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Exercising in India: An Exploratory Analysis Using the Time Use Survey, 2019

Mudit Kapoor[1], Shamika Ravi[2], Rockli Kim[3], S. V. Subramanian[4,5]

[1]Economics and Planning Unit, Indian Statistical Institute, New Delhi, India
[2]Observer Research Foundation, Delhi, India
[3]Division of Health Policy and Management, College of Health Science, Korea University, Seoul, South Korea
[4]Department of Social and Behavioral Sciences, Harvard T.H. Chan School of Public Health, Boston, MA, USA
[5]Harvard Center for Population and Development Studies, Cambridge, MA, USA

ABSTRACT

In this paper, we use the nationally representative Time Use Survey (TUS) data from India to estimate the proportion of people that spend any time of the day exercising. We found that overall, less than 7% of the adult population (age ≥18 years) spent any time of the day exercising. Our estimates also revealed that the proportion of population exercising varied across states, by rural and urban sectors, and by social and religious groups. We also estimated logistic regressions to model the probability of people exercising. We found that males had three times higher odds of exercising than females. Relative to less educated people (primary school and below), those with educational level of graduate and above had almost 2.5 times higher odds of exercising. People in the higher strata of consumption class, the top 10%, had 1.7 times higher odds of exercising relative to the bottom 50%. From a public policy perspective, the low level of exercise across all geographies and social, economic, and demographic characteristics indicates the need for population-wide interventions in India to encourage exercise.

Key words: *exercise, state variation, demography, socioeconomic status, time use survey, India*

Introduction

Regular physical activity and exercising are associated with significant health benefits. It helps prevent and manage non-communicable diseases (NCDs) like cardiovascular disease, diabetes, and cancers, such as breast and colon cancer. Physical activity and exercising are also associated with mental well-being as it reduces anxiety and depression and helps improve judgment, thinking, and learning. In general, it leads to overall well-being. People with insufficient physical activity have a 20% to 30% higher risk of death than those who are sufficiently active[1–5]. Given the importance of physical activity for overall well-being and healthier life, the World Health Organization (WHO) developed a global action plan on physical activity 2018 – 2030 to reduce physical inactivity by 10% and 15% by 2025 and 2030, respectively[6–8].

In the Indian context, in 2014, NCDs contributed to more than five million deaths and accounted for more than 60% of total deaths[9]. Four behavioral risk factors contribute significantly to high proportions of NCDs; tobacco use, unhealthy diet, lack of physical activity, and alcohol abuse. However, quantifying the extent of physical activity across the population, particularly in Low-Middle Income Countries (LMIC) such as India, remains a challenge.

This paper focuses on quantifying exercising, a subset of physical activity, at the population level in India. According to Caspersen et al[10], physical activity is defined as "any bodily movement produced by skeletal muscles that results in energy expenditure. The energy expenditure can be measured in kilocalories. Physical activity in daily life can be categorized into occupational, sports, conditioning, household, or other activities". Exercise is "a subset of physical activity that is planned, structured, and repetitive and has as a final or an intermediate objective the improvement or maintenance of physical fitness. Physical fitness is a set of attributes that are either health- or skill-related." Exercising has similar health and overall well-being benefits as physical activity. Regular and habitual exercising is associated with preventing and reduc-

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ing symptoms of cardiovascular disease and is also associated with reduced risk of other chronic conditions, such as type 2 disease, osteoporosis, obesity, depression, breast and colon cancers[11].

An important contribution of this paper is to quantify the extent of exercising at the population level in India using novel nationally representative publicly available data on the Time Use Survey (TUS) in India. In 2019, the Government of India conducted a nationally representative TUS to measure time spent by the population on different activities, which included paid and unpaid activity, learning, socializing, leisure activities, self-care activities, etc. The classification of activities in the TUS was based on the United Nations International Classification of Activities for Time Use Statistics (ICATUS)[12]. For this paper, we focus on Exercising (activity coded as 832), which was classified under the major division "Culture, Leisure, Mass Media, and sport practices," and under the subdivision "Sports participation, exercise, and related activities." According to ICATUS, exercising refers to physical exercise focused on health benefits. It includes walking, hiking, jogging, biking, skating, skateboarding, swimming, surfing, kayaking, skiing, ice skating, aerobics, yoga, weight-training, and other fitness programs including gymnastics, calisthenics, tae-bo, square collective exercising, kung fu, t'ai chi. However, it excludes participation in sports, walking to work, walked for exercise, went to the gym, practiced dance aerobics.

This paper has two important objectives. First, it aims to quantify the proportion of the adult population (age ≥ 18 years) in India who spent time exercising. Additionally, we highlight variations in the proportion of adult population who exercise across states/Union Territories (UTs), social and religious groups, consumption class (bottom 50%, middle, and top 10%), educational level, gender, and age groups (youth, middle-age group, and the elderly). Second, we quantify the time spent exercising on average for those who spent any time exercising. Variations in time spent exercising across states/UTs, social and religious groups, consumption class, educational level, gender, and age groups were highlighted.

Material and Methods

Data

In 2019, the Ministry of Statistics and Programme Implementation (MOSPI), Government of India, conducted a Time Use Survey (TUS) to measure time spent by the population on different activities, which ranged from paid to unpaid activities, activities relating to socializing, communication and religious practice, etc[13]. The classification of activities in the TUS was based on 2016 United Nations' ICATUS[12]. The geographical coverage of the survey was entire India, and it was representative at the state and the national level. The survey covered 138,799 households, of which 82,897 were rural, while 55,902 were urban households. Overall, the survey collected data from 447,250 persons six years and older, of which 273,195 were from rural areas while 174,055 were from urban areas.

The data on time-use activities was based on personal interviews. Information on time-use was collected, covering 24 hours from 4 AM on the day before the interview to 4 AM on the day of the interview[13]. The activities were classified using a three-digit code based on the 2016 United Nations' ICATUS[12]. For each activity at the individual level, (i) the duration time was recorded in 24-hour format, (ii) whether it was performed simultaneously with other activities, (iii) whether it was a major activity or not.

