Tamil Nadu in 2010 (aged 30–64 years), the prevalence of inadequate physical activity was 63.3% in the urban area and 40.6% in the rural area,[4] in Madhya Pradesh, among adults (18–69 years, 2017–2019) the prevalence of inadequate physical activity was 19.6%,[5] and among adults (18–69 years) in a rural population in South-India, the proportion of physical inactivity was 46.8%.[6] In a national study among middle-aged and older adults (≥50 years) in 2007–2008 in India, the prevalence of low physical activity was 22.0%.[7] In other countries in the Southeast and East Asian region, for example, in an adult population in Iran, the prevalence of physical inactivity was 44.8%,[8] in China (≥45 years), the proportion of physical inactivity was 44.1%,[9] and in Malaysia (≥60 years), 29.8% were physically inactive.[10]

Factors that increase the odds of physical inactivity may include sociodemographic, health status and health risk behaviours. Sociodemographic risk factors for physical inactivity include increasing age[11] and female sex,[4 8 12–14] those with higher education in India[4] and China,[15] lower education in

Table 1 Sociodemographic factors and physical activity levels

		Male			Female		
		Physically activity levels			Physically activity levels		
	Sample	Inactive	Active	Statistic	Inactive	Active	Statistic
Variable	N (%)	%	%	P value	%	%	P value
	72262	42.6	57.4		32.4	67.6	
Age in years							
45–59	40785 (54.1)	33.1	66.9	<0.001	23.9	76.1	<0.001
60–69	18979 (26.8)	43.1	56.9		36	64	
70 or more	12498 (19.0)	63.3	36.7		56.1	43.9	
Sex							
Female	41685 (58.0)	---			---		
Male	30577 (42.0)	---			---		
Marital status							
Not married	16852 (24.4)	53.6	46.4	<0.001	43.3	56.7	<0.001
Married	55401 (75.6)	41	59		27.1	72.9	
Education (completed years)							
No schooling	42213 (49.5)	43.9	56.1	0.381	36.2	63.8	<0.001
1–4	8056 (10.8)	40.3	59.7		28.3	71.7	
5–9	16911 (21.1)	42.3	57.7		27.2	72.8	
10 or more	14079 (18.5)	42.4	57.6		24.1	75.9	
Socioeconomic status							
Low	23625 (37.2)	38.3	61.7	<0.001	31	69	<0.001
Medium	28380 (38.7)	43.6	56.4		31.7	68.3	
High	18134 (24.1)	45.6	54.4		33.7	66.3	
Residential status							
Rural	46539 (68.2)	40.5	59.5	<0.001	33.4	66.6	0.13
Urban	25723 (31.8)	47.6	52.4		30.2	69.8	
Religion							
Hindu	52983 (81.9)	42	58	0.045	32	68	0.13
Muslim	8668 (11.7)	44.3	55.7		34.6	64.4	
Christian	7216 (3.0)	45.1	54.9		30.2	69.8	
Sikh	1999 (1.8)	54.5	45.5		40.4	59.6	
Other	1392 (1.7)	46.6	53.4		30.5	69.5	

Poland,[16] and insignificant in terms of educational level in Japan.[17] Health status factors associated with physical inactivity include poor self-rated health status,[7 12 13] poor cognitive functioning,[18] functional disability,[7 19] chronic back pain, bodily pain, visual impairment, hearing problems, low body mass index (BMI)[7] and obesity.[20] In addition, having the following chronic conditions may be associated with physical inactivity, including hypertension,[21 22] diabetes,[8 23] angina or coronary artery disease,[23] stroke, asthma, chronic obstructive pulmonary disease,[7] depressive symptoms[24] and sleep problems.[7 25] Furthermore, several health risk behaviours have been found associated with physical inactivity, including smoking,[13] heavy alcohol use,[26] inadequate fruit and vegetable consumption,[7 27] and low social participation or cohesion.[7] This study aimed to determine the prevalence and associated factors of physical inactivity in middle-aged and older adults in India.

