## Original Research Article

# Excessive daytime sleepiness and its determinants: do they have a pattern with study semesters among postgraduate medical resident doctors?

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### ABSTRACT

**Background:** Residency is a stressful period in the career of a medical professional. Excessive daytime sleepiness (EDS) is a major problem among resident doctors due to long work hours, stress, sleep deprivation, shift work, lack of sleep hygiene and other lifestyle related factors. The sleep problems and related factors need to be studied among resident doctors to know if any cumulative effect exists.
**Methods:** A cross sectional study design with pre-validated sleep assessment proforma, Epworth sleepiness scale (ESS), and sleep hygiene index (SHI) as study tools which were self-administered among a total of 428 enrolled eligible resident doctors.
**Results:** A total of 350 resident doctors returned the filled proforma, ESS and SHI (response rate 81.7%). Prevalence of EDS was found to be highest in $2^{nd}$ (51.1%), $3^{rd}$ (55.2%) and $5^{th}$ (47.1%) semesters. Socio-demographic factors did not vary much across semesters except for slight increase in quantity of coffee/tea intake. No major changes in shift pattern, total sleep hours were found across semesters but work hours differed significantly. Sleep latency was least in $3^{rd}$ semester where EDS was highest. Similarly, sleep quality, sleep hygiene and weekly sleep hours were least in $2^{nd}$ and $3^{rd}$ semester where EDS prevalence was high. In addition, as per visual analogue scale ratings by resident doctors, those in $2^{nd}$ and $3^{rd}$ semesters were maximally tired and maximally sleepy which is consistent with the finding of high prevalence of EDS in these semesters as recorded by ESS.
**Conclusions:** Sleep quality, sleep quantity, sleep hygiene and weekly work hours emerged as important and sensitive predictors of EDS across study semesters. These components must be present in any intervention package to address EDS especially in the first three semesters of residency program and other similar occupational settings.

**Keywords:** Resident doctors, Semester, Sleep problems, Sleep quality, Sleep hygiene, Sleep quantity

## INTRODUCTION

Sleep problems such as excessive daytime sleepiness (EDS) are increasing all over the world in epidemic proportions.[1,2] This is more so in population groups working under stress such as health professionals, nursing professionals, pilots, information technology professionals, BPO employees, etc.[3-5]

The international classification of sleep disorders defines EDS as difficulty in maintaining an alert awake state, usually accompanied by a rapid entrance into sleep when the person is sedentary. EDS may be behaviorally defined

as an inability to stay alert during the major awake period of the day, resulting in falling asleep at inappropriate times.[6,7] Poor sleep hygiene practices, poor sleep quality and sleep deprivation are documented as predictors of EDS.[7,8]

The post-graduation is a stressful period in the life of a medical doctor which lasts for a significant period of about 2-3 years in most institutions. Many studies have documented high levels of stress, sleep problems especially EDS among post graduate medical resident doctors.[3,9] It is observed by many studies that the prevalence of EDS was higher among resident physicians than the general population groups.[10,11] Also, there are well documented risk factors peculiar to residency periods which predispose resident doctors to higher prevalence of EDS.[12,13]

Some studies have documented that sleep debt builds over a period due to accumulating sleep deprivation.[14] Few studies have established that the problem of EDS increases over study duration among college students and those in professional courses.[15-17] Many studies have clearly established the importance duration of sleep problems in various long term health risks such as cancers, cardiovascular diseases and diabetes mellitus.[18,19] Studies have also documented short term consequences of sleep problems on health and wellbeing.[4,12,20,21]

Studies have demonstrated that sleep problems are amenable to interventions such as simple modification of lifestyles, practicing sleep hygiene, regular exercise, work hour regulations, shift pattern modifications, and also pharmacological interventions wherever necessary.[22-28] The effects of sleep problems on health and wellbeing are mostly reversible in short term, if timely interventions are made.[25] By studying the pattern of sleep problems and the simultaneous variations in determinant factors in specific population groups for temporal associations, we may find clues towards specific preventive measures.