In addition to time-use, the survey collected data at the household level on (i) social group; whether it belonged to ST/SC/OBC or others, (ii) religion of the household; such as Hinduism, Islam, Christianity, Sikhism, Jainism, Buddhism, Zoroastrianism, and others, (iii) level of usual monthly consumption expenditure. At the individual level, data were collected on; (i) age, (ii) sex (male, female, or others), (iii) marital status, and (iv) education level.

For our analysis, we exclusively focused on time spent on exercising (three-digit activity code 832)[12]. In addition, we limit our attention to the adult population, where age was ≥ 18 years. Our final sample consists of 357,993 individuals, of which 179,179 (50.1%) were male, 178,814 (49.9%) were female. The mean age of the sample was 40 years with a standard deviation of 16 years. The survey data was representative of 732,449,206 persons (95% Confidence Intervals [CI]: 723,634,911 to 741,263,501).

Covariates

The covariates we used in our analysis were the area of residence (rural or urban), religion, social group (SC/ST/OBC/Others) at the household level. While at the individual level, we included variables related to age, sex, and education level. We use the household's usual monthly per capita consumption expenditure (UMPCE). We then divided the households into deciles based on UMPCE and constructed three categories of consumption class: Bottom 50%, Middle 50% to 90%, and Top 10%. For education level, based on the highest level of education of the individual, we constructed three categories; those with primary or below level of education, those with secondary education, and those who were graduate and above. We grouped age into four categories: youth (18 years to 29 years), middle-aged (30 years to 44 years), upper-middle age (45 years to 59 years), and elderly (≥ 60 years).

Outcome variable

Our primary analysis was based on two outcome variables; (i) a categorical variable which took a value of one if the individual spent time exercising and zero otherwise, and (ii) the number of minutes spent exercising if the individual spent time on it.

Statistical Analysis

Our statistical analysis was based on two types of regression. First was a logistic regression of the following form,

Pr (time spent exercising = 1)
= constant + state fixed effects + sector + social group + consumption class
+ education level+gender+age group+error term.

We exploit the negative binomial regression models for our second outcome, time (in minutes) spent on exercising, a non-negative outcome variable[14]. The following regression was performed,

Time spent exercising (minutes)
= constant+state fixed effects + sector + social group + consumption class
+ education level + gender + age group + error term.

We used the statistical software STATA 16.1 (MP 2 core)[15] for our statistical analysis. The proportions and the averages after the logistic regressions and nbreg were computed using the margins command after the regression analysis. Our logistic and nbreg regression analysis exploited the survey design. STATA survey design command, svyset was used to declare the survey design, including the primary sampling unit, sampling weights, and stratification. Strata with single sampling units were centered, and the variance estimation was based on Taylor linearization.

Results

We estimated that out of 732,449,206 adult population in India (95% CI: 723,634,911 to 741,263,501), 46,102,079 people (95% CI: 44,252,605 to 47,951,553) spent time exercising, which represented approximately 6.3% (95% CI: 6.1% to 6.5%) of the total adult population. Our results revealed significant inter-state variations in the proportion of the adult population who exercised (see Figure 1a). Among the larger states, the proportion of people who exercised was the highest in Kerala at 10.9% (95% CI: 9.7% to 12.2%), and the lowest was in Gujarat at 2.8% (95% CI: 2.4% to 3.4%). While for the smaller states, Goa had the highest proportion of people who exercised at 24.7% (95% CI: 20.1% to 30.1%), and the lowest was in Sikkim at 1.8% (95% CI: 1.0% to 3.3%).

Our next set of results looks at the proportion of people exercising for different social, economic, and demographic factors (see Table 1). We found a higher proportion of people exercising in urban areas than rural areas; 9.8% (95% CI: 9.4% to 10.3%) versus 4.7% (95% CI: 4.4% to 5.5%). People belonging to social group ST and SC, were less likely to exercise compared to others category; 4.4% (95% CI: 3.9% to 5.1%), 5.1% (95% CI: 4.7% to 5.5%), and 8.4% (95% CI: 8.0% to 8.9%). People in the bottom 50% in terms of consumption class had a lower proportion of people exercising compared to those in the top 10%; 4.4% (95% CI: 4.1% to 4.7%) for the bottom 50%, while 12.2% (95% CI: 11.6% to 12.9%) for the top 10%. People with lower educational levels (primary or below) had a lower proportion of people exercising than those who were graduate and above; 4.3% (95% CI: 4.1% to 4.6%) versus 13.2% (95% CI: 12.6% to 13.8%). Concerning gender, females had a lower proportion of those exercising than males; 3.3% (95% CI: 3.1% to 3.5%) versus 9.3% (95% CI: 8.9% to 9.6%). Elderly people (age ≥ 60 years) had higher proportion of those exercising than those belong to the youth (18 to 29 years); 11.0% (95% CI: 10.5% to 11.5%) versus 4.9% (95% CI: 4.7% to 5.2%).

Next, we report results based on the logistic regressions (see Figure 2). We report unadjusted and adjusted odds ratios (ORs), where adjusted ORs (aORs) controlled for state fixed effects, social factors, such as religion and social group, economic factors, such as consumption class, educational level of the individual, gender, and age group. We found that urban areas relative to rural areas had 223% higher odds of people exercising; the unadjusted OR was 2.23 (95% CI: 2.05 to 2.42). However, after controlling for socio-economic and demographic factors, the aOR reduced to 1.75 (95% CI: 1.60 to 1.91). People adhering to Islam had lower odds of exercising relative to the Hindus; the OR was 0.72 (95% CI: 0.64 to 0.82), while the aOR was 0.78 (95% CI: 0.69 to 0.89). People in the higher strata of consumption class, the top 10% had 300% higher unadjusted odds of exercising relative to the bottom 50%, the OR was 3.00 (95% CI: 2.74 to 3.28), however after controlling for other factors, it reduced, the aOR was 1.69 (95% CI: 1.55 to 1.85). Relative to less educated people (primary school and below), those with educational level graduate and above had higher odds of exercising; the OR and aOR were 3.35 (95% CI: 3.12 to 3.61) and 2.43 (95% CI: 2.26 to 2.62), respectively. Males were more likely to exercise than females; the OR and aOR were 2.98 (95% CI: 2.81 to 3.16) and 2.78 (95% CI: 2.62 to 2.96), respectively. Older people (age ≥ 60 years) had higher odds of exercising relative to the youths (age between 18 and 29 years); the OR and aOR were 2.38 (95% CI: 2.24 to 2.53) and 3.60 (95% CI: 3.32 to 3.90), respectively.

