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Prashant Mathur ¹, Vaitheeswaran Kulothungan,¹ Sravya Leburu,¹ Anand Krishnan,² Himanshu Kumar Chaturvedi ³, Harshal Ramesh Salve ², Ritvik Amarchand,² Baridalyne Nongkynrih,² Parasuraman Ganeshkumar,⁴ Vinay Urs K S ¹, A Laxmaiah,⁵ Manjit Boruah,⁶ Sanjeev Kumar ⁷, Binod Kumar Patro,⁸ Pankaja Ravi Raghav,⁹ Prabu Rajkumar ¹⁰, P Sankara Sarma,¹¹ Rinku Sharma,¹² Muralidhar Tambe,¹³ N Arlappa,⁵ Tulika Goswami Mahanta,¹⁴ Pranab Jyoti Bhuyan,¹⁵ Rajnish P Joshi ¹⁶, Abhijit Pakhare ⁷, Abhiruchi Galhotra,¹⁷ Dewesh Kumar ¹⁸, Binod Kumar Behera,⁸ Roshan K Topno,¹⁹ Manoj Kumar Gupta,⁹ Neeti Rustagi,⁹ Atulkumar V Trivedi,²⁰ K R Thankappan ²¹, Sonia Gupta,¹² Suneela Garg,²² Sangita Chandrakant Shelke,¹³ ICMR-NNMS investigator group

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For numbered affiliations see end of article.

Correspondence to
Dr Prashant Mathur;
ncdir@ncdirindia.org

ABSTRACT

Objective To generate national estimates of key non-communicable disease (NCD) risk factors for adolescents (15–17 years) identified in the National NCD Monitoring Framework and, study the knowledge, attitudes and practices towards NCD risk behaviours among school-going adolescents.

Design and setting A community-based, national, cross-sectional survey conducted during 2017–2018. The survey was coordinated by the Indian Council of Medical Research—National Centre for Disease Informatics and Research with 10 reputed implementing research institutes/organisations across India in urban and rural areas.

Participants A multistage sampling design was adopted covering ages between 15 and 69 years—adolescents (15–17 years) and adults (18–69 years). The sample included 12 000 households drawn from 600 primary sampling units. All available adolescents (15–17 years) from the selected households were included in the survey.

Main outcome measures Key NCD risk factors for adolescents (15–17 years)—current tobacco and alcohol use, dietary behaviours, insufficient physical activity, overweight and obesity.

Results Overall, 1402 households and 1531 adolescents completed the survey. Prevalence of current daily use of tobacco was 3.1% (95% CI: 2.0% to 4.7%), 25.2% (95% CI: 22.2% to 28.5%) adolescents showed insufficient levels of physical activity, 6.2% (95% CI: 4.9% to 7.9%) were overweight and 1.8% (95% CI: 1.0% to 2.9%) were obese. Two-thirds reported being imparted health education on NCD risk factors in their schools/colleges.

Strengths and limitations of this study

- The use of standard tools and methods on a nationally representative study design.
- Generated reliable data to fulfil the needs of the National Non-communicable Disease Monitoring Framework and provide baseline evidence to monitor the progress of actions.
- The study included only adolescents of age 15–17 years, while the adolescent age group is 10–19 years.
- Self-reported behavioural risk factor information may have been influenced by recall bias and responses in socially desirable ways.

Conclusion The survey provides baseline data on NCD-related key risk factors among 15–17 years in India. These national-level data fill information gaps for this age group and help assess India's progress towards NCD targets set for 2025 comprehensively. Though the prevalence of select risk factors is much lower than in many developed countries, this study offers national evidence for revisiting and framing appropriate policies, strategies for prevention and control of NCDs in younger age groups.

INTRODUCTION

Adolescents (10–19 years) constitute 21% of India's total population, making it to be the largest in the world (1.5 billion adolescents).^{1–3} The health status during this phase

of growth and development has an important bearing on the overall health during her/his adulthood.⁴ Their ongoing transitional state of neural, psychological and physical development makes them susceptible to certain behavioural risk factors—tobacco use, alcohol consumption, unhealthy diet and insufficient physical activity.^{4 5} However, acquisition of these unhealthy behaviours often persists lifelong. This increases the risk of developing non-communicable diseases (NCDs) like cardiovascular diseases, respiratory diseases, diabetes, hypertension, cancers and mental disorders from early adulthood onwards.^{4 5}

Several studies have been undertaken to report the use of tobacco, alcohol and other risk factors in India. The differences in their objectives, inclusion of the NCD indicators, sample size, methodology, age groups and operational definitions used makes generalisability at the national level becomes difficult.^{6–10} The National Family Health Survey (NFHS)-3, conducted in 2005–2006, reports the use of tobacco—29% and 4% and alcohol use—11% and 1% among boys and girls aged 15–19 years, respectively.¹¹ The same survey (NFHS-4), repeated in 2015–2016, reports tobacco use as 18.5% and 1.6% and alcohol use to be 8.9% and 0.5% in boys and girls.⁶ The WHO-NCD country profile for India 2018 reported current tobacco smoking among those aged 15+ years to be 20% in boys and 2% in girls.¹² Nearly about 1.7% of adolescent boys and 2.4% of adolescent girls were overweight and these could contribute to the rise in the proportion with pre-diabetes in this age group.¹³ The prevalence of obesity shows an increasing trend from 2016 to 2025.¹² The increasing burden from NCDs is accelerated by the negative impact of globalisation and unplanned urbanisation. Insufficient physical activity, preferences for high salt, sugar and fatty foods, and sedentary behaviours accelerate the development of NCDs.¹⁴

