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Original Research Article

Prevalence and determinants of excessive daytime sleepiness among resident doctors at a tertiary care institution in India

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ABSTRACT

Background: Modern socio-occupational settings, especially medical settings, often involve shift work, long work hours, and concomitant maladaptive sleep habits. These factors may result in daytime sleepiness, an increase in the prevalence of sleep disorders, and/or an exacerbation of existing sleep disorders in the contemporary workforce. Aim was to measure the prevalence and determinants of excessive daytime sleepiness (EDS) among medical residents at a Tertiary Care Institution in India.
Methods: A cross-sectional study was designed and a list of all enrolled medical residents was obtained (N=430). The eligible subjects (N=428) were interviewed and administered the study instruments. The information on socio-demographics and sleep-related factors were collected using the sleep assessment proforma. The Epworth sleepiness scale (ESS) was used to measure excessive daytime sleepiness (EDS) and the sleep hygiene index (SHI) was used to measure sleep hygiene. Data were analyzed with appropriate statistical methods.
Results: A total of 350 residents responded (82%). The prevalence of EDS and Maladaptive sleep hygiene were 47.4% and 85.5% respectively. A positive association was found between EDS and weekly work hours, SHI score, sleep duration, sleep quality, midnight awakenings, clinical stream, and rotating shift work. Coffee intake and smoking within 4 hours of bedtime, restless legs and allergies had weak association with EDS.
Conclusions: EDS and unhygienic sleep were highly prevalent among resident doctors. The factors associated with EDS were mainly related to work, sleep quantity, sleep quality and sleep hygiene which are amenable to suitable modifications by behavioural change communications, awareness programs and by administrative actions.

Keywords: Excessive daytime sleepiness, Sleep hygiene, Work hours, Sleep quality, Shift work

INTRODUCTION

Modern socio-occupational settings, especially medical settings, often involve shift work, long work hours, and concomitant maladaptive sleep habits. These factors may result in daytime sleepiness, an increase in the prevalence of sleep disorders, and/or an exacerbation of existing sleep disorders in the contemporary workforce.

It has been well documented that poor sleep contributes to ill health.[1-11] Epidemiological studies have associated excessive daytime sleepiness (EDS) and other sleep

disorders with a reduced life span, cardiovascular diseases and breast cancer, etc.[2-7,10,12]

EDS is also associated with increased risk of accidents when operating motor vehicles or other machinery.[13-15] The World Health Organization's International Agency for Research on Cancer has classified sleep disturbing shift work as the 2A-Group (probable) carcinogen.[16-19]

EDS may be behaviourally defined as an inability to stay alert during the major awake period of the day, resulting in falling asleep at inappropriate times.[20,21] Maladaptive sleep hygiene practices are documented to be predictive of both EDS and poor sleep quality.[21,22] EDS is more likely to occur in monotonous situations when alerting stimuli are absent and may result in an increase in daily total sleep time without a significant feeling of restoration.[20,21] The severity of sleepiness can be quantified subjectively using scales such as the Epworth Sleepiness Scale (ESS).[20]

The incidence and prevalence of sleep disturbances are steadily rising in modern society due to changing lifestyles, fast and stressful life, increased travel, 24-hour economic activity, and other similar factors. The prevalence of EDS varies from 5-10% in general population to 40-80% in working population such as resident doctors, nurses, shift workers, business process outsourcing (BPO) employees, and information technology professionals.[8,9,23-26] Sleep disorders are documented in all age groups, and all societies and sections.[24,27,28] EDS may also result from internal factors such as organic illness, CNS dysfunction/damage, degenerative disorders, and advanced age, as well as from external factors such as sleep deprivation, alteration in circadian rhythm due to night shifts, caffeine, etc.[1,8,9,29]

With ongoing sleep deprivation (getting two to three hours less sleep than optimal), individuals develop a sleep debt.[30] If the sleep debt continues over 5 to 10 days, alertness at a maximum potential is often impaired. Their general performance, and particularly cognitive performance, becomes verifiably worse. Sleep debt also leads to slower response times, altered mood and motivation, and reduced morale and initiative. Sleep debt arising from sleep deprivation (shift work, prolonged work hours, etc.) is one of the most common causes of EDS.[31] This is problematic in that resident physicians have to make many critical decisions regarding patient care under these conditions.