The following results are for logistic regressions stratified by gender and age (see Figure 3a). We find that for both males and females, people in urban areas have higher odds of exercising than in rural areas; however, the effect was bigger for females than for males; the aOR for males was 1.58 (95% CI: 1.46 to 1.72) while for females it was 2.22 (95% CI: 1.89 to 2.60). Males and females belonging to the top 10% in the consumption class had higher odds of exercising relative to the bottom 50%; the aOR was 1.64 (95% CI: 1.50 to 1.79) and 1.79 (95% CI: 1.53 to 2.10), for males and females, respectively. Males and females with graduate and above educational level had higher odds than those with primary or below educational level; aOR for males was 2.52 (95% CI: 2.32 to 2.73), and for females, it was 2.30 (95% CI: 2.02 to 2.62). Older males and females

TABLE 1

DESCRIPTIVE SUMMARY OF THE FINAL ANALYTIC SAMPLE

		Exercise sample [N=24,713]	Overall sample [N=357,993]		
		Estimates of people who exercise	Estimates of overall population	Percent of population who exercise	Average time spent Exercising (Minutes)*
Overall	Overall	46,102,079 (44,252,605 to 47,951,553)	732,449,206 (723,634,911 to 741,263,501)	6.3% (6.1% to 6.5%)	58 (57 to 59)
Sector	Rural	23,557,786 (22,084,387 to 25,031,185)	503,526,658 (495,857,396 to 511,195,920)	4.7% (4.4% to 5.0%)	57 (55 to 58)
	Urban	22,544,293 (21,426,446 to 23,662,140)	228,922,548 (224,573,579 to 233,271,517)	9.8% (9.4% to 10.3%)	59 (58 to 60)
Social group	ST	3,163,572 (2,690,960 to 3,636,183)	71,184,148 (67,738,477 to 74,629,818)	4.4% (3.9% to 5.1%)	58 (55 to 61)
	SC	7,149,437 (6,546,834 to 7,752,040)	139,509,706 (135,094,953 to 143,924,459)	5.1% (4.7% to 5.5%)	58 (56 to 61)
	OBC	17,880,028 (16,884,299 to 18,875,756)	309,608,524 (302,692,018 to 316,525,029)	5.8% (5.5% to 6.1%)	57 (56 to 58)
	Others	17,909,043 (16,864,687 to 18,953,399)	212,146,829 (205,704,160 to 218,589,497)	8.4% (8.0% to 8.9%)	58 (56 to 59)
Religion	Hinduism	38,754,417 (37,062,875 to 40,445,959)	600,275,962 (591,032,555 to 609,519,370)	6.5% (6.2% to 6.7%)	58 (57 to 59)
	Islam	4,255,742 (3,771,812 to 4,739,671)	89,586,022 (85,058,173 to 94,113,870)	4.8% (4.3% to 5.3%)	58 (54 to 61)
	Christianity	1,388,225 (1,191,122 to 1,585,328)	19,922,411 (18,358,341 to 21,486,481)	7.0% (6.2% to 7.8%)	53 (50 to 56)
	Sikhism	902,103 (719,469 to 1,084,737)	13,514,599 (11,932,150 to 15,097,048)	6.7% (5.5% to 8.1%)	57 (52 to 62)
	Others	801,592 (608,148 to 995,035)	9,150,212 (8,231,048 to 10,069,377)	8.8% (7.1% to 10.8%)	54 (50 to 58)
Consumption class	Bottom 50%	13,599,234 (12,657,353 to 14,541,115)	306,378,164 (300,221,168 to 312,535,159)	4.4% (4.1% to 4.7%)	57 (55 to 58)
	Middle 50% to 90%	20,822,488 (19,801,950 to 21,843,026)	330,489,312 (324,477,109 to 336,501,516)	6.3% (6.0% to 6.6%)	57 (56 to 58)
	Top 10%	11,680,357 (10,936,811 to 12,423,903)	95,581,730 (92,081,312 to 99,082,149)	12.2% (11.6% to 12.9%)	60 (59 to 62)

TABLE 1
CONTINUED

		Exercise sample [N=24,713]	Overall sample [N=357,993]		
		Estimates of people who exercise	Estimates of overall population	Percent of population who exercise	Average time spent Exercising (Minutes)*
Marital status	Never married	8,915,989 (8,388,024 to 9,443,953)	122,635,364 (120,391,622 to 124,879,106)	7.3% (6.9% to 7.7%)	66 (63 to 68)
	Currently married	33,247,933 (31,835,350 to 34,660,516)	546,366,400 (539,735,905 to 552,996,896)	6.1% (5.8% to 6.3%)	56 (55 to 57)
	Widowed	3,729,542 (3,470,664 to 3,988,420)	59,143,705 (58,047,650 to 60,239,759)	6.3% (5.9% to 6.7%)	57 (54 to 59)
	Divorced/separated	208,615 (164,452 to 252,779)	4,303,737 (4,115,001 to 4,492,473)	4.8% (3.9% to 6.0%)	60 (54 to 66)
Education level	Primary or below	19,292,563 (18,227,036 to 20,358,089)	446,285,039 (439,999,455 to 452,570,624)	4.3% (4.1% to 4.6%)	56 (54 to 57)
	Secondary	14,814,340 (14,089,592 to 15,539,087)	195,031,256 (191,758,121 to 198,304,392)	7.6% (7.3% to 7.9%)	59 (58 to 60)
	Graduate & above	11,995,177 (11,323,981 to 12,666,372)	91,132,911 (88,623,152 to 93,642,669)	13.2% (12.6% to 13.8%)	59 (57 to 60)
Gender	Female	12,145,108 (11,366,031 to 12,924,185)	366,390,619 (362,011,627 to 370,769,612)	3.3% (3.1% to 3.5%)	56 (54 to 57)
	Male	33,956,971 (32,623,642 to 35,290,300)	366,058,587 (361,430,260 to 370,686,914)	9.3% (8.9% to 9.6%)	58 (57 to 59)
Age group	18 to 29 years	11,285,769 (10,647,033 to 11,924,505)	228,531,395 (225,194,831 to 231,867,959)	4.9% (4.7% to 5.2%)	53 (52 to 55)
	30 to 44	11,197,890 (10,601,510 to 11,794,271)	233,125,163 (229,786,865 to 236,463,461)	4.8% (4.6% to 5.1%)	52 (51 to 54)
	45 to 59	11,723,195 (11,141,800 to 12,304,590)	162,560,954 (160,251,637 to 164,870,271)	7.2% (6.9% to 7.6%)	57 (56 to 59)
	≥ 60 years	11,895,225 (11,342,588 to 12,447,862)	108,231,694 (106,367,119 to 110,096,270)	11.0% (10.5% to 11.5%)	68 (66 to 70)

