Adequateness in sleep duration among adults in India: Evidence from national time use survey

Abstract

Objective: To examine the adequacy in duration of sleep and its correlates among adults aged 18 years and above in India.

Methods: Data on duration of sleep on a normal day available for 214,489 adult members from the sample of 138,799 households covered in the Time Use Survey 2019 were analysed. Differentials in mean duration of sleep, prevalence of short sleep duration (<7 hours) and long sleep duration (≥9 hours) were examined. Multinomial logistic regression analysis was applied to understand the correlates of short and long sleep durations.

Results: The average sleep duration among Indian adults was 8:18 hours (95 percent CI, 8:17 - 8:18), with hours of sleep being higher in rural areas than in urban areas. The prevalence of short sleep duration and long sleep duration was 8.2 percent and 33.0 percent, respectively. Multivariate analysis showed relatively higher prevalence of short duration sleep and lower prevalence of long sleep duration in females than males, in urban areas than rural areas, among higher educated than less educated, and among rich than poor.

Conclusion: Sub-groups who have more time at their disposal are susceptible to excessive sleeping duration. Those in the higher socio-economic strata are more likely to experience sleep deficit than their counterparts. This study not only corroborates the usefulness of time use survey data for studying patterns in sleep duration, but also calls for the time to pay attention to sleep health issues in the country's public health policies.

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Introduction

Adequate daily sleep is considered to be essential for an overall healthful and productive lifestyle. Over recent years, there has been a noticeable shift in global sleep patterns, with both shorter and longer sleep durations becoming more common. A multi-country analysis on the prevalence of short and long sleep durations has shown a declining trend in the share of individuals getting the optimum amount of sleep required [1]. Further evidence indicates the effect of factors such as age, employment status, marital status, educational level, and race on sleep duration [2,3]. Sleep adequateness is not given due attention in public health programmes in most low- and middle-income countries, as there is little evidence on the burden of sleep problems in these settings [4].

A major question here is what is the ideal duration of sleep for adults? The American Academy of Sleep Medicine (AASM) and Sleep Research Society (SRS) have developed a consensus recommendation for the amount of sleep needed to promote optimal health in adults [5]. As per this recommendation an individual regularly requires 7 - 9 hours of sleep per night to promote their health. Any habitual sleep below or above this recommended norm is likely to be a public health concern. Studies show that habitual short and long sleep durations are associated with adverse health outcomes [6,7]. Existing evidence from a 10-country study shows short sleep duration is less prevalent than the prevalence of long sleep durations in respective countries [6]. Another analysis of 28 countries with comparable sleep data reported that Indians to be having third highest sleep duration and the earliest wake up time [8].

Studies have shown sleep deprivation is a risk factor for cardiovascular ailments, diabetes, cancerous tumour formation, impaired immune function, and accidents [7,9]. Long sleep duration too is associated with metabolic syndrome, cardiovascular disease, diabetes and cognitive impairment [7]. The existing evidence on sleep patterns from India has been limited to either younger or older age groups. Longitudinal Aging Study in India (LASI) showed 13 percent of population aged 45 years old and above in the country are currently grappling with various issues related to their sleep patterns and quality [10]. A study examining the associations between perceptions of neighbourhood safety and social cohesion on sleep

duration and sleep quality among older adults in India found that those in unsafe neighbourhoods had poor sleep quality than peers residing in safe neighbourhoods [11]. Sleep problems are strongly linked to poor health, decreased grip strength, and impaired cognitive functioning in older adults globally, particularly in low-income settings like India, where sleep issues are associated with poorer well-being, psychiatric comorbidities, diabetes, and social determinants [12,13].

In this background, this is the first nationally representative study on sleep duration and its differentials in the Indian sub-continent. Analysis aimed at understanding the prevalence of short and long duration sleep is expected to illustrate the sleep duration related burden in the population to the public health practitioners, researchers and policy planners.