METHODS

Methods are reported in detail elsewhere.[28 29] This study analysed secondary data from the cross-sectional and nationally representative 'Longitudinal Ageing Study in India (LASI) wave 1, 2017–2018[30]'; 'the overall household response rate is 96%, and the overall individual response rate is 87%'.[28] In a household survey, 'interview, physical measurement and biomarker data were collected from individuals aged 45 and above and their spouses, regardless of age.'.[28] The sampling design followed a

Table 2 Health, health behaviour and physical inactivity

		Male			Female		
		Physically activity levels			Physically activity levels		
	Sample	Inactive	Active	Statistic	Inactive	Active	Statistic
Variable (yes response)	N (%)	%	%	P value	%	%	P value
Self-rated health (poor or fair)	26 296 (39.7)	48.1	51.9	<0.001	37.6	27.9	<0.001
Functional disability	17 700 (28.8)	58.1	38.4	<0.001	40.6	28.1	<0.001
Physical pain	7934 (12.5)	41.9	42.7	0.630	32.7	32.3	0.763
Back pain or problem	24 519 (31.5)	43.2	42.4	0.583	33.2	31.9	0.219
Bone and joint diseases	10 163 (15.7)	48.4	41.8	<0.001	36.3	31.5	0.002
Hearing problem	4874 (6.6)	53.1	41.8	<0.001	39.9	31.9	<0.001
Vision impaired	6060 (8.7)	58.3	41.2	<0.001	49.1	30.7	<0.001
Overweight/obesity	20 497 (42.5)	42.5	40.8	0.152	30.8	32.4	0.178
Diabetes	8716 (11.6)	49.7	41.6	<0.001	35.9	31.9	0.082
Hypertension	27 964 (40.4)	46.0	39.1	<0.001	36.0	29.2	<0.001
Heart disease or stroke	3514 (5.2)	60.2	41.4	<0.001	43.3	31.9	<0.001
Angina	5953 (8.6)	44.4	42.5	0.290	34.4	32.2	0.138
Lung disease	3902 (6.3)	47.2	42.3	0.117	42.5	31.8	<0.001
Depressive symptoms	17 650 (27.6)	45.6	41.0	<0.001	38.0	29.4	<0.001
Insomnia symptoms	8367 (12.7)	50.0	41.6	<0.001	40.6	31.1	<0.001
Current tobacco use	31 074 (30.4)	37.3	47.9	<0.001	29.5	32.9	0.003
Heavy alcohol use	2600 (2.9)	40.2	42.8	0.259	27.2	32.4	0.259
Social participation	40 128 (54.5)	39.6	47.4	<0.001	27.6	37.4	<0.001
	M (SD)	M (SD)	M (SD)				
Cognitive functioning (scale)	18.7 (5.1)	19.2 (4.7)	20.1 (4.6)	<0.001	16.8 (5.2)	18.4 (5.2)	<0.001

'multi-stage stratified areas probability cluster sampling, with the selection of a Primary Sampling Unit from each state/union territory, followed by a village (from rural) or ward (from urban) area', and selection of households from rural areas, and selection of households from randomly chosen Census Enumeration Blocks from each urban area.[28] The field survey team was trained over 40 days on all field tools and procedures, and their implementation skills and capabilities were assessed through a multilayered supervision system.[28] For example, 'field teams received feedback based on direct observations, supervisor validations and quality control analyses of the server to minimise errors'.[28]

Measures

Physical activity was assessed with the questions (1) 'How often do you take part in sports or vigorous activities, such as running or jogging, swimming, going to a health centre or gym, cycling, or digging with a spade or shovel, heavy lifting, chopping, farm work, fast bicycling, cycling with loads: everyday, more than once a week, once a week, one to three times a month, or hardly ever or never?' (2) 'On the days you did vigorous activity, how much time did you usually spend doing any vigorous activity? (___minutes)', (3) 'How often do you take part in sports or activities that are moderately energetic such as cleaning house, washing clothes by hand, fetching water or wood, drawing water from a well, gardening, bicycling at a regular pace, walking at a moderate pace, dancing, floor or stretching exercises (everyday, more than once a week, once a week, one to three times a month, hardly ever or never)?' and (4) 'How much time did you usually spend doing any moderate activity on an average in a day?' The recall period is specified as 'everyday, more than once a week, once a week, one to three times a month, hardly ever, or never'.[28] The LASI questionnaire, including physical activity, was designed in harmony with the US Health and Retirement Study and adapted to the Indian context, such as enlisting types of physical activity (moderate or vigorous) common in India.[31] 'Asking about people's physical activities is considered to be sufficiently reliable and valid to measure the level of physical activity in a healthy adult population'.[32] Physical inactivity was defined as '<150 min/week of moderate, or<75 min/week of vigorous activity or<an equivalent combination of moderate-intensity and vigorous-intensity activity throughout the week, and physical activity was defined as ≥150 min/week of moderate, or ≥75 min/week of vigorous activity, or an equivalent combination of moderate-intensity and vigorous-intensity activity throughout the week.'[33 34]

