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Evaluation of sleep quality, excessive daytime sleepiness and associated factors in medical students - a systematic review

Avaliação da qualidade do sono, sonolência diurna excessiva e fatores associados em estudantes de medicina – uma revisão sistemática

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ABSTRACT

Objective: To systematically review the scientific literature from the last 20 years about the EDS and Medical Students dyad, in order to understand the relationship and the impacts on the health of these individuals. Methods: A systematic review was conducted in December 2020 in PubMed and SciELO using the descriptors "sleep disorders", "Excessive Daytime Sleepiness" (EDS) and "Medical Students". Inclusion criteria were: original articles from the last 20 years, in English, Portuguese and Spanish, and, as exclusion criteria, failure to meet inclusion eligibility. Result: The analysis of the studies demonstrates a direct relationship between the academic responsibilities of medical students and sleep deprivation. As a consequence, this course presents itself as a trigger of poor sleep quality indices and EDS, as well as social and psychological consequences for academics. Conclusion: The great demands of the medical course may lead to sleep disorders due to the difficulty in reconciling them with individual health, causing psychopathological symptoms and mental exhaustion. Thus, measures that balance the student's routine with academic needs are important.

Keywords: Sleep disorders, excessive daytime sleepiness, medical students, graduate education.

1 INTRODUCTION

The circadian rhythm of the sleep-wake cycle is regular and has a 24-hour period, being synchronized by both endogenous and exogenous factors. The suprachiasmatic nucleus, located in the hypothalamus and known as the biological clock, is the neural structure responsible for regulating it. The external elements are diverse, some of them being the day-night alternation, work schedules, study and daily chores, and the performance of physical activities (Almondes et al., 2003; Moraes et al., 2013). However, maintaining the regularity of this rhythm can be challenging when the individual's routine demands more waking hours, as is the case of college

students, who live the conflict between meeting the academic and professional demands and not jeopardizing their sleep-wake cycle (Almondes et al., 2003). More specifically, when medical students are analyzed, they demonstrate insufficient sleep time, delay to initiate sleep, and episodes of daytime sleepiness (Abdulghani et al., 2012).

Sleep is of great importance in the life of human beings, playing an essential role in memory consolidation, vision, thermoregulation, restoration and conservation of energy, and restoration of brain energy metabolism (Frasson et al., 2014; Silva et al., 2018). However, currently, the labor market demands more and more from its professionals, so that they have to give up the quality of their sleep in order to reach the expected level of performance (García et al., 2018). As a consequence, disorders such as insomnia and excessive daytime sleepiness (EDS) arise, which can be frequently found in the general population (Frasson et al., 2014).

These sleep disorders are responsible for causing expressive changes in the occupational, physical, social and cognitive exercise of the individual, leading to the emergence of symptoms such as exhaustion, irritability, stress and lack of motivation for daily tasks, which compromises their quality of life (Ribeiro et al., 2014; Purim et al., 2016). In addition, increased cardiovascular risk and increased mortality are also associated with inadequate and insufficient sleep (Hidalgo et al., 2002; Silva et al., 2018).

Although sleep disorders can occur in the entire population, it is notable that college students are more prone to them. This occurs due to the irregular sleep pattern of these students, which can be identified as being of short duration and late start during the week, but prolonged and with late end on weekends (Lima et al., 2009; Almondes et al., 2003). The amount of hours of sleep varies among individuals, however, its restriction and fragmentation are commonly detrimental factors for sleep quality. Sleep can be restricted by both academic demands and psychoactive substance use and can be fragmented due to environmental or physiological factors that interrupt it (Ribeiro et al., 2014).

The medical course is characterized by its full-time schedule, with an extensive workload and various extracurricular activities such as monitoring, academic leagues, internships, scientific initiation projects, among others. For this reason, medical science students make up a group in which sleep disorders and symptoms of anxiety and depression are frequent, caused by the irregularity of the sleep-wake cycle (Frasson et al., 2014; Almondes et al., 2003). Sleep deprivation in medical students directly interferes with the consolidation and codification of acquired concepts and practices, since they must assimilate extensive content in a short period of time (Genzel et al.,

2012). In addition, poor recovery of their physiological activities can lead to the onset of cognitive problems, impairing the teaching-learning process (Silva et al., 2018).

SDE affects 12-16% of the general population and is responsible for an increase in the number of motor vehicle accidents and occupational accidents, as well as medical error, becoming considered a current public health problem. It is characterized by a high level of daytime sleepiness, capable of impairing the attention, memory, and functionality of the individual as a whole (Machado-Duquea et al., 2015). It can also be defined as the individual's ability to fall asleep in various circumstances, regardless of the degree of alertness that these require, and it is also classified according to the activity performed at the time of the episode of daytime sleepiness (Escobar-Córdoba et al., 2011; García et al., 2018).