Methods

Data Source

This study utilizes data available from India's first Time Use Survey (TUS) undertaken by the National Statistical Office, Ministry of Statistics and Programme Implementation, Government of India [14]. Time use surveys are globally recognized as an ideal source to obtain an objective measure of sleep duration which can be compared within and across population [8,15,16]. India's TUS carried out between January and December 2019, gives information on how individuals aged 6 and above allocate their time across various activities throughout a typical day. TUS covered 518,744 members from 138,799 households surveyed, of which time use data was collected from 445,250 individuals aged 6 years and above. Household members aged below 18 years, individuals for whom information was not self-reported, and cases where time use was recorded for an abnormal day were excluded from this analysis. Thus, the final sample analysed here comprised 214,489 self-reported cases/individuals aged 18 years and above with information on time use on a normal day. TUS provides data on activities performed by these individual household members from 4:00 AM on the day before the date of the interview to 4:00 AM on the date of the interview. The reference period of 24 hours was split into 48 time slots, each slot of 30 minutes duration. The TUS data set has activities codified as per the International Classification of Activities for Time Use Statistics 2016 (ICATUS 2016) [17].

Outcome Variable

ICATUS (2016) activity code 911 (night sleep/essential sleep) refers to the longest sleep, either during the day or at night for each respondent in TUS. Activity code represents longest sleep, either during the day or at night, time in bed before and after sleep when no other activity is specified. Incidental sleep/naps were excluded while creating the duration of sleep variable [17]. This duration of sleep variable was converted into a categorical outcome variable using the AASM/ SRS recommendation of adequacy of sleep [6]. This outcome variable for sleep duration was categorised as short sleep duration ($<$7 hours), normal sleep (7-9 hours) and long sleep duration ($\geq$ 9 hours).

Predictor Variables

An association was examined between the demographic and socio-economic characteristics (SES) of respondents and their sleep duration. The following demographic and SES variables were considered for analysis: age groups in years (18-29, 30-44, 45-59, 60+); sex (male, female); place of residence (rural, urban); marital status (never married, currently married, widowed/divorced/separated); education level (primary or below, secondary, graduate & above); employment status (employed, casual labour, unpaid work, unemployed & others); consumption class (bottom 50%, middle 50% - 90%, top 10%); religion (Hindu, Muslim, Christian, others); social group (scheduled castes/scheduled tribes, other backward caste, others). Here, social group classification is a common variable used in India to capture the continuing caste or past occupation of the respondent's family based social hierarchy in India, while consumption class represents the economic background of the respondent's household. A type of day variable was also created based on the day for which sleep information was collected to examine the sleep differential between a weekday (Monday to Friday) and a weekend (Saturday and Sunday).

Statistical Analysis

Firstly, the age-sex differentials in the mean sleep duration (in hours) were undertaken to illustrate the differentials in the age-specific sleep curve for India. Secondly, a bivariate analysis of the risk of short/long duration sleep and an adult individual's demographic and socio-economic characteristics was performed.

Finally, a multinomial logistic regression analysis is applied for testing the association between short/ long duration and demographic and socio-economic characteristics under study. Here normal duration of sleep (7-9 hours) is kept as the base or reference outcome in this analysis. Multinomial logistic regression provides the relative risk ratios (RRR), which are the risk of short duration sleep relative to normal duration sleep in a sub-group against their reference category within the same sub-group. Similarly, it provides the RRR for long-duration sleep relative to normal duration sleep for each of the independent/exploratory variables of interest. An RRR > 1 indicates that the outcome is more likely to be in the comparison category than in the reference category, and vice versa if RRR<1. Survey weights provided in the data sets were applied in all analyses to adjust for the design of the study. Analysis was conducted using Stata software, version 16 (StataCorp LLC., College Station, United States of America).

Results

Duration of sleep: On a normal day, the mean adult sleep duration in India or the average duration for which an Indian aged 18 years and above sleep was 8:18 hours (95 percent CI, 8:17 – 8:18). Sleep duration was marginally higher for males (8:24 hours) than females (8:13 hours) (Fig. 1). The age-specific sleep duration for India shows a systematic increase in sleeping hours from 08:15 hours in those aged 45-59 years to at least 08:46 hours for those aged 60 years and above. The age group 30-44 recorded the shortest average sleep duration of 8:07 hours. Figure 2, which shows the relationship between sleep duration, age groups and gender, reveals that females sleep less than males till the age of 55 years, after which they tend to sleep more than males. Rural-urban differentials indicate that adult individuals in rural areas were noted to have marginally higher sleep duration than their urban counterparts (see Appendix Table 1). Analysis doesn't support any differential sleep pattern between weekdays and weekends in India (see Appendix Table 1). To conclude, the age-specific sleep curves (Fig. 2) in India is U-shaped with a very broad base, indicating sleep duration to be more in younger and older ages and less in middle age.