It is worthwhile to study how EDS varies temporally with the duration of the postgraduate residency program which is divided into distinct semesters. It is also interesting to see how certain well known risk factors/determinants vary with the progression of semesters of post-graduate resident doctors. This helps in identifying the highest risk period of residency program where specific interventions may need to be undertaken to protect the health and wellbeing of resident doctors.

## METHODS

A cross sectional descriptive study was designed to study excessive daytime sleepiness, sleep hygiene and associated factors among the resident doctors enrolled in all types of departments of a tertiary care Medical Institution of India. The study was conducted from July 2008 to June 2009. There were 6 groups (referred to as semesters) of residents at any point of time in the institute. There were about 50 resident doctors per semester. The list of all the residents was obtained from the concerned authorities with a prior approval from the Institutional Ethics Committee.

There were 430 residents enrolled at the time of assessment and all were included in the study. 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 (n=2) from the study and the rest 438 were finally included in the study.

The information on socio-demographics and sleep-related factors was collected using the sleep assessment proforma.[29] 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).[6,30,31] The sleep hygiene index (SHI) was used to measure the level of sleep hygiene with greater than 26 indicating poor sleep hygiene and 26 or less indicating good sleep hygiene.[7] The sleep assessment proforma included a Likert scale item for assessing sleep quality (1-8, 1 being extremely good and 8 being extremely poor). Also, visual analogue scale (VAS) items with scores from 0-10 were included (0 indicating no problem and 10 indicating extreme problem) to assess feeling of sleepiness and tiredness among study participants.

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.[7,29,30] The face validity for all these tools was assessed by the combined opinion of about 25-30 experts (faculty, senior residents) and colleagues 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. The analysis was performed to evaluate the differences in means, differences in proportions and linearity across semesters of study variables, with statistical significance using appropriate statistical methods.

## RESULTS

A total of 350 resident doctors returned filled study protocols. The response rate was 81.7%. The reasons provided by those who could not return filled protocols are shown in Table 1.

**Table 1: Reasons for not returning filled study protocols (n=78).**

| Reason | N (%) |
|---|---|
| Unable to find time to complete the forms over more than 1 month | 34 (43.5) |
| Passed final semester exam and did not return during the stay in the institute | 12 (15.3) |
| Returned after the analysis was completed | 11 (14.1) |
| Told *"busy with work"* | 8 (10.2) |
| Repeatedly misplaced forms | 6 (7.7) |
| Told *"the form is too lengthy"* | 5 (6.4) |
| Told *"lost interest to fill the form"* | 2 (2.5) |

**Table 2: Semester wise prevalence of EDS among resident doctors (N=350).**

| Semester | N | EDS (%) | No EDS (%) | $\chi^2$ value (df) | P value | Test for linearity p |
|---|---|---|---|---|---|---|
| 1st | 90 | 40 (44.4) | 50 (55.6) | | | |
| 2nd | 45 | 23 (51.1) | 22 (48.9) | | | |
| 3rd | 58 | 32 (55.2) | 26 (44.8) | 2.280 (5) | 0.809 | 0.893 |
| 4th | 41 | 18 (43.9) | 23 (56.1) | | | |
| 5th | 51 | 24 (47.1) | 27 (52.9) | | | |
| 6th | 64 | 29 (45.3) | 35 (54.7) | | | |

Table 2 shows the semester wise prevalence of EDS. The prevalence's were 44.4%. 51.1%, 55.2%, 43.9%, 47.1% and 45.3% respectively for semesters 1 to 6. It is evident that the problem of EDS is comparatively more in 2nd, 3rd and 5th semesters. It is also evident that the problem starts in 1st semester itself with 44.4% of study subjects having EDS. The chi-square test showed the differences in proportions were not statistically significant. Also, the test for linearity was not statistically significant indicating that the prevalence was not having a linear pattern.