Improving country-level surveillance and monitoring systems becomes the top priority to cope with the ever-expanding needs for policies, legislation, services and infrastructure to prevent and control NCDs.¹⁴ India was the first country to adopt the WHO-Global Voluntary NCD Targets to be achieved by 2025 and framed its

National NCD Monitoring Framework and Action Plan in 2014, which includes 10 targets and 21 indicators. Three out of 21 indicators on NCD risk factors are related to adolescents¹⁵ (table 1). Furthermore, the Sustainable Development Goals (SDGs) 2030 include ambitious targets related to NCDs and 11 out of 18 SDGs and 19 out of 53 health-associated SDG indicators address child and adolescent health.¹⁶ The National Health Policy 2017 emphasises health education and promotion as part of the curriculum in schools.¹⁷

Recognising the need for evaluation and monitoring of NCD risk factors, the National NCD Monitoring Survey (NNMS) was undertaken with a primary objective to generate national-level estimates of key NCD indicators identified in the National NCD Monitoring Framework. This paper exclusively presents and discusses the adolescent (15–17 years) risk factors for NCDs.¹⁸ It also describes the school-based information collected under the adolescent study tools to understand the status of health education and promotion interventions in schools/colleges.

METHODS

Study setting

The NNMS was a community-based cross-sectional survey conducted in 2017–2018. It covered age groups from 15 to 69 years, which included the adolescent population aged 15–17 years as a subset. The survey was coordinated by the Central Coordinating Unit, the Indian Council of Medical Research—National Centre for Disease Informatics and Research (ICMR—NCDIR), Bengaluru and included primary sampling units (PSUs) from 27 states of India and was implemented through a network of 10 implementing research institutes/agencies of repute across the country.¹⁸

Sampling and study participants

The survey used a stratified multistage sampling design across 27 states of India. The sample size was calculated based on previous estimates of the prevalence of obesity (6%),¹⁹ relative precision as half of the prevalence,²⁰ design effect of 1.5 and non-response rate of 15%. The

Table 1 Targets and Indicators in the National NCD Monitoring Framework¹⁵ for adolescents

Framework element	Targets for 2025	
	Outcomes	Indicator
NCD risk factors		
Obesity	Halt the rise in obesity	Prevalence of obesity in adolescents (defined as 2 SD BMI for age and sex overweight according to the WHO Growth Reference).
Physical inactivity	10% relative reduction in the prevalence of insufficient physical activity	Prevalence of insufficiently active adolescents (defined as less than 60 min per day of physical activity).
Tobacco use	30% relative reduction in the prevalence of current tobacco use	Prevalence of current tobacco use (smoking and smokeless) among adolescents.

BMI, body mass index; NCD, non-communicable disease.

total estimated sample size for adolescents (15–17 years) was 1700. The PSUs were villages for rural areas and wards for urban areas. One Census Enumeration Block from each ward was selected by random selection. The sampling frame was constituted for adults and adolescents together that was divided into four subgroups/strata: urban/rural and men/women (2×2). The number of households to be covered was calculated as 12 000 (6000 urban and 6000 rural) for adults keeping the prevalence of obesity among adults as 9%, relative precision of 15% and non-response rate of 15%. From each PSU, 20 households were selected through circular systematic sampling. Based on the proportion of adolescents as 10%–15% from the Census 2011 and assuming 12% adolescents were available in the 12 000 selected households for adults, the sample size for adolescents was expected to be 1440, if one adolescent was selected from each household. However, we covered all the available adolescents (15–17 years) in the selected household to reach the required sample size.¹⁸

Patient and public involvement

In the selected PSUs, the survey teams engaged with the local authorities, people's representatives and local population to explain the purpose and details of the survey before data collection. This ensured better participation, facilitation in the conduct of the survey and agreement of the community. The results of the survey have been shared with the health departments and local authorities.¹⁸