Note: The 95% Confidence Intervals are in the parenthesis. *Average time spent exercising was estimated based on the negative binomial regression where time spent exercising was the dependent variable, and the independent variables were dummy variables controlling for the state, area of residence (rural or urban), social status, religion, consumption class, education level, marital status, gender, and age group.

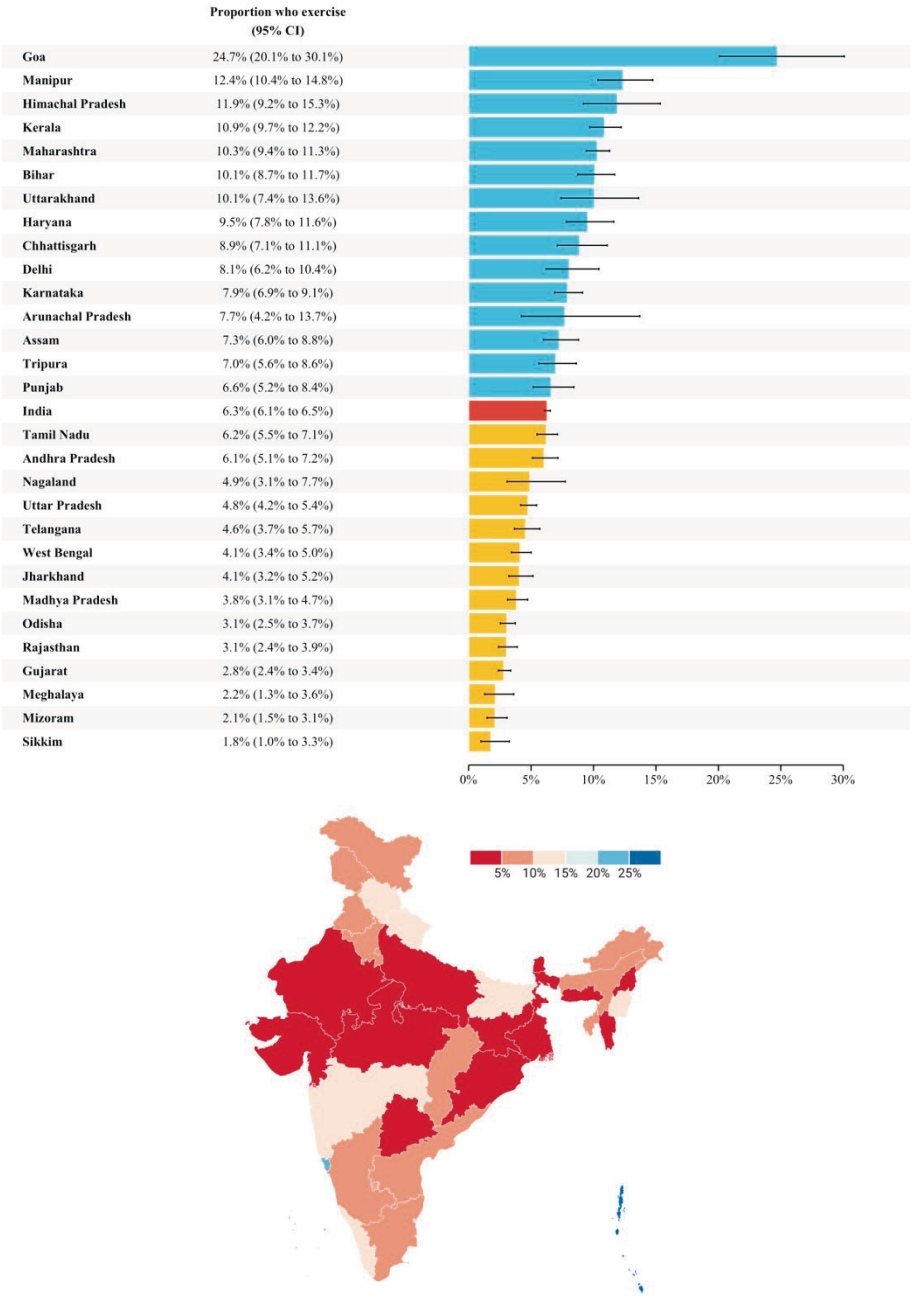


Fig. 1a. Inter-state variations in the proportion of the adult population (age ≥ 18 years) that exercises.

(age ≥ 60 years) had higher odds of exercising than younger people (age 18 years to 29 years); however, the odds were higher for females than males; aOR for females was 5.10 (95% CI: 4.39 to 5.93), and for males, it was 3.02 (95% CI: 2.78 to 3.28).