Table 3 shows the presence of various socio-demographic and lifestyle factors and sleep related variables in numbers and percentages across 6 semesters of study subjects. It is clear that more than 50% of the study subjects were not into physical activity in addition to work. Also, the amount of physical activity reported was less than 30 minutes in more than 50% of subjects across all semesters. Nil physical activity was highest among 2nd, 3rd and 5th semester residents. Coffee/tea intake of 1-2 cups was seen in more than 50% residents in all semesters and appears to increase to >2 cups of coffee/tea over semesters which is statistically significant.

In Table 3, it is also interesting to note that the coffee/tea intake within 4 hours of bedtime increases over semesters which is statistically significant. About 20% residents took alcohol and about 10% within 4 hours of bedtime but statistically not significant across semesters. Smoking was more among resident doctors in 2nd, 4th and 5th semesters and smoking within 4 hours of bedtime did not vary much; both were statistically not significant across semesters.

Table 3 also shows that sleep pattern of study subjects did not vary much across semesters as proportion of residents sleeping day time, night time and both were not statistically significant from 1st to 6th semester. Similarly, proportion of residents who wake up in the middle of sleep did not vary significantly across semesters. Self-reported sleep quality among resident doctors was worse in 2nd, 3rd, 4th and 5th semesters.

Table 4 shows the mean and standard deviation of various sleep related factors across 6 semesters of study participants along with ANOVA test for mean differences, chi square test for trend and eta squared values as a measure of association. Age varied across

semesters which was statistically significant. Body mass index varied in study subjects across semesters with an increasing trend and was statistically significant. Work hours in last one day and one week appear to decrease over semesters and were statistically significant with a clear trend. Sleep hours in last one day and one week did not vary much and were not statistically significant. But chi square test for trend for weekly sleep hours appeared to be significant.