Study tools and data collection

The study tools were adapted from the WHO-STEPwise approach to Surveillance (STEPS),²¹ Integrated Disease Surveillance Project-NCD risk factor survey,¹⁹ WHO-Global School Student Health Survey²² and the WHO-Global Adult Tobacco Survey (GATS).²³ All tools were translated to 11 regional languages of India and validated with back-translation. The data were collected using an open-source Android-based application, the Open Data Kit (ODK)^{24 25} in portable handheld devices, with built-in quality checks. Structured interview schedules were used for the collection of information on demographic characteristics, behavioural risk factors (tobacco, alcohol use, diet, physical activity), and measurements of height and weight were recorded to estimate the metabolic risk factors (overweight and obesity). Prior informed consent was sought from the parent/guardian, and assent was obtained from the selected participant to be interviewed and measured. Height and weight were measured using standard procedures using a portable stadiometer (SECA 213) and digital weighing scale (SECA 803) recommended by WHO-STEPs. The survey teams ensured that all instruments were calibrated regularly and maintained calibration logbooks. Both height and weight were measured in barefoot and light clothing with erect body posture, head looking straight and facing the interviewer with arms on his/her side. The survey also collected school/college-related information from the same selected adolescent who reported going to school in the last 12 months. In

this section, we obtained details on the availability of shops selling tobacco nearby their schools, time spent in physical activity in schools, type of food available in their canteens and availability of health promotion materials as well as information on health education being imparted. All the information was collected at the selected household itself.¹⁸

A separate participant anthropometry reporting form was used to obtain consent for measurement of height and weight. Those found with any risk factor were referred to the nearest public health facility for counselling and further management.

Quality assurance

National-level and regional-level workshops were organised to impart training in field operations, consenting procedures, interviewing techniques, data collection in handheld devices, importance and methods to maintain privacy and confidentiality. A mock field survey was undertaken in two non-selected PSUs in all the survey sites. Periodical retraining was delivered along with clarification of issues confronted in the field. Standard operational definitions²⁶ were used for estimating behavioural and metabolic risk factors (tobacco use, alcohol use, diet, physical activity, body mass index (BMI)).¹⁸ The senior investigators monitored data collection, and site visits by experts were undertaken for on-the-spot assessments, any matters identified were immediately resolved.

Statistical analysis

The data were imported from the ODK platform to IBM SPSS V.22.0 (IBM Corp, Armonk, NY, USA). It was cleaned and weighted to provide prevalence estimates at the level of the population, households, area of residence (urban and rural) and gender. Data were analysed in STATA V.14.1 (StataCorp, College Station, Texas, USA) by complex survey analysis and the results presented in descriptive statistics as mean and proportion with 95% CI.

RESULTS

During household mapping and listing, a total of 1819 adolescents were identified from 1402 participating households. Of them, 1643 adolescents participated (176 adolescents did not participate as the households were found locked despite four attempts made over 2 consecutive days) in the survey. A total of 1531 adolescents completed the survey (112 adolescents refused after initial acceptance or mid-way) with an overall response rate of 93.2%.

Tobacco and alcohol use

Only 3.1% (95% CI: 2.0% to 4.7%) of adolescents reported current use of any form of tobacco daily in the last 12 months preceding the survey. The proportion was higher in rural areas (3.6% (95% CI: 2.3% to 5.8%)) and among boys (5.5% (95% CI: 3.5% to 8.6%)). Nearly double the proportion (7.0% (95% CI: 5.4% to

9.1%)) reported having experimented using smoking or smokeless tobacco. Prevalence of smokeless tobacco use (2.9% (95% CI: 1.9% to 4.5%)) was higher than the use of smoked tobacco (0.3% (95% CI: 0.1% to 0.9%)). Findings showed that smokeless tobacco use was higher in rural (3.4% (95% CI: 2.1% to 5.6%)) than urban areas (1.9% (95% CI: 0.8% to 4.5%)) and among boys (5.2% (95% CI: 3.3% to 8.2%)) than girls (0.4% (95% CI: 0.1% to 1.3%)) (table 2).

More than three-fourths of adolescents (85.2% (95% CI: 82.0% to 88.0%)) recognised that secondhand smoke was harmful, with higher in urban areas (86.9% (95% CI: 82.3% to 90.4%)) and among boys (86.6% (95% CI: 82.1% to 90.2%)) (table 2).

Alcohol consumption proportion was less in girls without many urban–rural differences (table 2).

Dietary behaviours

Nearly half of adolescents reported consuming chips/namkeen (Indian savouries which are salted and fried) (52.1% (95% CI: 48.1% to 56.0%)) and fried items (49.3% (95% CI: 45.2% to 53.3%)) at least once a week. One-third (33.9% (95% CI: 30.0% to 38.1%)) reported consuming fresh fruits/fresh juices at least once a week. These findings were reported higher by adolescents in urban areas and boys (table 2).

In the last 30 days, 48.3% reported skipping breakfast on at least 1 day and 4.0% skipped breakfast on all 30 days. Breakfast was reportedly skipped on an average of 10 days (9.6 days (95% CI: 8.3 to 10.9)), which was similar across all strata (table 2).

Physical activity

One-fourth of adolescents were insufficiently physically active, higher proportion being urban residents (38.0% (95% CI: 31.9% to 44.4%)) and girls (29.3% (95% CI: 25.1% to 33.9%)). A total of 64.3% (95% CI: 59.6% to 68.7%) adolescents reported doing physical activity in their schools/colleges and on average spent 16.1 min per day (table 2).