For logistic regressions stratified by age group (see Figure 3b), we find that males had higher odds of exercising relative to females across all age groups; the aOR for age group 18 to 29 years it was 3.46 (95% CI: 3.00 to 4.00), for age group 30 to 44 years it was 3.02 (95% CI: 2.74 to 3.33), for age group 45 to 59 years it was 2.28 (95% CI: 2.09 to 2.49), and for age group ≥ 60 years it was 2.43 (95% CI: 2.24 to 2.63). Across all age groups, people with educational levels graduate and above had higher odds of exercising than people with primary or below the level of education; the aOR for ages 18 to 29 years was 1.98 (95% CI: 1.74 to 2.25), and for age group ≥ 60 years the aOR was 2.61 (95% CI: 2.30 to 2.96). People in the top 10% of the

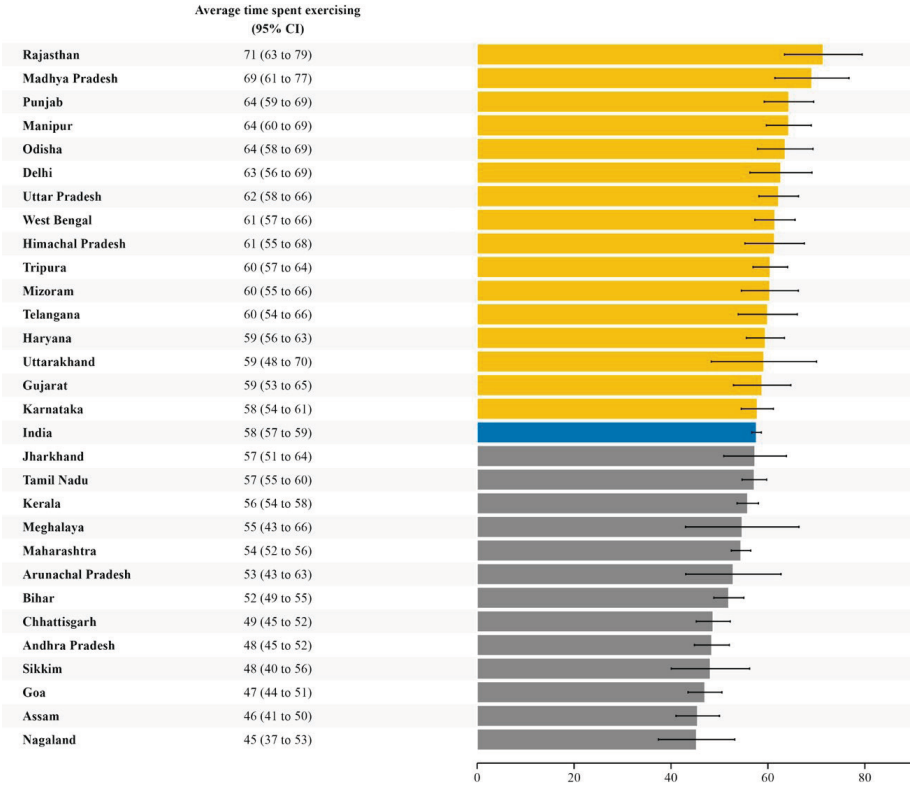
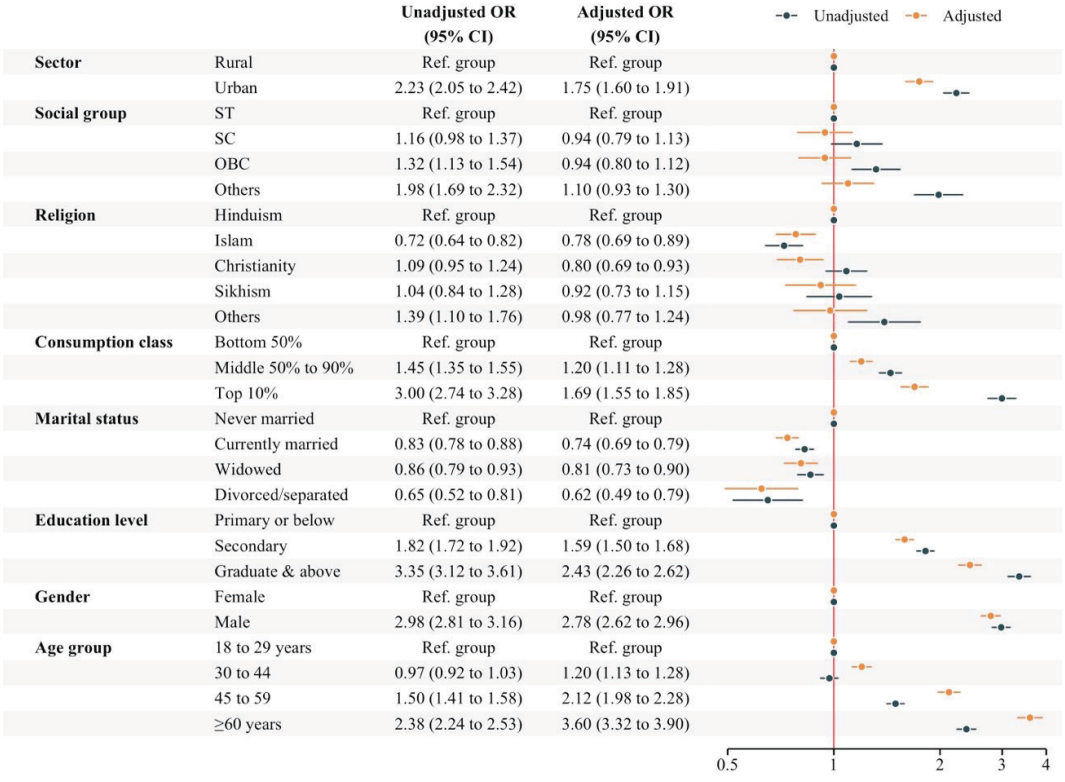


Fig. 1b. Inter-state variations in average time spent exercising (in minutes).