**Table 3: Semester wise differences in proportions of sleep related measures (N=350).**

| Variable | Category | Semester, N (%) | | | | | | $\chi^2$ test p |
| | | 1st | 2nd | 3rd | 4th | 5th | 6th | |
|---|---|---|---|---|---|---|---|---|
| **Physical activity frequency** | Nil | 54 (62.1) | 32 (71.1) | 42 (72.4) | 21 (53.8) | 25 (54.3) | 29 (49.2) | 0.365 |
| | 1-3 days | 25 (28.7) | 10 (22.2) | 13 (22.4) | 15 (38.5) | 16 (34.8) | 23 (39) | |
| | >4 days | 8 (9.2) | 3 (6.7) | 3 (5.2) | 3 (7.7) | 5 (10.9) | 7 (11.9) | |
| **Physical activity amount** | <30 min | 62 (71.3) | 33 (73.3) | 47 (81) | 27 (69.2) | 27 (58.7) | 37 (62.7) | 0.203 |
| | 30min-2hr | 21 (24.1) | 11 (24.4) | 7 (12.1) | 9 (23.1) | 12 (26.1) | 15 (25.4) | |
| | >2h | 4 (4.6) | 1 (2.2) | 4 (6.9) | 3 (7.7) | 7 (15.2) | 7 (11.9) | |
| **Coffee/tea intake** | 1-2 cups | 66 (75.9) | 32 (71.1) | 39 (67.2) | 21 (53.8) | 29 (63) | 30 (50.8) | 0.026 |
| | >2 cups | 21 (24.1) | 13 (28.9) | 19 (32.8) | 18 (46.2) | 17 (37) | 29 (49.2) | |
| **Coffee/tea intake within 4 hrs of bedtime** | Yes | 29 (33.3) | 14 (31.1) | 26 (44.8) | 22 (56.4) | 20 (43.5) | 31 (52.5) | 0.050 |
| | No | 58 (66.7) | 31 (68.9) | 32 (55.2) | 17 (43.6) | 26 (56.5) | 28 (47.5) | |
| **Alcohol intake** | No | 72 (82.8) | 32 (71.1) | 41 (70.7) | 30 (76.9) | 39 (84.8) | 47 (79.7) | 0.346 |
| | 1-2/wk | 15 (17.2) | 12 (26.7) | 17 (29.3) | 9 (23.1) | 6 (13) | 12 (20.3) | |
| | >2/wk | 0 (0) | 1 (2.2) | 0 (0) | 0 (0) | 1 (2.2) | 0 (0) | |
| **Alcohol intake within 4 hrs of bedtime** | Yes | 10 (11.5) | 4 (8.9) | 6 (10.3) | 4 (10.3) | 6 (13) | 6 (10.2) | 0.992 |
| | No | 77 (88.5) | 41 (91.1) | 52 (89.7) | 35 (89.7) | 40 (87) | 53 (89.8) | |
| **Smoking** | Yes | 7 (8) | 7 (15.6) | 4 (6.9) | 4 (10.3) | 5 (10.9) | 1 (1.7) | 0.208 |
| | No | 80 (92) | 38 (84.4) | 54 (93.1) | 35 (89.7) | 41 (89.1) | 58 (98.3) | |
| **Smoking within 4 hrs of bedtime** | Yes | 6 (6.9) | 3 (6.7) | 3 (5.2) | 4 (10.3) | 4 (8.7) | 1 (1.7) | 0.579 |
| | No | 81 (93.1) | 42 (93.3) | 55 (94.8) | 35 (89.7) | 42 (91.3) | 58 (98.3) | |
| **Sleep pattern** | Day time | 9 (10.3) | 9 (20) | 5 (8.6) | 2 (5.1) | 8 (17.4) | 8 (13.6) | 0.341 |
| | Night time | 61 (70.1) | 28 (62.2) | 38 (65.5) | 25 (64.1) | 24 (52.2) | 40 (67.8) | |
| | Both | 17 (19.5) | 8 (17.8) | 15 (25.9) | 12 (30.8) | 14 (30.4) | 11 (18.6) | |
| **Refreshing sleep in last week** | Refreshing | 54 (62.1) | 20 (44.4) | 33 (56.9) | 22 (56.4) | 26 (56.5) | 36 (61) | 0.520 |
| | Non-refreshing | 33 (37.9) | 25 (55.6) | 25 (43.1) | 17 (43.6) | 20 (43.5) | 23 (39) | |
| **Wake up from sleep in between** | Yes | 16 (18.4) | 6 (13.3) | 7 (12.1) | 8 (20.5) | 7 (15.2) | 9 (15.3) | 0.860 |
| | No | 71 (81.6) | 39 (86.7) | 51 (87.9) | 31 (79.5) | 39 (84.8) | 50 (84.7) | |

In Table 4, it is evident that sleep latency of study subjects was not significantly different across semesters statistically. It is also evident that the resident doctors in all semesters are not spending enough time on bed; on average, the time spent on bed and time slept were lesser than 7 hours for all semesters and they were not different between semesters. Night shifts and duty offs per month were not significantly different across semesters. Sleep quality ratings by study subjects on a Likert scale of 1-8 (with 1 as extremely good and 8 as extremely poor) was not varying much across semesters and also were not statistically significant.

Table 4 also shows that sleepiness and tiredness mean scores on visual analogue scale of 0-10 by study participants were high for all semesters especially tiredness in 2nd semester; but they were not significantly different. ESS score means were high in first four semesters and SHI score means were high during 3rd, 5th and 6th semesters. Higher scores of ESS indicate Excessive Daytime Sleepiness and also higher SHI scores indicate poorer sleep hygiene. Both ESS and SHI scores were not significantly different across semesters.

Figure 1 shows that across 6 semesters, the trend of EDS clearly varied in accordance with sleep hygiene and poor sleep quality. Sleep and work hours though varied slightly across semesters, did not seem to explain the variation in EDS to a great extent. This possibly signifies the role of sleep quality and sleep hygiene in preventing EDS in working population groups such as resident doctors.