Overweight and obesity

Mean BMI and proportion of overweight and obesity was higher in urban areas (mean BMI: 19.5 kg/m²; overweight: 11.9% (95% CI: 9.0% to 15.7%); obesity: 3.5% (95% CI: 1.9% to 6.5%)) (table 2).

School/college-related information

The majority (94.2%) of adolescents had completed formal schooling and among them, 84.2% boys and 73.9% girls completed high school and higher secondary education (figure 1). Overall, 86.8% of adolescents from urban and 74.0% from rural areas reported attending school/college in the last 12 months (table 3).

More than two-fifths (44.7% (95% CI: 40.3% to 49.2%)) of adolescents going to school or college in the last 12 months reported the presence of a shop selling tobacco within 100 m of school/college. Nearly one-fifth (17.5% (95% CI: 14.4% to 20.9%)) adolescents reported

noticing teacher/school staff smoking within the premises (table 3).

Nearly one-third of adolescents reported having noticed health promotion materials (any poster/wall painting/signboard) displayed in their schools/colleges. Two-thirds of them reported health education being provided in their schools/colleges on benefits of a healthy diet, physical activity, ill effects of tobacco and alcohol use (table 3).

DISCUSSION

The NNMS was a large national-level comprehensive survey designed to provide baseline values on the national targets of the NCD Monitoring Framework and Action Plan. It covered information on behavioural and metabolic risk factors for adolescents (15–17 years) to fill national-level data gaps for this age group. In addition, this survey included a separate set of questions corresponding to school-based information. These are of much relevance to strengthen the Government of India's school-based health promotion services like the Poshan Abhiyaan, safe and nutritious food campaign, Rashtriya Bal Swasthya Karyakram, Rashtriya Kishor Swasthya Karyakram, etc.^{5 27 28}

In comparison with several countries, the prevalence of selected behavioural and metabolic risk factors in India was much lower among adolescents.^{29–31} The prevalence of binge drinking among those aged 10–19 years was 56% in Denmark, 35% in European countries, 17.7% in the USA, 10.3% in Korea, 8% in Iceland and 7.1% in Hong Kong.²⁹ More than 70% of boys and girls aged 10–19 years were doing insufficient physical activity across the world.³⁰ The prevalence of obesity was 21% in the USA, 15% in the United Arab Emirates, 9% in the UK and China.³¹ However, aggressive redressal to modify these unhealthy behavioural indices in India when at much lower proportions could have major benefits in controlling and tackling NCDs before they attain higher proportions in adulthood.

There have been several flagship initiatives, regulations, policy and programmatic measures taken by the Government of India to address the mounting transitions in adolescent health.^{27 28 32–40} Numerous national surveys have been undertaken in India either as standalone or surveys with some of the risk factors as components.^{6–11 41 42} The differences in their study objectives, design, methodology, age inclusion criteria and operational definitions limit comparisons and create knowledge lacunae in this age group. This highlights the need for sustained surveillance mechanisms using standardised methodology.

The high prevalence of tobacco use (any form) and alcohol consumption among boys than girls was similar (NNMS) to those reported in other surveys like GATS-2, NFHS-4 and Magnitude of Substance Use in India-2019.^{6–8} Use of smokeless tobacco higher than smoked tobacco was also consistent with findings from GATS-2.⁷ The prevalence of current daily use of tobacco was 3.1%

Table 2 NCD risk factors in adolescents of 15–17 years, (percentage) and (mean) with 95% CI