The aim of the present study is to examine the prevalence of EDS among resident physicians, especially those working in rotating shifts and those working longer weekly-hours. Sleep hygiene, sleep quality, and sleep duration were also examined in their relationship to EDS.

METHODS

This study included all medical residents enrolled in clinical, pre-clinical and para-clinical departments of a tertiary care medical institution of India. The study was conducted from July 2008 to June 2009. There were 6 groups of residents at any point of time in the institute. There were more than 70 residents per group. The list of all the residents was obtained from the concerned authorities with a prior approval from an IRB.

A cross sectional descriptive study was designed in which all participants were interviewed and administered the assessment protocol once. The information on socio-demographics and sleep-related factors was collected using the sleep assessment proforma.[32] The assessment of EDS was conducted using the Epworth sleep scale (ESS) with qualitative definition of EDS as normal (scores 0-9), mild EDS (score 10-12), moderate EDS (scores 13-14) and severe EDS (score >14).[20,33,34] The sleep hygiene index (SHI) was used to measure the level of sleep hygiene with greater than 26 indicating maladaptive sleep hygiene and 26 or less indicating adaptive sleep hygiene practices.[21]

There were 430 residents enrolled at the time of assessment and all were included in the study. A list of all the resident physicians enrolled was obtained from the training branch administration. The list consisted of resident physicians from all parts of India. The study population was a uniform homogenous population with regard to age as most of the physicians were in mid and late 20's. The study subjects were visited at their work place and a suitable appointment was taken from them for the initial interview. Consent was obtained after explaining the purpose of the study. Residents who were pregnant, sick, or admitted to the hospital were excluded from the study. After an initial brief interview, socio demographic data was collected followed by self-administration of tools and questionnaire in sequence i) sleep assessment proforma ii) ESS iii) SHI, which took about 30 minutes. Clarifications were made to the study participants on various aspects of the study tools and questionnaire. The collection of the data was conducted mainly in the afternoons, post lunch sessions, and in the early evening.

Most residents (70%) completed the assessment forms during their free time. Subjects asked for 2 days to 2-4 weeks of time for completing the forms. The phone numbers and e-mail addresses of these residents were collected. They also fixed a probable place for returning the filled forms which was noted and followed. Residents were later contacted for clarifications in almost all cases where forms were incomplete.

The assessment tools (ESS and SHI) and sleep assessment proforma had been in use and were validated by prior studies.[21,32,33] The face validity for all these tools was assessed by the combined opinion of about 25-30 experts (faculty, senior residents), colleagues and study subjects prior to data collection. The tools were pretested on five outgoing residents prior to data collection for feedback on potentially confusing and difficult questions and overlapping categories of the tool. A pilot study was

conducted on 10-15 residents of the outgoing batch in the hospital setting to test the feasibility of the survey methodology. The time taken to complete each questionnaire was noted. Necessary changes in the tools/ survey plan were executed as per the observations during the pilot study.

The data was entered into SPSS® Statistical Package 10.00 for analysis. The statistical tests used were percentage, mean, S.D., $\chi 2$ test, t- test, ANOVA, Cronbach's alpha, kappa statistics, logistic regression analysis, and multivariate analysis. The analysis was performed to evaluate the association of study variables with the outcome and not the causation. The results were presented in terms of mean differences, differences in proportions, odds ratios/β co-efficient with statistical significance using appropriate statistical methods.

RESULTS

The prevalence of EDS was high with nearly half of the studied residents reporting EDS (Table 1). The SHI revealed a high prevalence of maladaptive sleep hygiene practices among the resident physicians (Table 1). Chi-square tests demonstrated a significant difference between the prevalence ratios of the normal, mild moderate and severe groups based on EDS and maladaptive sleep hygiene practices.

Table 1: Prevalence of EDS and maladaptive sleep hygiene (N=350).