**Table 4: Semester wise differences in mean scores of sleep related measures (N=350).**

| Variable | Semester, Mean (SD) | | | | | | ANOVA p | $\chi^2$ trend p value | Eta $^2$ |
| | 1st | 2nd | 3rd | 4th | 5th | 6th | | | |
|---|---|---|---|---|---|---|---|---|---|
| Age | 25.44 (1.97) | 25.80 (2.01) | 26.72 (2.39) | 26.45 (1.55) | 27.34 (1.75) | 27.95 (2.17) | 0.000 | 0.000 | 0.174 |
| BMI | 22.20 (3.41) | 22.81 (2.82) | 23.32 (3.11) | 23.32 (3.17) | 23.14 (2.85) | 23.76 (2.68) | 0.053 | 0.003 | 0.032 |
| Work hours/ last day | 13.30 (3.89) | 12.70 (3.06) | 12.88 (3.35) | 13.60 (4.75) | 12.87 (2.57) | 11.48 (3.56) | 0.037 | 0.019 | 0.035 |
| Work hours/ last week | 84.66 (21.51) | 87.61 (19.73) | 87.61 (25.22) | 80.82 (21.08) | 83.44 (19.80) | 73.04 (24.53) | 0.004 | 0.002 | 0.050 |
| Sleep hours/day | 6.13 (1.46) | 6.27 (1.64) | 6.10 (1.29) | 6.62 (1.19) | 6.20 (1.44) | 6.10 (1.40) | 0.480 | 0.866 | 0.013 |
| Sleep hours/week | 45.09 (10.89) | 43.15 (10.37) | 45.39 (13.22) | 48.30 (10.94) | 49.24 (12.53) | 46.83 (11.75) | 0.117 | 0.037 | 0.026 |
| Sleep latency | 15.74 (13.05) | 16.43 (15.65) | 11.25 (11.67) | 16.55 (20.50) | 17.57 (16.92) | 15.79 (13.04) | 0.304 | 0.659 | 0.018 |
| Usual hours of total sleep/day | 6.06 (1.40) | 5.95 (1.19) | 5.90 (0.86) | 6.15 (0.96) | 6.19 (0.96) | 5.79 (1.16) | 0.422 | 0.549 | 0.015 |
| Usual hours of time on bed/day | 6.58 (1.34) | 6.61 (1.03) | 6.30 (1.13) | 6.55 (1.14) | 6.72 (1.15) | 6.21 (1.05) | 0.159 | 0.244 | 0.024 |
| Night shifts/ 1 month | 5.26 (7.27) | 6.16 (6.17) | 5.63 (5.91) | 5.77 (5.73) | 7.26 (7.87) | 5.25 (5.49) | 0.601 | 0.586 | 0.011 |
| Duty off/month | 1.86 (2.55) | 2.00 (2.35) | 1.42 (1.81) | 2.12 (2.54) | 2.77 (3.90) | 2.32 (2.31) | 0.149 | 0.074 | 0.024 |
| Sleep quality on Likert scale 1-8 | 3.53 (1.50) | 3.91 (1.48) | 3.96 (1.38) | 3.58 (1.72) | 3.51 (1.63) | 3.66 (1.54) | 0.479 | 0.855 | 0.013 |
| Sleepiness on VAS 0-10 | 4.67 (2.68) | 4.41 (2.59) | 4.56 (2.40) | 4.20 (2.70) | 4.29 (2.50) | 4.18 (2.59) | 0.852 | 0.209 | 0.006 |
| Tiredness on VAS 0-10 | 4.84 (2.78) | 5.27 (2.72) | 4.82 (2.41) | 4.53 (2.91) | 4.61 (2.67) | 4.23 (2.38) | 0.463 | 0.087 | 0.014 |
| ESS score | 9.40 (4.41) | 9.45 (3.68) | 10.07 (4.65) | 9.33 (4.22) | 8.9 (4.41) | 8.97 (3.82) | 0.740 | 0.367 | 0.008 |
| SHI score | 31.20 (6.20) | 31.91 (6.06) | 32.49 (5.28) | 31.63 (6.10) | 33.96 (6.74) | 32.13 (5.71) | 0.214 | 0.108 | 0.021 |