Parameter	Urban	Rural	Boys	Girls	Overall
Tobacco use (%)					
Ever use/experimented any form of tobacco	5.6 (3.6 to 8.8)	7.7 (5.5 to 10.6)	11.9 (9.0 to 15.6)	1.7 (0.6 to 4.3)	7.0 (5.4 to 9.1)
Current daily use*					
Any form of tobacco	1.9 (0.8 to 4.5)	3.6 (2.3 to 5.8)	5.5 (3.5 to 8.6)	0.4 (0.1 to 1.3)	3.1 (2.0 to 4.7)
Smoked tobacco	0.1 (0.0 to 0.6)	0.4 (0.1 to 1.3)	0.4 (0.1 to 1.5)	0.2 (0.0 to 1.2)	0.3 (0.1 to 0.9)
Smokeless tobacco	1.9 (0.8 to 4.5)	3.4 (2.1 to 5.6)	5.2 (3.3 to 8.2)	0.4 (0.1 to 1.3)	2.9 (1.9 to 4.5)
Both smoked and smokeless tobacco	0.1 (0.0 to 0.7)	0.2 (0.0 to 0.8)	0.2 (0.0 to 0.6)	0.2 (0.0 to 1.2)	0.2 (0.0 to 0.5)
Thoughts about harm from secondhand tobacco smoke					
Thought that inhaling smoke from other people's tobacco smoking can cause harm	86.9 (82.3 to 90.4)	84.4 (80.1 to 88.0)	86.6 (82.1 to 90.2)	83.6 (79.3 to 87.2)	85.2 (82.0 to 88.0)
Alcohol use (%)					
Ever consumed	3.2 (1.5 to 6.6)	3.6 (2.1 to 6.1)	5.4 (3.3 to 8.6)	1.4 (0.6 to 3.1)	3.5 (2.2 to 5.4)
Consumed in last 12 months	1.1 (0.4 to 2.6)	1.4 (0.7 to 2.8)	1.8 (1.0 to 3.4)	0.7 (0.2 to 2.0)	1.3 (0.7 to 2.3)
Consumed in last 30 days	0.9 (0.3 to 2.5)	0.4 (0.1 to 1.2)	0.8 (0.3 to 2.0)	0.3 (0.1 to 1.0)	0.5 (0.2 to 1.2)
Binge drinking†	0.2 (0.02 to 0.6)	0.1 (0.01 to 0.6)	0.2 (0.1 to 0.7)	0.0 (0.0 to 0.0)	0.1 (0.03 to 0.4)
Dietary behaviours					
Usually consumed any of the food items at least once a week					
Fried items	52.9 (46.1 to 59.6)	47.6 (42.6 to 52.6)	55.3 (49.9 to 60.5)	42.7 (37.7 to 47.9)	49.3 (45.2 to 53.3)
Chips/namkeen	58.3 (52.4 to 63.9)	49.2 (44.1 to 54.3)	49.9 (44.1 to 55.7)	54.4 (49.5 to 59.1)	52.1 (48.1 to 56)
Pizza/burger	10.1 (6.0 to 16.5)	4.7 (3.3 to 6.8)	7.3 (5.0 to 10.4)	5.5 (3.4 to 8.7)	6.4 (4.7 to 8.8)
Instant noodles	31.8 (24.9 to 39.7)	13.1 (10.1 to 16.7)	16.1 (12.6 to 20.3)	22.1 (17.4 to 27.7)	19.0 (15.7 to 22.7)
Cold aerated drinks	23.2 (18.3 to 28.9)	15.9 (12.6 to 19.9)	24.5 (20.4 to 29.1)	11.4 (8.3 to 15.4)	18.2 (15.4 to 21.5)
Fresh fruits/fresh juices	49.0 (42.4 to 55.5)	27.0 (22.3 to 32.3)	37.2 (31.8 to 43)	30.3 (25.6 to 35.5)	33.9 (30.0 to 38.1)
Energy drinks	11.6 (7.4 to 17.7)	4.2 (2.1 to 8.2)	6.6 (3.8 to 11.3)	6.4 (3.9 to 10.4)	6.5 (4.4 to 9.6)
Breakfast-related information					
Skipping breakfast on all 30 days (%)	4.6 (1.8 to 11.4)	3.7 (2.2 to 6.0)	3.8 (1.9 to 7.3)	4.1 (2.6 to 6.5)	4.0 (2.5 to 6.3)
Skipping breakfast on any 1 day in last 30 days (%)	48.7 (42.3 to 55.1)	48.1 (43.3 to 52.9)	45.8 (40.6 to 51.2)	50.9 (45.8 to 56.1)	48.3 (44.4 to 52.2)
Number of days breakfast was skipped in a month (mean)	9.5 (7.2 to 11.8)	9.7 (8.1 to 11.2)	9.2 (7.4 to 11.0)	10.0 (8.6 to 11.3)	9.6 (8.3 to 10.9)

Continued

Table 2 Continued

Parameter	Urban	Rural	Boys	Girls	Overall
Physical activity					
Insufficient physical activity† (%)	38.0 (31.9 to 44.4)	19.3 (16.2 to 22.9)	21.5 (17.3 to 26.3)	29.3 (25.1 to 33.9)	25.2 (22.2 to 28.5)
Minutes being sedentary in a day (mean)	361.4 (314.9 to 407.9)	331.2 (297.2 to 365.2)	331.1 (298.5 to 363.7)	351.2 (318.8 to 383.7)	340.7 (313.2 to 368.2)
Doing physical activity in school/college (%)	68.0 (60.1 to 75.0)	62.3 (56.4 to 67.8)	69.1 (63.3 to 74.3)	58.2 (52.1 to 63.9)	64.3 (59.6 to 68.7)
Minutes spent in physical activity per day at school (mean)	18.0 (14.7 to 21.3)	15.3 (12.8 to 17.7)	20.0 (17.1 to 23.0)	11.8 (9.6 to 14.0)	16.1 (14.1 to 18.1)
Metabolic risk factors§					
Mean BMI (kg/m ²)	19.5 (19.0 to 19.9)	18.4 (18.2 to 18.7)	18.5 (18.1 to 18.8)	19.1 (18.8 to 19.4)	18.8 (18.5 to 19.0)
Overweight (including obesity) (%)	11.9 (9.0 to 15.7)	3.6 (2.4 to 5.3)	6.4 (4.5 to 8.9)	6.1 (4.3 to 8.7)	6.2 (4.9 to 7.9)
Obesity (%)	3.5 (1.9 to 6.5)	0.9 (0.4 to 2.3)	2.6 (1.4 to 4.7)	0.8 (0.3 to 2.3)	1.8 (1.0 to 2.9)

*Defined as the use of any form of tobacco (smoke and/or smokeless) daily in the last 12 months preceding the survey.