Sleep domain	Normal	Mild	Moderate	Severe	Total abnormal	χ^2 test p
	n (%)	n (%)	n (%)	n (%)	n (%)	
EDS	183 (52.3)	91 (26)	33 (9.4)	42 (12)	166 (47.4)	0.000
Maladaptive sleep hygiene	50 (14.3)	290 (82.9)		9 (2.6)	299 (85.5)	0.000

Table 2: Comparison of study variable means between EDS and non-EDS groups (N=350).

Variable	EDS(n=166), M (SD)	Non-EDS(n=183) M (SD)	t	P (2-tailed)
Sleep hours in last 1 week	44.47 (10.47)	47.72 (12.69)	2.590	0.010
Work hours in last 1week	86.98 (21.59)	79.39 (23.17)	-3.155	0.002
Night shifts in last 1 month	6.86 (6.48)	4.82 (6.39)	-2.917	0.004
Duty offs in last 1 month	1.59 (2.02)	2.44 (3.02)	3.045	0.003
Number of night-time awakenings	1.91 (0.97)	1.40 (1.12)	-2.569	0.012

The comparison of cumulative sleep and work hour means over a week revealed the presence of a significant difference between EDS and non-EDS groups. Similarly, there was a significant difference of total number of night shifts and off duty periods over the past one month. The number of night-time awakenings also differed significantly between EDS and non-EDS groups (Table 2).

Tables 3a and 3b show the summary of the distribution of study variables between EDS and Non-EDS groups and their association. An analysis of the magnitude and direction of the association of study factors with EDS found that the odds of developing EDS was 2.98 times more likely for physicians reporting maladaptive sleep hygiene (95% CI = 1-54-5.83 ($p<0.001$). Further, a strong positive association is observed for self-rated sleep quality (OR=1.85, 95% CI=1.18-2.78, p=0.006); disrupted sleep continuity (OR=1.69, 95% CI=1.37-2.09, $p<0.001$); work hours in the past week (OR=1.70, 95% CI=1.10-2.61, p=0.015); and clinical department (OR=3.45, 95% CI=1.69-7.03, $p<0.001$). Although there was a positive association (odds ratio >1) of EDS with factors such as sex, intake of >2 cups of coffee per day, intake of coffee within 4 hours of bedtime, smoking, restless leg syndrome (RLS), and allergies, the association was not statistically significant.

Table 4 demonstrates the direction and magnitude of association of the studied explanatory variables which are non-overlapping domains with EDS using a logistic regression model. This model is not adjusted for interaction and confounding variables. Here, SHI scores and weekly sleep and work hours are taken on a continuous scale, along with other important continuous and categorical variables. The observed results are consistent with the earlier measures of linearity and crude odds ratios. It is evident that variables such as SHI score, night shifts in past month, number of nocturnal awakenings, being in a clinical department, mixed sleep pattern, and non-refreshing sleep in past week have a positive relationship.

Tables 5a and 5b depict the association of EDS with sleep hygiene and weekly work hour categories before and after adjusting for interaction and confounding respectively. These results suggest that there is protective effect for those working less than 80 hours per week and adaptive sleep hygiene on EDS even after adjustment for interaction/confounding.

Table 3a: Association of the study variables with EDS (N=350).