Short sleep duration: Table 1 shows the prevalence of short and long sleep durations across selected background characteristics. In India, short sleep duration (<7 hours) was noted in 8.2 percent of the adults. Females had a slightly higher prevalence (9.1 percent) than males (7.1

percent). The age group with the highest prevalence was 30-44 years (9.7 percent), while those aged 60 and above had the lowest prevalence (5.2 percent). Urban residents have a higher prevalence (12.4 percent) than those living in rural areas (6.6 percent). The prevalence of short sleep duration is higher among both males and females residing in urban areas compared to their counterparts in rural areas (Fig. 3). Individuals aged 30–44 years in the urban areas exhibited the highest prevalence of short sleep duration, with 14.4 percent reporting insufficient sleep (Fig. 4). Currently married individuals exhibited the highest prevalence (8.8 percent) of short sleep duration. The prevalence increases with education levels, from 6.5 percent in those who had an education level of primary or below to 11.6 percent in those who are graduates and above. The highest prevalence was observed among individuals who were employed (9.3%) and those engaged in unpaid work (9.2%). Individuals in the top 10% of the consumption class exhibited the highest prevalence (13.4%), whereas those in the bottom 50% reported the lowest prevalence (6.4%) of short sleep durations. Muslims have the highest prevalence (11.5 percent) when compared to all other religious groups. Those belonging to the "Others" social group have the highest prevalence (10.0 percent) compared to scheduled tribes/scheduled castes (6.5 percent) and other backwards castes (7.8 percent).

Long sleep duration: The prevalence of long sleep duration (≥9 hours) was observed in one-third of the Indian adults. Long sleep duration was more common in males (37.5 percent) than females (29.4 percent) and in those residing in rural areas (34.5 percent) than urban areas (29.2 percent). The age group wise differentials were highly explicit, with the highest prevalence in those above 60 years (48.7 percent) and lowest among those aged 30-44 years (27.0 percent). Individuals who were widowed, divorced, or separated exhibited the highest prevalence of long sleep durations, with 48.1 percent reporting extended sleep. The prevalence declined with increasing levels of education, from 36.1 percent among individuals with primary education or below to 28.1 percent among those with graduate-level education or higher. Individuals in the bottom 50% of the consumption class exhibited the highest prevalence at 36.2 percent, whereas the prevalence among those in the top 10% was notably lower, at 27.3 percent. Adults belonging to scheduled tribes or scheduled castes have the highest prevalence (36.4 percent) compared to other backward castes (33.5 percent) and "Others" (28.4 percent).

Multinomial logistic regression analysis: The adjusted relative risk ratios (RRR) for sleep duration are shown in Table 2. The results, when adjusted for selected covariates, indicate

several significant associations. As compared to males, the relative risk ratio for short duration sleep was higher for females (RRR:1.25, 95 percent CI [1.20-1.32]). The relative risk of short duration sleep was significantly higher in the 30-44 and 45-59 age groups than in the 18-29 age group. Relative risk ratio shows short duration sleep was more likely in urban residents (RRR:1.64, 95 percent CI [1.58-1.69]) than among the rural residents. Higher educated individuals had an increased prevalence of short sleep when compared to those with primary or below level of education. Compared to individuals in the bottom 50% of the consumption class, those in the top 10% demonstrated the highest likelihood of experiencing short sleep duration (RRR: 1.32, 95 percent CI [1.25–1.39]). As compared to Hindus, the Muslims (RRR:1.43, 95 percent CI [1.37-1.50]) had a higher prevalence of short duration sleep.