†Defined as those engaged in five or more standard drinks of alcohol for boys and four or more for girls in a single drinking occasion in the past 30 days.

‡Insufficient physical activity in adolescents was percentage doing less than 60 min of moderate to vigorous-intensity physical activity daily, which is equivalent to <1680 MET min/week and calculated as (60 min×4 MET×7 days).

§The BMI (as per WHO) was used to categorise the respondents into overweight and obesity. Overweight was ≥1 SD BMI for age and sex (equivalent to BMI 25 kg/m² at 19 years) and obesity was ≥2 SD BMI for age and sex (equivalent to BMI 30 kg/m² at 19 years), as per WHO. BMI, body mass index; MET, metabolic equivalent; NCD, non-communicable disease.

(NNMS) and GATS-2 reported the current use of tobacco as 12.4%. These expected variations are related to differences in study design, sampling strategy, coverage, age groups selected, weighting procedures and the questionnaires adopted.⁷ On close examination, we found a similar prevalence of tobacco use (3%) in the age group 15–17 years in the GATS-2 survey.

In India, the Cigarette and Other Tobacco Products Act (COTPA)-2003 has restrictions on the sale of tobacco

products within 100 m of schools.³² NNMS revealed 44.7% of adolescents to have reported the presence of a shop selling tobacco within 100 m of their schools or colleges, indicating easy access to tobacco products in school/college vicinity. Several other studies^{43–45} conducted in different parts of India showed violations of the COTPA. These findings recommend the need for better implementation, monitoring and enforcement of COTPA in both urban and rural areas. The prevalence of current

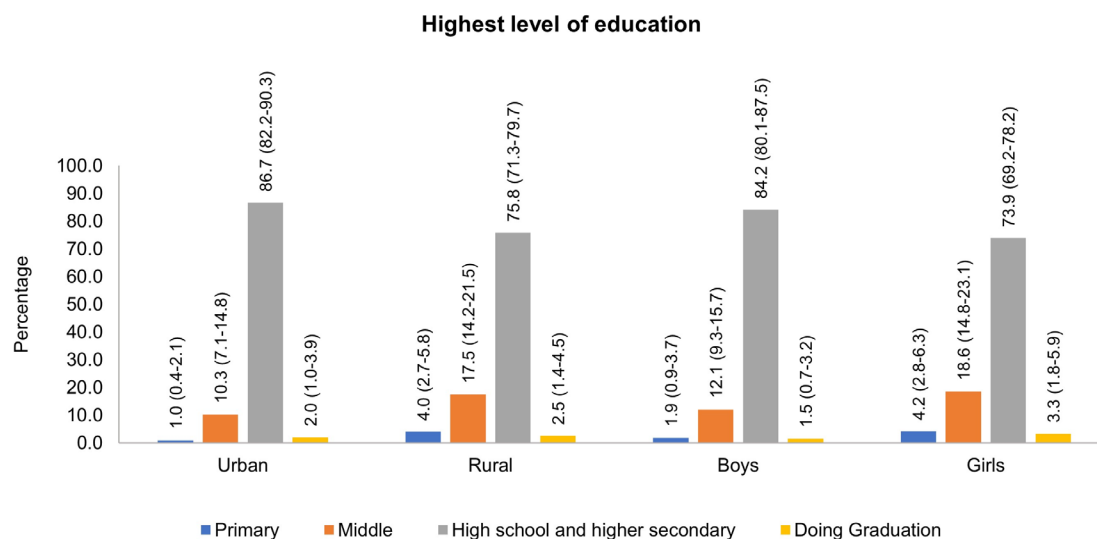


Figure 1 Highest educational status among adolescents (15–17 years) by area of residence and gender.

Table 3 School/college-related information reported in the last 12 months (percentage with 95% CI)