Variable	Category	EDS n (%)	Non-EDS n (%)	P value	Crude OR	95% CI(P)
Department	Clinical	155 (51.3)	147 (48.7)	0.000	3.45	1.69-7.03 (0.001)
	Non-clinical	11 (23.4)	36 (73.6)			
Sex	Male	131 (46.5)	151 (53.5)	0.394	1.26	0.74-2.14 (0.395)
	Female	35 (52.2)	32 (47.8)			
Married	Yes	46 (50)	46 (50)	0.586	0.88	0.54-1.41 (0.586)
	No	120 (46.7)	137 (53.3)			
Coffee/tea	>2cups	63 (49.2)	58 (50.8)	0.220	1.31	0.84-2.05 (0.220)
	0-2cups	103 (45.2)	125 (54.8)			
Smoking	Yes	16 (57.1)	12 (42.9)	0.297	1.21	0.86-1.71 (0.300)
	No	150 (46.9)	170 (53.1)			
Coffee/tea within 4 hours of bedtime	Yes	75 (50.7)	73 (49.3)	0.519	1.07	0.86-1.33 (0.519)
	No	91 (47.2)	102 (52.8)			
Smoking within 4 hours of bedtime	Yes	13 (61.9)	8 (38.1)	0.178	1.32	0.92-1.88 (0.184)
	No	152 (46.8)	173 (53.2)			
Waking during the sleep period	Yes	40 (72.7)	15 (27.3)	0.000	1.69	1.37-2.09 (0.000)
	No	126 (42.9)	168 (57.1)			
RLS	Yes	31 (54.4)	26 (45.6)	0.260	1.38	0.78-2.45 (0.261)
	No	135 (46.2)	157 (53.8)			
Legs jerking during sleep	Yes	44 (52.4)	40 (47.6)	0.293	1.30	0.79-2.13 (0.294)
	No	120 (45.8)	142 (54.2)			
Allergies	Yes	49 (48)	53 (52)	0.906	1.02	0.06-1.63 (0.906)
	No	116 (47.3)	129 (52.7)			
Work hours in 1 week	≥80	105 (53.3)	92 (46.7)	0.015	1.70	1.10-2.61 (0.015)
	≤80	61 (40.1)	91 (59.9)			
Sleep hygiene by SHI	Un hygienic	153 (51.2)	146 (48.8)	0.001	2.98	1.54-5.83 (0.001)
	Hygienic	13 (26)	37 (74)			
Self-rated sleep quality	Non-refreshing	83 (41.3)	65 (58.7)	0.006	1.85	1.18-2.78 (0.006)
	Refreshing	83 (56.1)	118 (43.9)			

Table 3b: Association of categorical study variables with EDS (N=350).

Variable	Category	EDS n (%)	Non-EDS n (%)	P value	χ^2 for trend
Liquor	No	130 (48.1)	140 (51.9)	0.990	0.916
	1-2 drinks/week	35 (47.3)	39 (52.7)		
	>2 drinks/week	1 (50)	1 (50)		
Physical activity	Nil	105 (49.8)	106 (50.2)	0.288	0.093
	1-3 days a week	51 (48.1)	55 (51.9)		
	>4 days a week	10 (33.3)	20 (66.7)		
Sleep pattern (time)	Daytime	20 (47.6)	22 (52.4)	0.509	0.414
	Night time	103 (45.6)	123 (54.4)		
	Both	43 (53.1)	38 (46.9)		
Snoring	Yes	13 (44.2)	16 (55.8)	0.238	0.297
	No	131 (50)	131 (50)		
	Don't know	22 (37.9)	36 (62.1)		
Obstructive sleep apnea (OSA)	Yes	2 (66.6)	1 (33.3)	0.549	0.291
	No	155 (47.8)	169 (52.2)		
	Don't know	8 (38.1)	13 (61.9)		
Body mass index (BMI)	Low	7 (38.9)	11 (61.1)	0.363	0.155
	Normal	111 (45.9)	131 (54.1)		
	Obese	47 (53.4)	41 (46.6)		
Semester	1st	40 (44.4)	50 (55.6)	0.809	0.893
	2nd	23 (51.1)	22 (48.9)		
	3rd	32 (55.2)	26 (44.8)		
	4th	18 (43.9)	23 (56.1)		
	5th	24 (47.1)	27 (52.9)		
	6th	29 (45.3)	35 (54.7)		

Table 4: Logistic regression model with non-overlapping domains for EDS (N=350).

Variable		B	Wald	P value	Exp(β)	95% C.I
SHI score		0.061	2.174	0.140	1.063	0.980-1.153
Work hours in last 1 week		-0.004	0.113	0.737	0.996	0.970-1.022
Sleep hours in last 1 week		-0.014	0.424	0.515	0.986	0.944-1.029
Duty offs in last 1 week		-0.036	0.177	0.674	0.965	0.817-1.139
Night shifts in last 1 month		0.025	0.380	0.538	1.025	0.947-1.110
Sleep latency		-0.045	5.782	0.016	0.956	0.922-0.992
Number of times awakened in a night		0.185	0.388	0.533	1.204	0.672-2.158
Department	Clinical	1.640	3.604	0.058	5.154	0.948-28.021
	Non-clinical	Ref*				
Sleep pattern	Daytime	Ref*	1.334	0.513		
	Night time	0.436	0.463	0.496	1.546	0.441-5.426
	Both	0.881	1.316	0.251	2.413	0.536-10.871
Sleep quality in last 1 week	Non refreshing	0.202	0.138	0.711	1.224	0.421-3.557
	Refreshing	Ref*				
Waking up during sleep	Yes	1.077	3.202	0.074	2.937	0.902-9.558
	No	Ref*				
Constant		-2.657	1.446	0.229	0.070	
***Ref- Reference category**						