VAS- visual analogue scale; ESS- Epworth sleepiness scale; SHI- sleep hygiene index; BMI- body mass index.
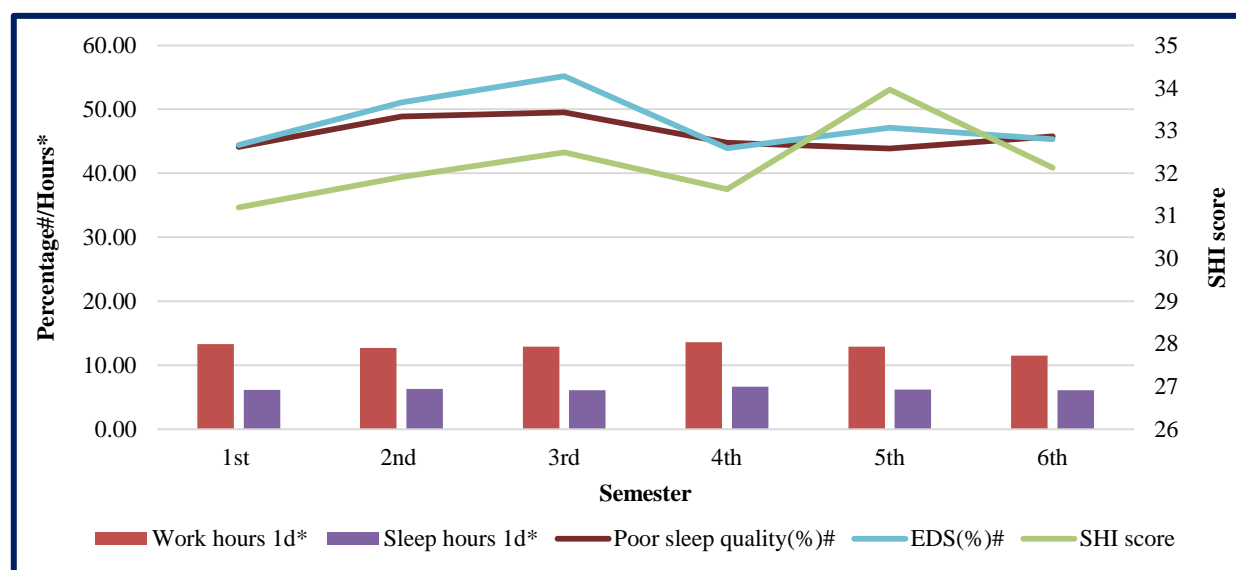


**Figure 1: Trend in work hours, sleep hours, sleep quality, SHI scores and EDS (N=350).**

## DISCUSSION

There was a high prevalence of EDS among resident doctors in all semesters. The problem of EDS started immediately after joining post-graduation in these resident doctors as evidenced by the prevalence of 44.4% in first semester residents. This indicates that the sleep is a highly susceptible entity for even slight changes in determinants such as lifestyle, work and stress factors.[17] Even a few days of exposure to sleep deprivation, shift work, stress generating factors and certain stimulants may alter normal sleep physiology and the consequences begin to show.[32] Many studies have clearly documented similar findings.[5,9,10,13,32,33] Conversely, it is also true that the removal of these factors normalises the sleep quality, quantity and architecture and also restores health benefits.[25,26]

Certain other interesting findings also emerge from the results. The problem of EDS persists throughout all the semesters of post-graduate study but with a variation, up to an extent of 10%, depending on the variations in the magnitude of determinants. The prevalence was high in second, third and fifth semesters. The determinants such as socio-demographic factors, physical activity, alcohol intake, smoking and use of stimulants within 4 hours of bedtime appear to be not much different among study subjects across semester groups. But their presence is in significant proportions in all semesters and may be contributing in part to the higher presence of EDS. Interestingly, coffee intake quantity appears to increase with semesters probably as a temporary coping strategy. There are many studies which have clearly documented the role of these factors on EDS.[9,17]