15–17 years	Urban	Rural	Boys	Girls	Overall
Attended school/college in the last 12 months	86.8 (81.3 to 90.8)	74.0 (69.6 to 78.0)	84.0 (80.2 to 87.2)	71.5 (66.6 to 76.0)	78.0 (74.6 to 81.2)
Noticed any poster/wall painting/signboard/display on the following topics:					
Harmful effects of tobacco	41.4 (34.3 to 48.8)	40.5 (34.8 to 46.5)	42.7 (36.7 to 48.9)	38.4 (32.7 to 44.6)	40.8 (36.3 to 45.5)
No smoking sign	45.7 (38.9 to 52.7)	43.1 (37.3 to 49.2)	46.4 (40.5 to 52.4)	41.0 (35.1 to 47.3)	44.0 (39.5 to 48.7)
Harmful effects of alcohol	35.3 (28.7 to 42.5)	26.3 (21.3 to 32.0)	31.8 (26.1 to 38.1)	26.4 (21.7 to 31.8)	29.4 (25.3 to 33.9)
Promotion material on healthy diet	43.6 (37.0 to 50.5)	31.6 (26.3 to 37.5)	35.9 (30.4 to 41.8)	35.8 (30.1 to 41.9)	35.8 (31.6 to 40.4)
Promotion material on physical activity	40.8 (34.3 to 47.7)	30.4 (24.8 to 36.7)	33.4 (27.8 to 39.6)	34.9 (29.2 to 41.1)	34.1 (29.7 to 38.8)
Percentage who reported being taught in schools about:					
Ill effects of tobacco	67.0 (59.3 to 73.8)	66.5 (61.3 to 71.4)	67.3 (61.3 to 72.7)	65.9 (59.6 to 71.6)	66.7 (62.4 to 70.7)
Ill effects of alcohol	65.0 (57.6 to 71.7)	66.6 (61.8 to 71.1)	67.2 (61.7 to 72.7)	64.6 (58.4 to 70.3)	66.0 (62.0 to 69.8)
Benefits of healthy diet	69.0 (62.2 to 75.1)	65.2 (59.9 to 70.2)	67.7 (62.1 to 72.9)	65.1 (58.9 to 70.8)	66.6 (62.4 to 70.5)
Benefits of physical activity	63.2 (57.1 to 68.9)	64.8 (59.7 to 69.6)	63.1 (57.8 to 68.2)	65.6 (60.2 to 70.7)	64.2 (60.3 to 68.0)
Tobacco-related information					
Noticed teacher/staff smoke in school/college premises in last 12 months	16.2 (11.5 to 22.5)	18.1 (14.4 to 22.5)	20.4 (16.3 to 25.3)	13.7 (10.0 to 18.4)	17.5 (14.4 to 20.9)
Any shop within 100 m of school/college selling tobacco	48.2 (41.1 to 55.4)	42.9 (37.3 to 48.6)	48.5 (42.8 to 54.4)	39.8 (33.9 to 46.0)	44.7 (40.3 to 49.2)
School/college canteen-related information					
Presence of canteen	34.7 (27.8 to 42.2)	21.4 (16.4 to 27.4)	24.7 (19.7 to 30.5)	27.7 (22.0 to 34.3)	26.0 (21.9 to 30.6)
Reported availability of high fat, salt and sugar foods in school/college canteen	94.0 (88.3 to 97.0)	83.0 (69.8 to 91.2)	86.1 (74.1 to 93.0)	90.6 (88.3 to 94.9)	88.2 (80.8 to 93.0)

alcohol use in the last 12 months (1.3%) among adolescents (15–17 years) was similar to those reported by the Magnitude of Substance Use in India-2019 (1.3%) among the age group 10–17 years.⁸

The mean BMI among boys (18.5 kg/m²) and girls (19.1 kg/m²) observed in this study was closer to findings from age-wise results of NFHS-4 (men: 19.3 kg/m² and women: 19.4 kg/m² among 15–19 years).⁶ The prevalence of overweight among boys (6.4%) and girls (6.1%) from the current survey was found to be nearly similar to NFHS-4 (men: 4.8% and women: 4.2% among 15–19 years).⁶ Overall, 6.2% (95% CI: 4.9% to 7.9%) of adolescents were overweight (including obesity) and these were comparable with the findings (5%) from the Comprehensive National Nutrition Survey, 2016–2017 (among 10–19 years).¹⁰

India is undergoing a rapid nutrition transition⁴⁶ where preference for packaged, processed and hyperpalatable foods over traditional nutritious diet or

home-cooked meals is the major contributor. In addition, sedentary lifestyles and lack of adequate physical activity fuel these challenges. Nearly half of adolescents consumed fried items at least once a week and a higher proportion were boys (55.3%). Also, a larger proportion (88.2%) reported availability of high fat, salt and sugar food in their school/college canteen, indicating easy access to unhealthy food items. The preferences to packaged, high salt and fried foods were similar to those reported in NFHS-4 (47.4% among boys aged between 15 and 19 years).⁶

The Government of India flagship initiatives like the midday meal programme, Poshan Abhiyaan, Eat Right India have been implemented across the country to improve the nutritional outcomes in children and adolescents. Regulations on taxation, food advertisements and guidelines for food nutrition labels have been issued by the Food Safety and Security Authority of India.^{27 28 33 34} The safe and nutritious food campaign helps schools promote

healthy dietary habits.⁵ Three specific policies were brought out in the year 2018 to address adolescent health: (1) national regulations on the marketing of all foods and beverages high in sugar, salt and fat to children; (2) prohibiting sales of tobacco products to minors and (3) marketing of alcohol to adolescents.^{28 33–35}

Regular physical activity has multiple benefits on cardiorespiratory and muscular fitness, improves bone and functional health, lowers risk of NCDs and improves mental well-being. This survey estimated that a quarter of adolescents were insufficiently physically active. Though India has been able to take initiatives at the community level to promote and encourage physical activity through programmes like Fit India Movement, there is a need to strengthen such efforts.³⁶ Also, some concerns on the outdoor activity being influenced by the high levels of air pollution need urgent policy and programme action.⁴⁷