Table 5a: Logistic regression for association of SHI and work hours with EDS (without adjustment for interaction/confounding).

Variable		B	Wald	P value	Exp(β)	95% C.I
	Intercept	0.292	3.687	0.055		
Work in 1 week	≤80 hours	-0.559	6.325	0.012	0.572	0.370-0.884
	>80 hours	0	-	-	-	-
Sleep hygiene	Adaptive	-1.122	10.541	0.001	0.326	0.165-0.641
	Maladaptive	0	-	-	-	-

Table 5b: Logistic regression for association of SHI and work hours with EDS (with adjustment for interaction/confounding).

Variable		B	Wald	P value	Exp(β)	95% C.I
	Intercept	0.215	1.921	0.166		
Work in 1 week	≤80 hours	-0.383	2.681	0.102	0.682	0.431-1.078
	>80 hours	1	-	-	-	-
Sleep hygiene	Adaptive	-0.563	1.909	0.167	0.569	0.256-1.266
	Maladaptive	1	-	-	-	-
Interaction	Work in 1 week* sleep hygiene	-2.264	4.110	0.043	0.104	

DISCUSSION

The medical residents studied were found to have greater EDS with poorer sleep hygiene. Almost 50% of the studied residents reported the presence of EDS and 85% reported the presence of maladaptive sleep hygiene. Further, these residents were found to work more, sleep less, have more night shifts, have fewer duty shifts off, and have more night time awakenings. These findings also suggest the resident physicians are at much higher risk of EDS with maladaptive sleep hygiene and identified contributing work factors.

An examination of the magnitude and direction of the association of the study factors with EDS found that the odds of developing EDS was 2.98 times more likely for residents reporting maladaptive sleep hygiene and is consistent with previous findings.[21,22] Further, odds ratio analyses indicated a strong positive relationship between EDS and self-reported sleep quality, number of night time awakenings, work hours, and being a resident in a clinical department. Although there was also a positive association found between a number of factors including gender, use of coffee, smoking, RLS, and presence of allergies, these relationships did not meet statistical significance. It is also interesting to note that differences

in the amount of physical activity/exercise between EDS and non-EDS groups appeared to be approaching statistical significance (p=0.093). The amount of physical activity/exercise as a factor should be a focus for future investigations.

Further analysis using logistic regression models provided strong evidence that there is a positive association between maladaptive sleep hygiene (measured by SHI) and night shifts in past month, number of nocturnal awakenings, work in a clinical department, self-rated and sleep quality. Analysis with logistic regression also supports the protective effects of adaptive sleep hygiene and limiting weekly work hours to less than 80. This also supports earlier reported findings regarding sleep hygiene and work hours among resident physicians.[21] It is clear that work hours are a major concern in this population.

As the study was a cross sectional survey, further confirmations of the risk factors and the magnitude of risks may be attempted by follow up or interventional studies. Also, the results reported here may be specific to this population and environment and not necessarily generalizable globally. However, it should be understood that there may be many work environments where conditions are similar. Future studies should also examine the effects of sleep hygiene practices on longitudinal health quality, burn out, and cognitive impairments. Studies on sleep hygiene and EDS should also be expanded to include resident physicians in different countries and in different specialities.

CONCLUSION

Medical residents are a risk group for developing the EDS and engaging in maladaptive sleep hygiene. We suggest there are specific identifiable factors related to work and sleep patterns which predispose to the development of EDS. These factors are amenable to suitable modifications by behavioural change communications, awareness programs and by administrative actions.

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