Table 3 Associations between sociodemographic factors and physical inactivity estimated by multivariable logistic regression among men

Variable	Crude OR (95% CI)	Adjusted OR (95% CI)†
Age in years		
45–59	1 (Reference)	1 (Reference)
60–69	1.53 (1.38 to 1.69)***	1.33 (1.20 to 1.46)***
70 or more	3.48 (3.07 to 3.94)***	2.36 (2.02 to 2.75)***
Marital status		
Not married	1 (Reference)	1 (Reference)
Married	0.60 (0.53 to 0.68)***	0.87 (0.75 to 1.00)
Education (completed years)		
No schooling	1 (Reference)	---
1–4	0.86 (0.75 to 1.00)	
5–9	0.93 (0.83 to 1.06)	
10 or more	0.94 (0.79 to 1.11)	
Socioeconomic status		
Low	1 (Reference)	1 (Reference)
Medium	1.25 (1.11 to 1.40)***	1.30 (1.16 to 1.45)***
High	1.35 (1.17 to 1.56)***	1.39 (1.20 to 1.62)***
Residential status		
Rural	1 (Reference)	1 (Reference)
Urban	1.34 (1.13 to 1.58)***	1.41 (1.22 to 1.63)***
Religion		
Hindu	1 (Reference)	1 (Reference)
Muslim	1.10 (0.90 to 1.34)	1.14 (0.97 to 1.34)
Christian	1.14 (0.86 to 1.50)	1.17 (0.91 to 1.50)
Sikh	1.66 (1.34 to 2.05)***	1.49 (1.17 to 1.90)***
Other	1.21 (0.83 to 1.76)	0.94 (0.59 to 1.52)

***p<0.001.
†Adjusted for all variables in tables 3 and 4.

Sociodemographic information: level of education (number of completed years), sex (male, female), age, religion, residential and marital status (married and not married, including 'never married, live-in relationship, widowed, divorced, separated and deserted'). Subjective socioeconomic status (1–3: low, 4–5: medium, 6–10 high): 'Please imagine a 10-step ladder, where at the bottom are the people who are the worst off—who have the least money, least education, and the worst jobs or no jobs, and at the top of the ladder are the people who are the best off—those who have the most money, most education, and best jobs. Please indicate the number (1–10) on the rung on the ladder where you would place yourself.'.[28]

Self-rated health status was derived from the question, 'In general, would you say your health is excellent, very good, good, fair or poor?' The responses were coded as '1=poor, 2=fair, 3=good, 4=very good and 5=excellent'.[28]

Cognitive functioning was assessed with 'tests for immediate and delayed word recall, serial 7s, and orientation based on the Mini-Mental State Exam', totalling 0–32 scores.[35]

Functional disability was measured based on 'Activities of Daily Living (ADL) (six items) and Instrumental ADL (IADL) (seven items)[36 37]'; (Cronbach alpha 0.89). The responses were 'Yes/No' and were dichotomised into 0 or 1, and ≥2 ADL/IADL items, as in previous studies.[29 38]

Physical pain was classified as 'troubled by pain and required some form of medication or treatment for relief of pain.'.[28]

Back pain or problems was sourced from the question 'Have you had any of the following persistent or troublesome problems in past 2 years, back pain or problems (Yes, No)?'.[28]

Impaired vision was defined as 'poor or very poor near and far vision despite the use of corrective lenses' and hearing impairment as 'diagnosed with any hearing or ear-related problem or condition'.[28]

Table 4 Associations between health, health behaviour and physical inactivity estimated by multivariable logistic regression among men