Recently, school health programmes were incorporated into the health and wellness component of the Ayushman Bharat to strengthen health-promotion activities.³⁷ In the year 2018, the Government of India adopted the WHO policy of national standards for health-promoting schools to provide a healthy environment through health education and community/school outreach activities.^{38–40}

Strengths and limitations

The strengths of this study include NNMS being a large nationally representative survey with high survey response rates. Being able to generate baseline national evidence on NCD risk factors in this age group would strengthen policy and programme interventions in India. Though the prevalence of risk factors among adolescents in India is much lower compared with the western countries like the USA and the UK, stronger public health initiatives are needed in mitigating risk exposures during this key phase of growth and development. The study has limitations in covering only the age group 15–17 years and not all adolescents from 10 to 19 years. Self-reported information of behavioural risk factors might be associated with socially desirable responses and recall bias. To facilitate appropriate responses and limit such biases, adequate time was spent on every question maintaining privacy and confidentiality of participant responses. Also, the interviews were conducted by skilled and trained personnel using globally standardised questionnaires and show cards to facilitate recall of health risk behaviours. Our data collection was directed to fulfil the National NCD Monitoring Framework and Action Plan for India, as the country needed baseline evidence to track NCDs and their risk factors. However, there is much scope to expand the data collection tools to incorporate additional indicators relevant to NCDs—for example, socioeconomic factors, stress, sleep patterns and other social factors need further examination to provide a

better comprehensive picture of the determinants of risk factors in adolescents.

CONCLUSION

Through this survey, we have been able to establish a standardised method of data collection. It has recognised the need to strengthen the functioning of school/college health promotion programmes. Such surveys should be repeated at periodical intervals to drive evidence-based programming, policy, resource allocation and map trends as well as track progress being made in tackling NCDs at younger age groups.

Author affiliations

¹National Centre for Disease Informatics and Research, Bangalore, Karnataka, India

²Centre for Community Medicine, All India Institute of Medical Sciences, New Delhi, Delhi, India

³National Institute of Medical Statistics, New Delhi, Delhi, India

⁴Division of Epidemiology, National Institute of Epidemiology, Chennai, Tamil Nadu, India

⁵Division of Public Health Nutrition, National Institute of Nutrition, Hyderabad, Telangana, India

⁶Department of Community Medicine, Assam Medical College and Hospital, Dibrugarh, Assam, India

⁷Department of Community and Family Medicine, All India Institute of Medical Sciences—Bhopal, Bhopal, Madhya Pradesh, India

⁸Department of Community and Family Medicine, All India Institute of Medical Sciences—Bhubaneswar, Bhubaneswar, Orissa, India

⁹Department of Community Medicine and Family Medicine, All India Institute of Medical Sciences Jodhpur, Jodhpur, Rajasthan, India

¹⁰Division of Health Systems Research, National Institute of Epidemiology, Chennai, Tamil Nadu, India

¹¹Achutha Menon Centre for Health Science Studies, Sree Chitra Tirunal Institute for Medical Sciences and Technology, Thiruvananthapuram, Kerala, India

¹²Centre for Non-communicable Diseases, National Centre for Disease Control, New Delhi, Delhi, India

¹³Department of Community Medicine, BJ Government Medical College and Sasoon General Hospitals, Pune, Maharashtra, India

¹⁴Department of Community Medicine/Prevention and Social Medicine, Tezpur Medical College, Tezpur, Assam, India

¹⁵Regional Director Office, Ministry of Health and Family Welfare, Guwahati, Assam, India

¹⁶Department of General Medicine, All India Institute of Medical Sciences—Bhopal, Bhopal, India

¹⁷Department of Community and Family Medicine, All India Institute of Medical Sciences—Raipur, Raipur, Chhattisgarh, India

¹⁸Department of Preventive and Social Medicine, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand, India

¹⁹Department of Epidemiology, Rajendra Memorial Research Institute of Medical Sciences, Patna, Bihar, India

²⁰Department of Community Medicine, Government Medical College Bhavnagar, Bhavnagar, Gujarat, India

²¹Department of Public Health and Community Medicine, Central University of Kerala, Kasaragod Town, Kerala, India

²²Department of Community Medicine, Maulana Azad Medical College, New Delhi, India

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ORCID iDs

Prashant Mathur <http://orcid.org/0000-0002-9271-1373>

Himanshu Kumar Chaturvedi <http://orcid.org/0000-0001-9395-8522>

Harshal Ramesh Salve <http://orcid.org/0000-0002-6445-6432>

Vinay Urs K S <http://orcid.org/0000-0002-7317-4429>

Sanjeev Kumar <http://orcid.org/0000-0003-2730-2378>

Prabu Rajkumar <http://orcid.org/0000-0001-9839-800X>

Rajnish P Joshi <http://orcid.org/0000-0002-4702-0522>

Abhijit Pakhare <http://orcid.org/0000-0003-2897-4141>

Dewesh Kumar <http://orcid.org/0000-0001-5356-801X>

K R Thankappan <http://orcid.org/0000-0002-4536-2684>

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