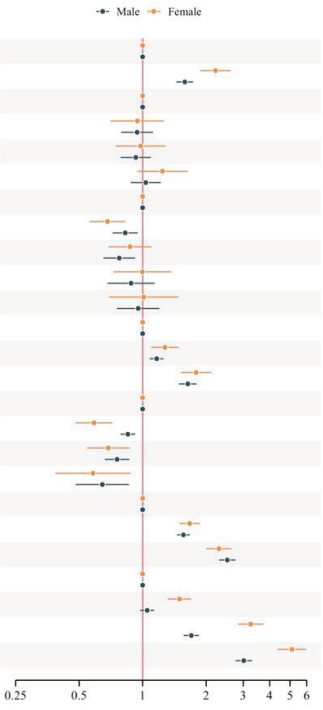


		Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Sector	Rural	Ref. group	Ref. group
	Urban	2.23 (2.05 to 2.42)	1.75 (1.60 to 1.91)
Social group	ST	Ref. group	Ref. group
	SC	1.16 (0.98 to 1.37)	0.94 (0.79 to 1.13)
	OBC	1.32 (1.13 to 1.54)	0.94 (0.80 to 1.12)
	Others	1.98 (1.69 to 2.32)	1.10 (0.93 to 1.30)
Religion	Hinduism	Ref. group	Ref. group
	Islam	0.72 (0.64 to 0.82)	0.78 (0.69 to 0.89)
	Christianity	1.09 (0.95 to 1.24)	0.80 (0.69 to 0.93)
	Sikhism	1.04 (0.84 to 1.28)	0.92 (0.73 to 1.15)
	Others	1.39 (1.10 to 1.76)	0.98 (0.77 to 1.24)
Consumption class	Bottom 50%	Ref. group	Ref. group
	Middle 50% to 90%	1.45 (1.35 to 1.55)	1.20 (1.11 to 1.28)
	Top 10%	3.00 (2.74 to 3.28)	1.69 (1.55 to 1.85)
Marital status	Never married	Ref. group	Ref. group
	Currently married	0.83 (0.78 to 0.88)	0.74 (0.69 to 0.79)
	Widowed	0.86 (0.79 to 0.93)	0.81 (0.73 to 0.90)
	Divorced/separated	0.65 (0.52 to 0.81)	0.62 (0.49 to 0.79)
Education level	Primary or below	Ref. group	Ref. group
	Secondary	1.82 (1.72 to 1.92)	1.59 (1.50 to 1.68)
	Graduate & above	3.35 (3.12 to 3.61)	2.43 (2.26 to 2.62)
Gender	Female	Ref. group	Ref. group
	Male	2.98 (2.81 to 3.16)	2.78 (2.62 to 2.96)
Age group	18 to 29 years	Ref. group	Ref. group
	30 to 44	0.97 (0.92 to 1.03)	1.20 (1.13 to 1.28)
	45 to 59	1.50 (1.41 to 1.58)	2.12 (1.98 to 2.28)
	≥60 years	2.38 (2.24 to 2.53)	3.60 (3.32 to 3.90)

Fig. 2. Odds ratios of exercising by demographic and socioeconomic characteristics.

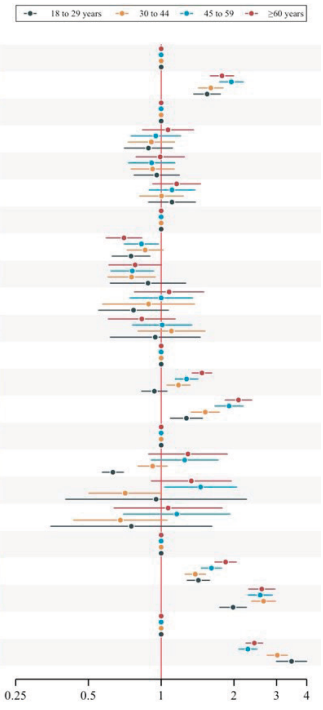
Adjusted Odds Ratios (stratified by gender)

		Male	Female
Sector	Rural	Ref. group	Ref. group
	Urban	1.58 (1.46 to 1.72)	2.22 (1.89 to 2.60)
Social group	ST	Ref. group	Ref. group
	SC	0.94 (0.80 to 1.11)	0.94 (0.71 to 1.25)
	OBC	0.93 (0.79 to 1.09)	0.98 (0.75 to 1.28)
	Others	1.03 (0.88 to 1.21)	1.24 (0.95 to 1.62)
Religion	Hinduism	Ref. group	Ref. group
	Islam	0.83 (0.73 to 0.94)	0.68 (0.56 to 0.82)
	Christianity	0.77 (0.66 to 0.92)	0.87 (0.70 to 1.09)
	Sikhism	0.88 (0.69 to 1.13)	1.00 (0.73 to 1.36)
	Others	0.95 (0.76 to 1.19)	1.01 (0.70 to 1.47)
Consumption class	Bottom 50%	Ref. group	Ref. group
	Middle 50% to 90%	1.17 (1.09 to 1.25)	1.28 (1.11 to 1.48)
	Top 10%	1.64 (1.50 to 1.79)	1.79 (1.53 to 2.10)
Marital status	Never married	Ref. group	Ref. group
	Currently married	0.85 (0.79 to 0.92)	0.59 (0.49 to 0.71)
	Widowed	0.76 (0.67 to 0.86)	0.69 (0.55 to 0.86)
	Divorced/separated	0.64 (0.48 to 0.86)	0.58 (0.39 to 0.87)
Education level	Primary or below	Ref. group	Ref. group
	Secondary	1.56 (1.47 to 1.66)	1.67 (1.51 to 1.85)
	Graduate & above	2.52 (2.32 to 2.73)	2.30 (2.02 to 2.62)
Age group	18 to 29 years	Ref. group	Ref. group
	30 to 44	1.05 (0.98 to 1.13)	1.50 (1.33 to 1.69)
	45 to 59	1.70 (1.58 to 1.84)	3.25 (2.85 to 3.71)
	≥60 years	3.02 (2.78 to 3.28)	5.10 (4.39 to 5.93)



Adjusted Odds Ratios (stratified by age)