Variable	Crude OR (95% CI)	Adjusted OR (95% CI)†
Self-rated health (poor or fair)		
No	1 (Reference)	1 (Reference)
Yes	1.49 (1.33 to 1.67)***	1.10 (0.98 to 1.23)
Cognitive functioning (scale)	0.96 (0.95 to 0.97)***	0.97 (0.96 to 0.98)***
Functional disability		
No	1 (Reference)	1 (Reference)
Yes	2.22 (1.91 to 2.58)***	1.30 (1.12 to 1.51)***
Physical pain		
No	1 (Reference)	---
Yes	0.97 (0.85 to 1.10)	
Back pain or problem		
No	1 (Reference)	---
Yes	1.03 (0.92 to 1.16)	
Bone or joint diseases		
No	1 (Reference)	1 (Reference)
Yes	1.31 (1.11 to 1.54)***	1.07 (0.93 to 1.24)
Hearing problem		
No	1 (Reference)	1 (Reference)
Yes	1.58 (1.37 to 1.81)***	1.00 (0.84 to 1.19)
Vision impaired		
No	1 (Reference)	1 (Reference)
Yes	1.55 (1.38 to 1.74)***	1.23 (1.10 to 1.37)***
Overweight/obesity		
No	1 (Reference)	---
Yes	1.07 (0.97 to 1.19)	
Diabetes		
No	1 (Reference)	1 (Reference)
Yes	1.39 (1.16 to 1.65)***	1.12 (0.96 to 1.30)
Hypertension		
No	1 (Reference)	1 (Reference)
Yes	1.33 (1.22 to 1.45)***	1.04 (0.93 to 1.15)
Heart disease or stroke		
No	1 (Reference)	1 (Reference)
Yes	2.14 (1.75 to 2.60)***	1.38 (1.14 to 1.68)***
Angina		
No	1 (Reference)	---
Yes	1.08 (0.94 to 1.25)	
Lung disease		
No	1 (Reference)	---
Yes	1.22 (0.95 to 1.57)	
Depressive symptoms		
No	1 (Reference)	1 (Reference)
Yes	1.21 (1.08 to 1.35)***	1.15 (1.02 to 1.29)*
Insomnia symptoms		
No	1 (Reference)	1 (Reference)
Yes	1.40 (1.25 to 1.58)***	1.13 (0.99 to 1.29)
Current tobacco use		
No	1 (Reference)	1 (Reference)
Yes	0.65 (0.58 to 0.72)***	0.69 (0.62 to 0.76)***
Heavy alcohol use		
No	1 (Reference)	---
Yes	0.90 (0.75 to 1.08)	
Social participation		
No	1 (Reference)	1 (Reference)
Yes	0.73 (0.66 to 0.80)***	0.84 (0.76 to 0.92)***

*p<0.05, **p<0.01, ***p<0.001.
†Adjusted for all variables in tables 3 and 4.
CI, Confidence Interval.

Anthropometry: 'Height and weight of adults were measured using the Seca 803 digital scale'.[28] 'BMI was calculated according to Asian criteria: underweight (<18.5 kg/m^2), normal weight (18.5–22.9 kg/m^2), overweight (23.0–24.9 kg/m^2), class I obesity (25.0–29.9 kg/m^2) and class II obesity (≥30.0 kg/m^2)'.[39]

Other chronic conditions included, 'Has any health professional ever told you that you have…?': '(1) diabetes or high blood sugar; (2) chronic lung disease such as asthma, chronic obstructive pulmonary disease/chronic bronchitis or other chronic lung problems; (3) bone or joint disorder (arthritis or rheumatism, osteoporosis or other bone/joint diseases); (4) chronic lung disease such as asthma, chronic obstructive pulmonary disease/chronic bronchitis or other chronic lung problems; (5) Chronic heart diseases such as coronary heart disease (heart attack or myocardial infarction), congestive heart failure, or other chronic heart problems and (6) Stroke (Yes/No).'.[28]

Hypertension was measured and defined as 'systolic blood pressure (BP) ≥140 mm Hg and/or diastolic BP ≥90 mm Hg (based on the last two averaged of three BP readings) or where the participant is currently on antihypertensive medication.'.[40]

Angina was assessed with the 'WHO's Rose angina questionnaire'.[41]

Depressive symptoms (defined as ≥4 symptoms) were obtained from a modified 'Centre for Epidemiological Studies Depression Scale-10'.[42 43] The 10 items 'included 7 negative symptoms (trouble concentrating, feeling depressed, low energy, fear of something, feeling alone, bothered by things and everything is an effort), and three positive symptoms (feeling happy, hopeful, and satisfied).' (Cronbach α was 0.79 in this sample).