Females have a significantly lower prevalence of long sleep duration compared to males (RRR:0.58, 95 percent CI [0.57-0.60]). Those in older age groups, 60+ years (RRR:1.48, 95 percent CI [1.43-1.54]) had a significantly higher prevalence of long sleep duration than those aged 18-29 years. Urban residents have a lower risk of long sleep duration (RRR:0.87, 95 percent CI [0.86-0.89]) than their rural counterparts. Currently married individuals were less likely to have long sleep duration (RRR:0.74, 95 percent CI [0.72-0.77]) than never-married individuals. The prevalence of longer sleep duration was significantly higher among individuals with primary education or below compared to those with higher levels of education. Additionally, unemployed individuals and others exhibited a greater likelihood of longer sleep duration (RRR: 1.77, 95% CI [1.71–1.83]) compared to those who were employed. Variation by consumption class indicates that individuals in the top 10% had the lowest likelihood of experiencing longer sleep duration (RRR: 0.79, 95% CI [0.76–0.83]) compared to those in the bottom 50%. As compared to Hindus, long sleep duration was noted to be more in Christians and others, but less in Muslims. Social group differentials showed that the long sleep duration to significantly lower in all subgroups when compared to the scheduled castes/scheduled tribes.

Discussion

This analysis clearly illustrated the patterns in sleep duration and its differentials across different subpopulations. One notable observation was that the prevalence of long sleep duration in Indian adults (33 percent) is higher than what is observed in countries like Sweden (30 percent), Netherlands (25 percent), United Kingdom (28 percent) and Norway (27 percent) [6]. Also, the prevalence of short duration sleep (8.2 percent) was higher than in Sweden (4.7

percent), Norway (5.6 percent), and the Netherlands (0.8 percent) [6]. The observation that one-third of the Indian population sleeps longer than recommended sleep time is a concern, as this is not only harmful to the health of the oversleeping individual [18] but also affects the economic productivity of the population.

The health and mortality effects of long sleep are equally or sometimes even riskier than short sleep. Cohort-level studies have shown that mortality risks are greater in those reporting more than 9 hours of sleep as compared with those sleeping less than 6 hours [19,20,21]. Prolonged sleep duration was found to be associated with depression, social withdrawal, or chronic medical conditions, either individually or in combination [18]. Our results show that ageing, low educational status, lack of employment, low household economic status, and low social group status are associated with long sleep durations. Extended periods of sleep could potentially disrupt the progress of social connections and achievements in education or employment; conversely, the absence of these engagements might result in increased opportunities for additional rest. Other studies have reported that limited physical activity, depression, and alcohol consumption were the largest confounders of the effect of short sleep times, while improved physical activity was the primary confounder of long sleep times [20].

Sleep debt has long-term adverse effects on health as it is reported to increase the severity of age-related pathologies, such as diabetes and hypertension [22,23]. Short sleep duration is also associated with obesity, an increase in sleepiness and decrements in psychomotor performance [24,25]. Our results show that individuals in the working age groups, females, urban residents, secondary or higher educated, and those in the highest consumption class have the highest risk of short sleep durations. Women are at higher risk of sleep disturbances due to factors like caregiving, fulfilling responsibilities, domestic violence, and economic stress. Urban areas have more noise, light pollution, and stress that can disturb sleep. Educated and wealthy people often have stressful jobs, leading to long work hours and less sleep [26]. Despite better healthcare access, higher-income groups may have unhealthy sleep habits like irregular schedules and high caffeine/alcohol intake, prioritizing work or social life over sleep.

In general, the sub-groups who had more time at their disposal, like elderly, the unemployed, indigenous tribes, and the poor are susceptible to excess sleeping duration. The higher likelihood of short sleep duration and lower long sleep duration in Muslims than Hindus remains unexplained. Here, the religious practice involving the need to adhere to obligatory

prayers every day at frequent intervals might have contributed to the overall sleep gap noted among Muslims to some extent.

Apart from providing estimates of the prevalence of long/short sleep in India, this study justifies the usefulness of globally available time use survey data in understanding these important health-related behaviours in a population. Sleep data from TUS captures all activities in a 24-hour recall period and is less likely to be influenced by the usual recall biases and self-perception, which is a concern for sleep data from other national-level health surveys [10]. However, the data from TUS, which is not a sleep-focused survey, has the following limitations.