		18 to 29 years	30 to 44 years	45 to 59 years	≥ 60 years
Sector	Rural	Ref. group	Ref. group	Ref. group	Ref. group
	Urban	1.55 (1.36 to 1.76)	1.60 (1.43 to 1.81)	1.95 (1.74 to 2.19)	1.78 (1.60 to 2.00)
Social group	ST	Ref. group	Ref. group	Ref. group	Ref. group
	SC	0.89 (0.70 to 1.11)	0.91 (0.73 to 1.14)	0.95 (0.75 to 1.20)	1.07 (0.84 to 1.36)
	OBC	0.96 (0.77 to 1.19)	0.92 (0.75 to 1.13)	0.91 (0.73 to 1.14)	0.99 (0.79 to 1.25)
	Others	1.11 (0.89 to 1.39)	1.00 (0.81 to 1.24)	1.11 (0.89 to 1.38)	1.16 (0.92 to 1.45)
Religion	Hinduism	Ref. group	Ref. group	Ref. group	Ref. group
	Islam	0.75 (0.63 to 0.90)	0.86 (0.72 to 1.02)	0.83 (0.70 to 0.98)	0.70 (0.59 to 0.83)
	Christianity	0.88 (0.62 to 1.26)	0.75 (0.60 to 0.95)	0.76 (0.62 to 0.93)	0.78 (0.61 to 1.00)
	Sikhism	0.77 (0.55 to 1.07)	0.89 (0.57 to 1.37)	1.00 (0.74 to 1.35)	1.08 (0.77 to 1.50)
	Others	0.95 (0.62 to 1.45)	1.10 (0.80 to 1.52)	1.01 (0.76 to 1.34)	0.83 (0.60 to 1.14)
Consumption class	Bottom 50%	Ref. group	Ref. group	Ref. group	Ref. group
	Middle 50% to 90%	0.94 (0.83 to 1.06)	1.18 (1.06 to 1.32)	1.27 (1.14 to 1.42)	1.47 (1.34 to 1.62)
	Top 10%	1.27 (1.09 to 1.48)	1.52 (1.33 to 1.74)	1.91 (1.67 to 2.18)	2.09 (1.84 to 2.37)
Marital status	Never married	Ref. group	Ref. group	Ref. group	Ref. group
	Currently married	0.63 (0.57 to 0.70)	0.92 (0.80 to 1.06)	1.25 (0.91 to 1.72)	1.29 (0.89 to 1.88)
	Widowed	0.95 (0.40 to 2.26)	0.71 (0.50 to 1.00)	1.46 (1.03 to 2.05)	1.33 (0.91 to 1.95)
	Divorced/separated	0.75 (0.35 to 1.62)	0.68 (0.43 to 1.06)	1.16 (0.70 to 1.93)	1.07 (0.64 to 1.79)
Education level	Primary or below	Ref. group	Ref. group	Ref. group	Ref. group
	Secondary	1.42 (1.28 to 1.59)	1.38 (1.26 to 1.53)	1.61 (1.46 to 1.78)	1.85 (1.67 to 2.05)
	Graduate & above	1.98 (1.74 to 2.25)	2.65 (2.37 to 2.97)	2.57 (2.29 to 2.88)	2.61 (2.30 to 2.96)
Gender	Female	Ref. group	Ref. group	Ref. group	Ref. group
	Male	3.46 (3.00 to 4.00)	3.02 (2.74 to 3.33)	2.28 (2.09 to 2.49)	2.43 (2.24 to 2.63)



Figs. 3a and 3b.

consumption class had higher odds of exercising than those in the bottom 50% across all age groups; however, it increased with age; the aOR for 18 to 29 years was 1.27 (95% CI: 1,09 to 1.48), while for age ≥ 60 years it was 2.09 (95% CI: 1.84 to 2.37).

When we look at the average time (in minutes) spent on exercising (see Table 1 & Figure 1b) among those who spent any time exercising, we found that older people (age ≥ 60 years) spent the maximum time; 68 minutes (95% CI: 66 to 70), while overall, on average, people spent 58 minutes exercising (95% CI: 57 to 59). Inter-state variations reveal that among the states, people from Rajasthan spent the most time exercising; 71 minutes (95% CI: 63 to 79), while people from Nagaland spent the least time exercising; 45 minutes (95% CI: 37 to 53).

Discussion

To our knowledge, this is a first paper that uses a nationally representative sample survey on TUS to quantify the extent of exercising (an important subset of physical activity) among the adult population in India. It highlights the inter-state variations and differences across social, economic, and demographic factors in the proportions of people who exercise and the average time they spend exercising. Overall, less than 10% of the adult population in India spends time exercising. Poor and socially disadvantaged people, females, and those who are less educated are less likely to spend time exercising; less than 5% spent any time exercising.

Given that physical activity and exercising are important risk factors associated with NCDs[4,9,16], our results are relevant in the Indian context, where approximately 60% of the more than five million deaths are associated with NCDs[9]. For example, NCDs such as ischemic heart disease, stroke, diabetes are among India's top ten causes of death[17]. In addition to deaths related to NCDs, India has a high prevalence of hypertension and diabetes across all geographical areas and socio-demographic groups[18,19]. Research has shown that regular exercising is an economical, "drug-free" approach to controlling hypertension[20], and it helps lower blood glucose levels and boosts the body's sensitivity to insulin[21].

From a public policy perspective, given the low levels of exercise across all geographies and social, economic, and demographic characteristics, the Indian government would need a public campaign that encourages people to exercise. Additionally, the government needs to invest in exercise-related infrastructures, such as parks, special cycling, walking lanes, etc. Rural and urban infrastructure development programs should encourage people to exercise regularly.

Limitations

The key limitation of the paper is that the analysis was based on TUS, where data on activity was based on the day before the survey date. To better understand how much time people typically spend on exercising, it would have been optimal to get the individual to maintain a daily diary for some time. Unfortunately, this is a costly endeavour. Furthermore, the TUS data on exercising does not capture the intensity of the activity. However, conducting a large nationally representative TUS in a Low-Middle Income Country (LMIC) such as India is a novel exercise, as these surveys are primarily conducted in rich countries. Despite the limitation, the survey is informative on how Indians spend time across different activities, including paid and unpaid activity, learning, socializing, leisure activities, self-care activities, etc.

In this paper we have limited our attention to time spent on exercising, which is a part of overall physical activity, defined by WHO7 as "any bodily movement produced by skeletal muscle that requires energy expenditure". Physical activity is not limited to exercising only, it could be undertaken in multiple domains related to work, travel, and recreational activities (such as exercising, sports, etc.). WHO recommends 150 minutes of moderate intensity physical activity for adults per week[7]. However, an implication of the broader definition of physical activity is that there is a possibility that Indian adults are physically active, even though they are less likely to spend any time exercising.

Conclusions

A large nationally representative TUS was used to quantify the inter-state variations and differences across social, economic, and demographic factors in the proportions of adult people who exercise and the average time they spend on exercising. The data reveals that less than 10% of the adult population spent any time exercising. For socially and economically disadvantaged, less educated females, and the youth (aged between 18 and 29 years), less than 5% of people spent any time exercising.

Author contribution

Conceptualization and design: MK, SVS; *Data acquisition and analysis*: MK; *Data interpretation*: MK, SR, RK, SVS; *Writing of the manuscript*: MK; *Critical revisions*: MK, SR, RK, SVS, RK; *Overall supervision*: SVS.