Table 5 Associations between sociodemographic factors and physical inactivity estimated by multivariable logistic regression among women

Variable	Crude OR (95% CI)	Adjusted OR (95% CI)†
Age in years		
45–59	1 (Reference)	1 (Reference)
60–69	1.79 (1.65 to 1.94)***	1.55 (1.41 to 1.70)***
70 or more	4.07 (3.61 to 4.61)***	2.57 (2.21 to 2.99)***
Marital status		
Not married	1 (Reference)	1 (Reference)
Married	0.49 (0.44 to 0.54)***	0.79 (0.71 to 0.88)***
Education (completed years)		
No schooling	1 (Reference)	1 (Reference)
1–4	0.70 (0.61 to 0.80)***	0.81 (0.70 to 0.93)**
5–9	0.66 (0.59 to 0.74)***	0.86 (0.74 to 0.99)*
10 or more	0.56 (0.41 to 0.76)***	0.92 (0.70 to 1.21)
Socioeconomic status		
Low	1 (Reference)	---
Medium	1.04 (0.94 to 1.14)	
High	1.13 (0.95 to 1.35)	
Residential status		
Rural	1 (Reference)	---
Urban	0.86 (0.71 to 1.04)	
Religion		
Hindu	1 (Reference)	1 (Reference)
Muslim	1.13 (0.97 to 1.31)	1.11 (0.96 to 1.29)
Christian	0.92 (0.68 to 1.24)	1.14 (0.93 to 1.41)
Sikh	1.44 (1.08 to 1.91)*	1.39 (1.05 to 1.86)*
Other	0.93 (0.64 to 1.35)	1.10 (0.76 to 1.60)

*p<0.05, **p<0.01, ***p<0.001.
†Adjusted for all variables in tables 5 and 6.

Insomnia symptoms were sourced from the Jenkins Sleep Scale-4,[44] for example, 'How often do you have trouble falling asleep?' The response options were 'never, rarely (1–2 nights per week), occasionally (3–4 nights per week) and frequently (5 or more nights per week)'. Insomnia symptoms were defined as 'frequently' for the any of the four questions.[45] (Cronbach alpha was 0.80 in this study).

Current tobacco use: (1) 'Do you currently smoke any tobacco products (cigarettes, bidis, cigars, hookah, cheroot, etc)? and/or (2) Do you use smokeless tobacco (such as chewing tobacco, gutka, pan masala, etc)?' (Yes, No).[28]

Heavy episodic alcohol use: 'In the last 3 months, how frequently on average, have you had at least five or more drinks on one occasion?[28]' and defined as '1–3 days per month, one to 4 days per week, five or more days per week, or daily.'

Social participation was sourced from six questions, for example, 'Eat-out-of-house (restaurant/hotel)'.[46] Responses were 'coded 1=daily to at least once a month and 0=rarely/once a year or never, and social participation was defined as at least one activity'.[46]

Data management

The survey protocol used in sample management interviewing, computer-assisted personal interviewing (CAPI) and data processing. 'These technologies ensure data quality through built-in checks in CAPI as well as real-time data monitoring with an automated data quality control protocol'.[28]

Statistical analysis

Descriptive statistics were applied to describe sociodemographic information, health indicators and physical activity levels. Unadjusted and adjusted logistic regression using Taylor linearisation methods was used to assess associations between sociodemographic, health variables and physical inactivity for men and women, separately. Taylor linearisation methods are used because of the complex

Table 6 Associations between health, health behaviour and physical inactivity estimated by multivariable logistic regression among women

Variable	Crude OR (95% CI)	Adjusted OR (95% CI)†
Self-rated health (poor or fair)		
No	1 (Reference)	1 (Reference)
Yes	1.55 (1.42 to 1.70***	1.18 (1.07 to 1.31)***
Cognitive functioning (scale)	0.94 (0.93 to 0.95)***	0.98 (0.97 to 0.99)***
Functional disability		
No	1 (Reference)	1 (Reference)
Yes	1.75 (1.61 to 1.90)***	0.99 (0.88 to 1.11)
Physical pain		
No	1 (Reference)	---
Yes	1.02 (0.91 to 1.14)	
Back pain or problem		
No	1 (Reference)	---
Yes	1.06 (0.97 to 1.16)	
Bone or joint diseases		
No	1 (Reference)	1 (Reference)
Yes	1.26 (1.08 to 1.41)**	0.96 (0.83 to 1.11)
Hearing problem		
No	1 (Reference)	1 (Reference)
Yes	1.42 (1.19 to 1.69)***	0.87 (0.67 to 1.13)
Vision impaired		
No	1 (Reference)	1 (Reference)
Yes	1.56 (1.42 to 1.71)***	1.24 (1.11 to 1.37)***
Overweight/obesity		
No	1 (Reference)	---
Yes	0.93 (0.84 to 1.03)	
Diabetes		
No	1 (Reference)	---
Yes	1.19 (0.98 to 1.46)	
Hypertension		
No	1 (Reference)	1 (Reference)
Yes	1.36 (1.21 to 1.53)***	1.07 (0.96 to 1.18)
Heart disease or stroke		
No	1 (Reference)	1 (Reference)
Yes	1.63 (1.25 to 2.14)***	1.02 (0.74 to 1.40)
Angina		
No	1 (Reference)	---
Yes	1.11 (0.97 to 1.27)	
Lung disease		
No	1 (Reference)	1 (Reference)
Yes	1.59 (1.28 to 1.97)***	1.06 (0.83 to 1.36)
Depressive symptoms		
No	1 (Reference)	1 (Reference)
Yes	1.47 (1.36 to 1.59)***	1.30 (1.19 to 1.43)***
Insomnia symptoms		