Firstly, TUS enables the study of the duration of sleep and not the quality of sleep. Good sleep health is characterised by subjective satisfaction, appropriate timing, adequate duration, high efficiency, and sustained alertness during waking hours [28]. Secondly, the coding of activities in TUS based on the International Classification of Activities for Time-Use Statistics (ICATUS), for sleep and related activities, includes time in bed before and after sleep when no other activity is specified. Additionally, sleep is measured across the entire 24-hour period, rather than being limited to the main nocturnal sleep episode. Thus, sleep estimates from time use surveys are likely to overestimate sleep time from actual physiological sleep [28]. This may partially underestimate the prevalence of short duration sleep and overestimate the prevalence of long duration sleep reported in the study. However, we expect this to have an even much lesser effect on patterns in sleep differentials observed in this study.

The findings of this study underscore the need for public health planners and policymakers to pay attention to sleep health issues and related disparities in India [29]. Public awareness campaigns and school health programmes emphasizing the importance of adequate sleep, promoting healthy sleep practices, and seeking professional care/ attention for sleep problems are essential for larger gains in overall health status and quality of life of the population.

Fig 1: Distribution of sleep duration by gender

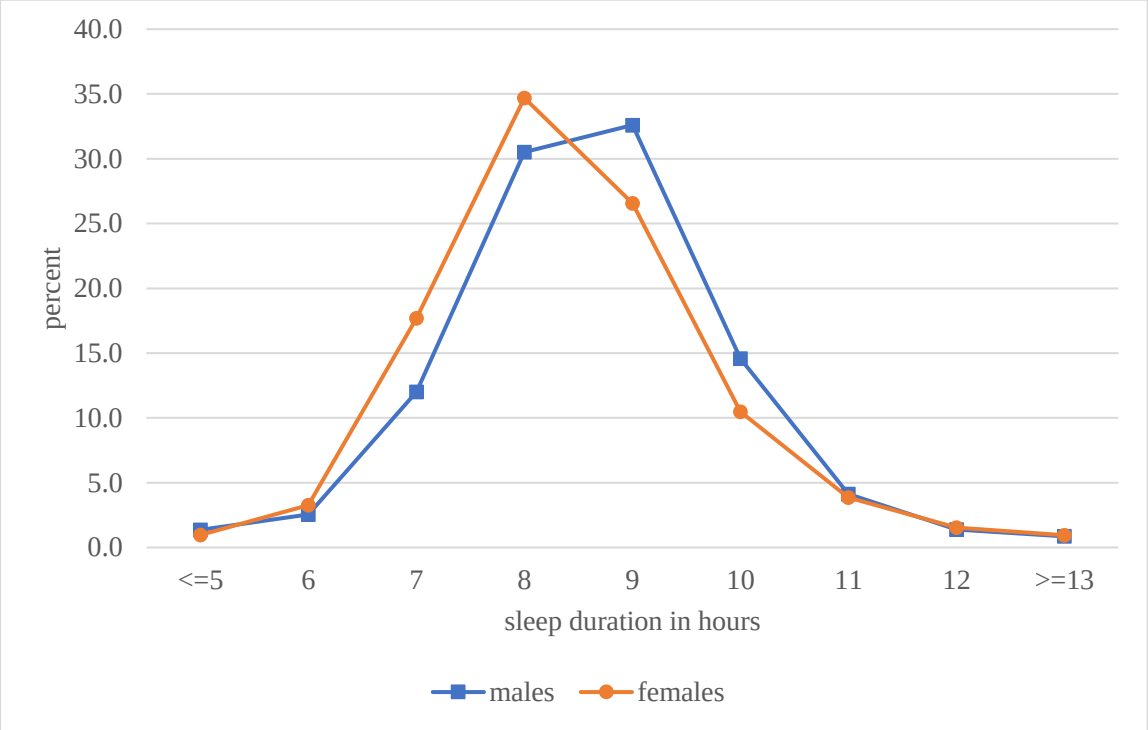

Fig 2: Distribution of Sleep Duration by Age and Gender

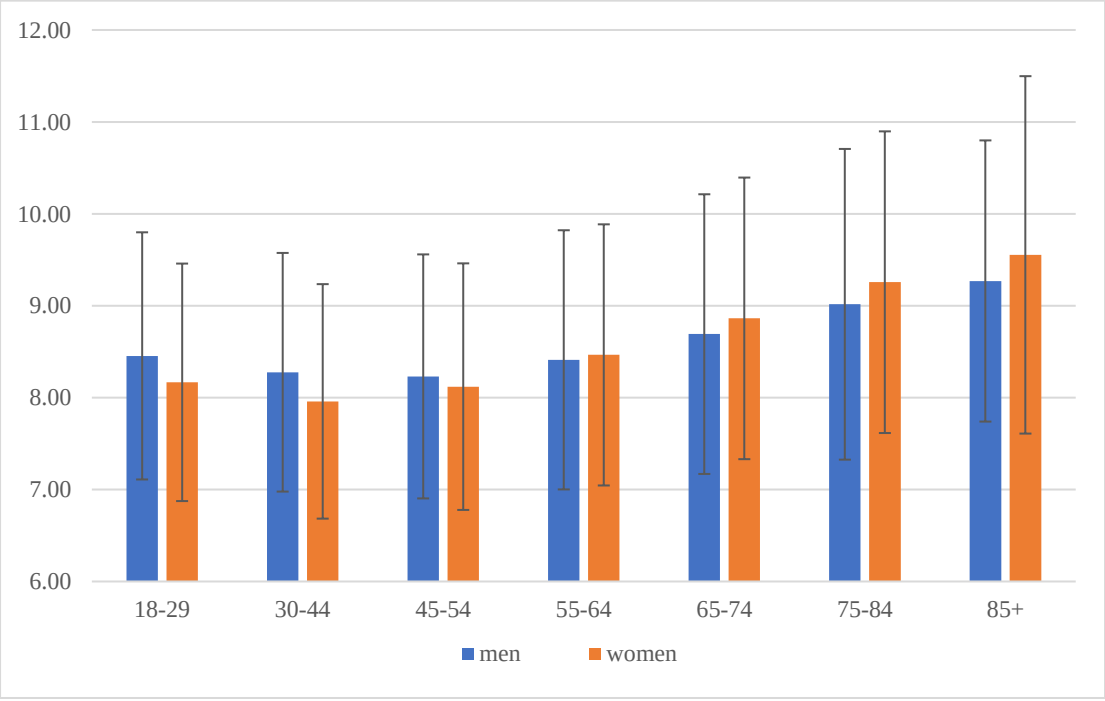

Fig 3: Prevalence of short sleep duration (<7 hours) by place of residence and gender