Data sharing statement: The study is based on publicly available data and can be accessed from https://mospi.gov.in/time-use-survey-0.

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REFERENCES

1. WHO, Physical activity, 2022. https://www.who.int/news-room/fact-sheets/detail/physical-activity. — 2. MEDLINEPLUS, Benefits of Exercise. (National Library of Medicine, Bethesda MD. 2020). https://medlineplus.gov/benefitsofexercise.html. — 3. U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, Physical Activity Guidelines Advisory Committee 2018. Physical Activity Guidelines Advisory Committee Scientific Report (U.S. Department of Health and Human Services, Washington DC, 2018). https://health.gov/our-work/nutrition-physical-activity/physical-activity-guidelines/current-guidelines/scientific-report. — 4. PIERCY KL, TROIANO RP, BALLARD RM, et al., JAMA **320** (2018) 2020. doi:10.1001/jama.2018.14854. — 5. SCHUCH FB, VANCAMPFORT D, RICHARDS J, ROSENBAUM S, WARD PB, STUBBS B, J. Psychiatr. Res, **77** (2016) 42. doi:10.1016/j.jpsychires.2016.02.023. — 6. WHO, Let's be active. https://www.who.int/news-room/initiatives/gappa. — 7. WHO, The global action plan on physical activity 2018 – 2030. https://www.who.int/news-room/initiatives/gappa/action-plan. — 8. GUTHOLD R, STEVENS GA, RILEY LM, BULL FC, Lancet Glob. Health, 6 (2018) e1077. doi:10.1016/S2214-109X(18)30357-7. — 9. WHO, Noncommunicable diseases. https://www.who.int/westernpacific/health-topics/noncommunicable-diseases. — 10. CASPERSEN CJ, POWELL KE, CHRISTENSON GM, Public Health Rep, 100 (1985) 126. — 11. THOMPSON PD, BUCHNER D, PINA IL, ET AL., Circulation, 107 (2003) 3109. doi:10.1161/01.CIR.0000075572.40158.77. — 12. UN STATISTICS DIVISION, Time Use Statistics, 2016. https://unstats.un.org/unsd/demographic-social/time-use/. — 13. MOSPI, Government of India, Time Use Survey, Ministry of Statistics and Programme, 2019. https://mospi.gov.in/time-use-survey-0. — 14. CAMERON A,TRIVEDI P, Microeconometrics Using Stata (Stata Press, College Station TX, 2009). — 15. STATA, StataCorp LLC, https://www.stata.com/company/. — 16. WARBURTON DER, NICOL CW, BREDIN SSD, CMAJ Can. Med. Assoc. J. 174 (2006) 801.. — 17. IHME, India (Institute for Health Metrics and Evaluation, India, 2015). https://www.healthdata.org/india. — 18. GELDSETZER P, MANNE-GOEHLER J, THEILMANN M, ET AL, JAMA Intern. Med. 178 (2018) 363. doi:10.1001/jamainternmed.2017.8094. — 19. RAMAKRISHNAN S, ZACHARIAH G, GUPTA K, SHIVKUMAR RAO J, MOHANAN PP, VENUGOPAL K, SATEESH S, SETHI R, JAIN D, BARDOLEI N, MANI K, KAKAR TS, KIDAMBI B, BHUSHAN S, VERMA SK, BHARGAVA B, ROY A, KOTHARI SS, GUPTA R, BANSAL S, SOOD S, NATH RK, TYAGI S, GUPTA MD, GIRISH MP, KALRA IPS, WANDER GS, GUPTA S, MANDAL S, SENGUTTUVAN NB, SUBRAMANYAM G, ROY D, DATTA S, GANGULY K, ROUTRAY SN, MISHRA SS, SINGH BP, BHARTI BB, DAS MK, KUMAR S, GOSWAMI KC, BAHL VK, CHANDRA S, BANERJEE A, GUHA S, DEB PK, CHOPRA HK, DEEDWANIA P, SETH A, Indian Heart J, 71 (2019) 309. — 20. MAYO CLINIC, Why exercise is medicine for high blood pressure. https://www.mayoclinic.org/diseases-conditions/high-blood-pressure/in-depth/high-blood-pressure/art-20045206. — 21. HARVARD HEALTH PUBLISHING, The importance of exercise when you have diabetes, 2018. https://www.health.harvard.edu/staying-healthy/the-importance-of-exercise-when-you-have-diabetes.

S.V. Subramanian

Department of Social and Behavioral Sciences, Harvard T.H. Chan School of Public Health, 677 Huntington Avenue, Boston, MA, 02115, USA.
e-mail: svsubram@hsph.harvard.edu

TJELESNO VJEŽBANJE U INDIJI: ZNANSTVENA ANALIZA ANKETE O KORIŠTENJU VREMENA, 2019

SAŽETAK

U ovom radu koristimo nacionalno reprezentativne podatke iz ankete o korištenju vremena (Time Use Survey; TUS) za Indiju kako bi procijenili udio stanovnika koji bilo koje doba dana provodi vježbajući. Utvrdili smo da ukupno manje od 7% odrasle populacije (u dobi ≥18 godina) provodi bilo koji dio dana vježbajući. Naše procjene također ukazuju na činjenicu da udio stanovnika koji vježba varira prema državama, zatim u odnosu na ruralna i urbana područja, kao i prema društvenim i vjerskim skupinama. Također smo procijenili logičke regresije kako bi prikazali vjerojatnost da ljudi vježbaju. Zaključili smo da je tri puta veća vjerojatnost da muškarci vježbaju u odnosu na žene. U odnosu na stanovnike s nižom razinom obrazovanja (osnovna škola i niže), pojedinci s visokom obrazovnom razinom imaju gotovo 2,5 puta veću vjerojatnost da vježbaju. Populacija iz viših slojeva prema razredu potrošnje, gornjih 10% stanovnika, imaju 1,7 puta veću vjerojatnost da vježbaju u odnosu na pojedince u donjih 50%. Iz perspektive javne politike, niska razina vježbanja u svim geografskim područjima, te prema svim socijalnim, ekonomskim i demografskim značajkama, ukazuje na potrebu provedbe intervencija na razini cjelokupne populacije u Indiji s ciljem poticanja na vježbanje.