Sleep pattern did not vary significantly across semesters in study subjects. The flotation type of shift work existed in subjects of all semesters but it was slightly more in 3rd, 4th and 5th semester students due to the factors related to work pattern. Overall, it can be said that similar shift work pattern, mid sleep awakenings and fewer duty offs were observed in all semesters and contributed to EDS burden equally in study subjects of all semesters.[34]

The study participants in 2nd semester reported higher levels of non-refreshing sleep than others which is also consistent with the higher prevalence of EDS among 2nd semester subjects. This can be further explained by considering self-reported quality of sleep on a Likert scale by the participants with higher scores indicating poorer quality sleep which is evident in 2nd and 3rd semester subjects. The consistency in observations on sleep quality through these variables of different kinds adds to reliability and validity of the findings from this study indicating that sleep quality is the poorest in 2nd semester which is mainly responsible for higher prevalence of EDS observed in that semester. A large number of studies have shown the role of sleep quality in etiology of EDS in a dose-response manner.[35-38]

The presence of weekly work hours were highest in 2nd and 3rd semester and weekly sleep hours were least in 2nd semester. Night shifts in a month were highest for 5th and 2nd semester. Sleep quality ratings on a Likert scale were highest (poor sleep quality) for 2nd and 3rd semesters; reported sleepiness and tiredness were also high for 2nd and 3rd semester resident doctors. All these factors probably explain higher prevalence of EDS among 2nd and 3rd semester students. It appears that the first 3 semesters are the most stressful period for resident doctors mainly due to the nature of their work pattern and related factors. Slight decrease in the sleep problem related measures towards the end of the residency probably indicates some adaptation that might take place, but this requires further study before making any such conclusions.

Sleep hygiene appears to be poor throughout residency in all semesters, but slightly larger means (poor sleep hygiene) in 2nd, 3rd and 5th semester correspond to higher prevalence of EDS in these semesters. It can also be derived that sleep hygiene is a sensitive determinant of EDS such that even minor modifications in sleep hygiene might provide larger benefits in normalizing sleep quality and quantity.[7,9,39-41] The findings on dose-response relationship of sleep hygiene with EDS are consistent with a large number of previous studies.[7,9,42]

Another important observation in this study was that the BMI increased gradually over semesters in a statistically significant way. The studies in the past have established that sleep problems such as EDS predispose individuals to higher BMI and hence consequences such as metabolic disorders and diabetes.[43-46] The abnormal BMI is both a cause and consequence of sleep disorders.[20,43,46]

Overall, it is evident from the present study that sleep quantity, sleep quality and sleep hygiene are important determinants of EDS and may have a dose-response relationship. With other determinants and conditions being constant, these three factors can influence the occurrence of EDS. Hence, these three factors must be integrated into any intervention strategy that may be planned to address the issue of EDS in resident doctors and possibly in other population groups.

This study being a cross sectional design and based on self-reported measures, limitations such as respondents bias, recall bias etc. cannot be ruled out. But, the use of pre-validated tools with established validity and reliability, and also the inclusion of items in the questionnaire to measure same sleep dimensions in different ways proved that the results are consistent, reliable and reasonably valid.

The study had a response rate of 81.7%. This response rate was better than many previous studies.[13,33] The reasons provided by non-responders probably indicate the lack of time for other activities other than work. The prevalence of EDS and various other sleep related factors

may be distributed in similar pattern as found among responders, or may be with a bit more proportion. Hence, the estimate of EDS is not an overestimate but may represent all the resident doctors of the institution. Also, the results of the study may as well be generalised to other population groups with similar occupational settings and characteristics.

## CONCLUSION

In conclusion, the resident doctors are more prone to develop EDS in first three semesters mainly because of inadequate sleep quantity, poor sleep quality and poor sleep hygiene. Some factors known to cause EDS such as shift work, long work hours, stimulant use were also present throughout the residency duration and were also responsible for EDS. Established consequences of EDS such as increase in BMI was also observed in this study. It is essential to include sleep quality, sleep hygiene and work pattern regulation in the prevention programs for EDS and other sleep problems.

## ACKNOWLEDGEMENTS

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