Continued

Table 6 Continued

Variable	Crude OR (95% CI)	Adjusted OR (95% CI)†
No	1 (Reference)	1 (Reference)
Yes	1.52 (1.35 to 1.71)***	1.16 (1.02 to 1.31)*
Current tobacco use		
No	1 (Reference)	1 (Reference)
Yes	0.85 (0.76 to 0.95)**	0.72 (0.65 to 0.80)***
Heavy alcohol use		
No	1 (Reference)	---
Yes	0.78 (0.51 to 1.20)	
Social participation		
No	1 (Reference)	1 (Reference)
Yes	0.64 (0.56 to 0.73)***	0.76 (0.69 to 0.84)***

*p<0.05, **p<0.01, ***p<0.001.
†Adjusted for all variables in tables 5 and 6.

study design. Variables significant (p<0.05) in univariate analyses were subsequently included in the multivariable model. A p<0.05 was accepted as significant, missing values were excluded and no multicollinearity was found. Statistical analyses were conducted using 'STATA software V.15.0 (Stata)', taking the multistage stratified area probability cluster sampling design survey weights into account to compensate for unequal selection probabilities and to compensate for non-response.

Patient and public involvement

Participants were not involved in the design of the study, recruitment or conduct of the study.

RESULTS

Sample characteristics and level of physical activity

The sample included 72 262 adults (45 years and older, mean age 58.8 years, SD=11.8), 58.0% were women and 48.0% men. Majority (68.2%) of the participants live in rural areas, 75.6% were married, 81.9% were Hindus, 49.5% had no schooling and 37.2% perceived their socioeconomic status as low. Overall, 36.7% were physically inactive, 42.6% among men and 32.4% among women (p<0.001) (see table 1).

In general, 39.7% of the participants rated their health status as poor or fair, 28.8% had two or more functional disabilities, 12.5% had physical pain, 31.5% had back pain, 15.7% had bone or joint diseases, 6.6% had a hearing problem and 8.7% had impaired vision. Regarding general body weight status, 42.5 were overweight or had obesity. The prevalence of hypertension was 40.4%, diabetes 11.6%, angina 8.6%, heart disease or stroke 5.2% and lung disease 6.3%. In terms of mental health and substance use, the proportion of depressive symptoms was 27.6%, insomnia symptoms 12.7%, current tobacco use 30.4% and heavy alcohol use 2.7% (see table 2).

Associations with physical inactivity among men and women

In the adjusted logistic regression analysis, among both men and women, older age (70 years and older) and being Sikh were positively associated with physical inactivity. Furthermore, among men, higher socioeconomic status and urban residence were positively associated with physical inactivity, and among women, being married and higher education were negatively associated with physical inactivity. Among both sexes impaired vision and depressive symptoms were positively and cognitive functioning, current tobacco use and social participation were negatively associated with physical inactivity. In addition, among men, functional disability, and heart disease or stroke were positively associated with physical inactivity, and among women, insomnia symptoms and poor or fair self-rated health status were positively associated (see tables 3–6).