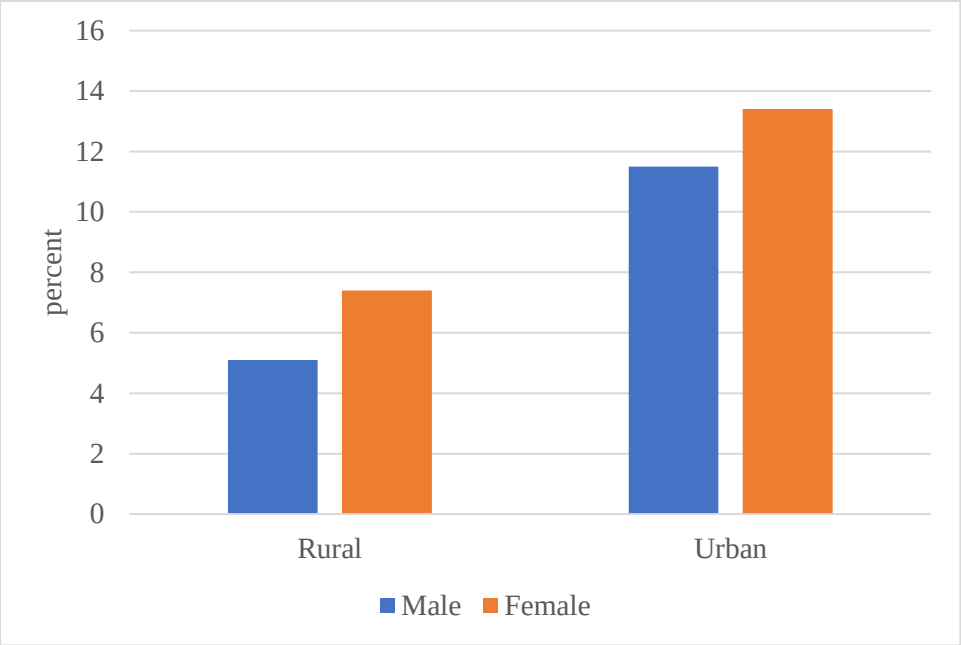

Fig 4: Prevalence of short sleep duration (<7 hours) by age and place of residence

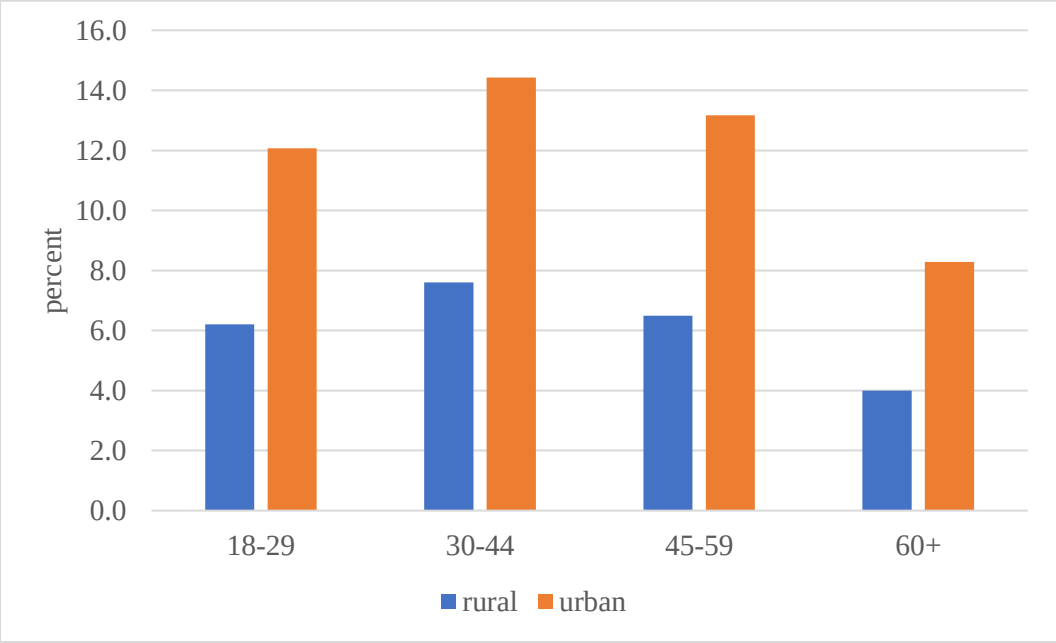

Table 1: Prevalence of long and short duration sleep across selected background characteristics of adults, India 2019

Characteristics	Short duration sleep (< 7 hours) %	Long duration sleep (≥9 hours) %	No of cases (unweighted)
Overall	8.2	33.0	2,14,489
Sex			
Males	7.1	37.5	95,875
Females	9.1	29.4	1,18,614
Age Group			
18 - 29	7.9	33.2	59,479
30 - 44	9.7	27.0	71,464
45 - 59	8.6	31.3	50,320
60+	5.2	47.7	33,226
Place of Residence			
Rural	6.6	34.5	1,34,079
Urban	12.4	29.2	80,410
Marital Status			
Never Married	7.5	39.9	28,124
Currently Married	8.8	30.0	1,65,508
Widowed/Divorced/Separated	5.2	48.1	20,857
Education Level			
Primary or below	6.5	36.1	98,250
Secondary	9.5	30.5	89,068
Graduate & above	11.6	28.1	27,171
Employment Status			
Employed	9.3	30.2	67,597
Casual Labour	4.9	37.0	26,692
Unpaid Work	9.2	28.8	91,124
Unemployed & Others	6.3	48.8	29,076
Consumption Class			
Bottom 50%	6.4	36.2	99,936
Middle 50% - 90%	9.3	30.3	91,575
Top 10%	13.4	27.3	22,978
Religion			
Hindu	7.8	33.4	1,69,622
Muslim	11.5	29.0	23,936
Christian	8.5	35.2	11,965
Others	6.4	35.2	8,966
Social Group			
Schedules castes/Schedule tribes	6.5	36.4	68,526
Other backward castes	7.8	33.5	86,825
Others	10.9	28.4	59,138