DISCUSSION

This study is one of the first investigations assessing physical inactivity (prevalence and associated factors) among ageing adults (≥45 years) in a national population sample in India in 2017–2018. The study found an overall prevalence of physical inactivity of 36.7%, which is higher than in a previous national survey among ageing adults (≥50 years) in 2007–2008 in India (22.0%)[7] and among adults (18–69 years, 2017–2019) in Madhya Pradesh, (19.6%),[5] but lower than in Tamil Nadu in 2010 (aged 30–64 years) (63.3%–40.6%),[4] and among adults (18–69 years) in a rural population in South-India (46.8%).[6] The physical inactivity level found in this study compares with previous national studies in other countries in the Southeast and East Asian region, for example, for example in China (≥45 years) (44.1%)[9] but was higher than for example in Malaysia (≥60 years) (29.8%).[10] The high levels of physical inactivity found in this study call for intensified efforts to promote physical activity in India.

Consistent with previous research,[11] this study showed that physical inactivity increased with age. Although previous studies[4 8 12–14] found a higher prevalence of physical inactivity in women than in men, we found a higher prevalence in men than in women. Similar results were found in the 2007–2008 India survey,[7] meaning that men should be particularly targeted in improving on physical activity. According to previous findings,[4] we found that physical inactivity increased with higher socioeconomic status among men. It is possible that men with higher socioeconomic status are less likely to engage in physical activity due to less physical labour. Compared with women with no education, women with 1–9 years of education were less likely to engage in physical inactivity in this study. This finding is consistent with a study in a high-income country (Poland),[16] but it is the opposite to previous studies in India[4] and China.[15] While, among men, we did not find a significant association between education and physical inactivity, which is similar to a study in Japan.[17] People who were Sikhs and men with urban residence were found to be more likely to be physically inactive. The latter is consistent with previous research on urban-rural differences in the prevalence of physical inactivity.[3 13] Furthermore, in line with a large previous study among adults,[46] we found that being married decreased the odds of physical inactivity.

In agreement with previous research,[7 12 13 18 19] we found that among men and/or women poor self-rated health, poor cognitive functioning, visual impairment, functional disability and in unadjusted analysis having bone or joint diseases were associated with physical inactivity. However, contrary to expectations,[7] physical pain and back pain or problem were not significantly associated with physical inactivity. Unlike some previous research,[7 20] we did not find a significant association between overweight and obesity and physical inactivity. We found that having other chronic diseases (hypertension, diabetes and chronic lung disease) were significantly associated with physical inactivity in bivariate analysis and heart disease or stroke in adjusted analysis among men and/or women, while other studies found significant associations with these conditions.[7 8 21–23]

In line with former findings,[7 24 25 47] we found significant positive associations between depressive symptoms, insomnia symptoms and physical inactivity. Some research[48] found bidirectionality between PA and mental health: 'from midlife to old age, greater PA is associated with better mental health and vice versa, suggesting persistent longitudinal and bidirectional associations between PA and mental health'.[48] 'During the ageing process, physical exercise might represent a potential adjunctive treatment for neuropsychiatric disorders and cognitive impairment, helping delay the onset of neurodegenerative processes. Neurotransmitter release, neurotrophic factors and neurogenesis, and cerebral blood flow alteration are some of the concepts involved'.[49]

Regarding other health behaviours, we found that, according to some research,[7 50] social participation was inversely associated with physical inactivity. Some research[13 26] found associations between smoking, heavy drinking and physical inactivity, while in our study current tobacco use was negatively and heavy drinking was not associated with physical inactivity. This finding may be explained by a higher rate of tobacco use among lower socioeconomic groups and the low prevalence of heavy drinking (2.9%) in India. It is possible that, in particular, men who are engaged in more physically active work, such as manual labour, also engage more frequently in tobacco use. The factors highlighted in this study should be taken into account when designing physical activity intervention programmes.

The limitations of the study include the assessment of some variables by self-report, including physical activity. The study did also not assess the different domains of moderate and vigorous physical activity. The assessed diagnosed chronic conditions by a healthcare provided may be less prone to bias than for self-reported health. In addition, the study only included non-institutional ageing adults.

CONCLUSIONS

Almost 4 in 10 middle-aged and older adults in India had inadequate physical activity.

Overall risk factors (male sex, being Sikh, impaired vision, depressive symptoms, poor cognitive functioning and lack of social participation) and gender-specific risk factors (among men, higher socioeconomic status, urban residence, functional disability, and heart disease or stroke, and among women not married, no education, insomnia symptoms and poor or fair self-rated health status) for physical inactivity were identified. Interventions may operate at multiple levels and consider gender-related physical inactivity patterns.

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