Table 2: Relative risk ratios from the multinomial logistic regression for assessing the association between short/long sleep duration and selected background characteristics of respondents, India 2019 (N=214,489)

Variables	Short duration sleep (<7 hours) vs Normal duration sleep		Long duration sleep (≥9 hours) vs Normal duration sleep	
	Relative Risk Ratio	**95% CI**	**Relative Risk Ratio**	**95% CI**
Sex				
Males[$]	1		1	
Females	1.25**	1.20 - 1.32	0.58**	0.57 - 0.60
Age Group				
18 - 29[$]	1		1	
30 - 44	1.14**	1.10 - 1.20	0.90**	0.88 - 0.93
45 - 59	1.08*	1.03 - 1.14	1.00	0.97 - 1.04
60+	0.89**	0.83 - 0.95	1.48**	1.43 - 1.54
Place of Residence				
Rural[$]	1		1	
Urban	1.64**	1.58 - 1.69	0.87**	0.86 - 0.89
Marital Status				
Never Married[$]	1		1	
Currently Married	1.05	0.99 - 0.12	0.74*	0.72 - 0.77
Widowed/Divorced/Separated	0.90	0.82 - 0.98	1.26	1.20 - 1.32
Education Level				
Primary or below[$]	1		1	
Secondary	1.25**	1.20 - 1.30	0.86**	0.85 - 0.88
Graduate & above	1.17**	1.11 - 1.24	0.86**	0.83 - 0.89
Employment Status				
Employed[$]	1		1	
Casual Labour	0.70**	0.66 - 0.75	1.14**	1.10 - 1.17
Unpaid Work	0.85**	0.81 - 0.90	1.37*	1.33 - 1.41
Unemployed & Others	0.93	0.88 - 0.99	1.77*	1.71 - 1.83
Consumption Class				
Bottom 50%[$]	1		1	
Middle 50% - 90%	1.15**	1.11 - 1.19	0.86**	0.84 - 0.88
Top 10%	1.32**	1.25 - 1.39	0.79*	0.76 - 0.82
Religion				
Hindu[$]	1		1	
Muslim	1.43*	1.37 - 1.50	0.92*	0.90 - 0.95
Christian	0.73*	0.68 - 0.80	1.27*	1.22 - 1.33
Others	0.75*	0.68 - 0.82	1.28**	1.22 - 1.34
Social Group				
Schedules castes/Schedule tribes[$]	1		1	
Other backward castes	1.02	0.98 - 1.06	0.95*	0.93 - 0.98
Others	1.20**	1.15 - 1.25	0.77**	0.75 - 0.79

CI: confidence interval, *p < 0.05, **p < 0.01

[$] Indicates subgroup used as reference category in the multinomial logistic regression

Appendix Table 1: Mean sleep duration among adults aged 18 years and above across selected background characteristics of population, India 2019

	Mean Sleep Duration (in hours)	95% CI		No of cases (unweighted)
Sex				
Males	08:24	08:23	08:24	95,875
Females	08:13	08:13	08:13	1,18,614
Age Group				
18-29	08:18	08:17	08:18	59,479
30-44	08:07	08:06	08:07	71,464
45-59	08:15	08:15	08:15	50,320
60+	08:46	08:44	08:46	33,226
Place of Residence				
Rural	08:22	08:22	08:22	1,34,079
Urban	08:08	08:07	08:08	80,410
Type of Day				
Weekend	08:20	08:20	08:21	56,631
Weekday	08:17	08:17	08:17	1,57,851
All	08:18	08:17	08:18	2,14,489

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