The analysis of EDS can be performed through the Epworth Sleepiness Scale (ESS), a questionnaire composed of eight questions that seek to determine whether the individual presents sleep disorders or deprivation (Machado-Duquea et al., 2015). During the application of this method, participants must score how likely they are to fall asleep in eight everyday situations, such as watching television; reading while sitting; sitting as a passenger in a car for an hour; among others, with 0 = never dozing, 1 = slight chance of dozing, 2 = moderate chance of dozing, 3 = high chance of dozing. The maximum score is 24 and 10 is the upper limit, indicating that individuals with ESE higher than 10 have SDE (Zailinawati et al., 2009; Silva et al., 2018). The SES also presents the ability to distinguish participants who do or do not have sleep disorders from those who have or have not had their sleep deprived (Escobar-Córdoba et al., 2011).

For a qualitative assessment, the Pittsburgh Sleep Quality Index (PSQI) can be used, which is a reference on sleep and has a sensitivity of 80% and specificity of 68.8% in its translation into Portuguese (Moraes et al., 2013). The PSQI evaluates the global quality and sleep disturbances in the last month through 10 questions with a total score from 0 to 21 (Machado-Duquea et al., 2015). These questions are divided into seven components, these are (1) subjective sleep quality; (2) sleep latency; (3) sleep duration; (4) sleep efficiency; (5) sleep disturbances; (6) use of sleep medication; (7) daytime sleepiness. The scores of all components are summed and sleep quality is classified as good (PSQI from 0 to 5); poor (PSQI from 5 to 10; sleep disturbances (PSQI above 10) (Ribeiro et al., 2014).

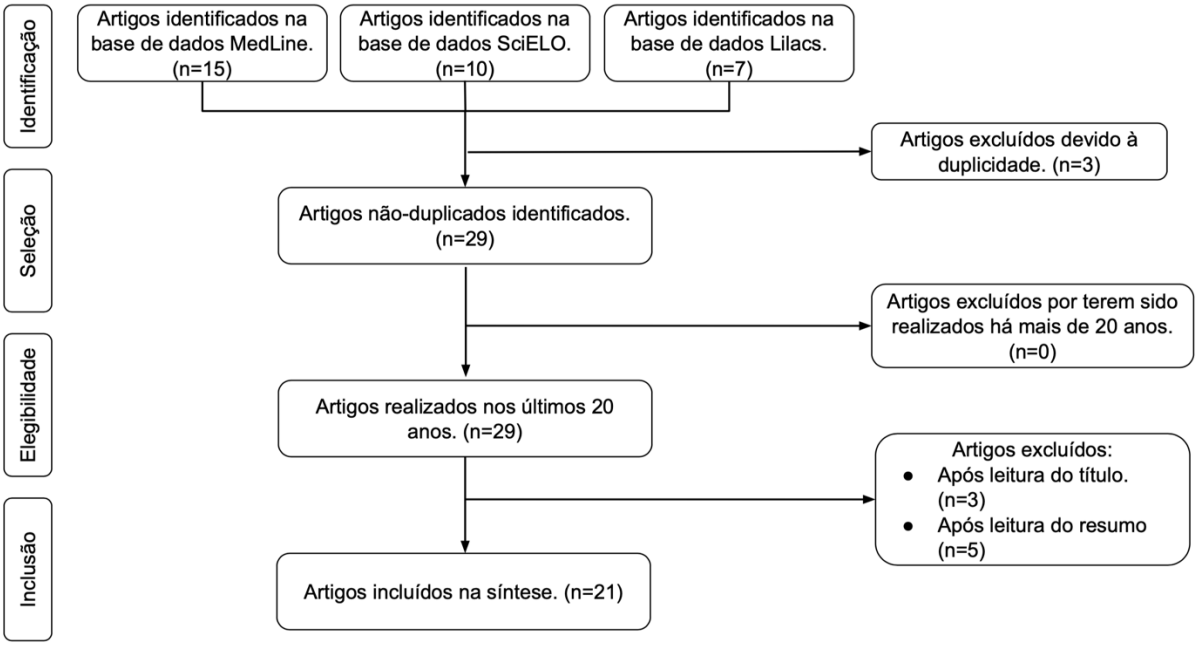
2 OBJECTIVE

To review the scientific literature from the last twenty years, in a systematic way, about the dyad EDS and Medical Students, aiming to understand the relationship and the health impacts on these individuals.

3 METHODS

A systematic review was conducted in December 2020 in PubMed and SciELO using the descriptors "Sleep Disorders" "Excessive Daytime Sleepiness" and "Medical Students". Inclusion criteria were: original articles from the last twenty years, in English, Portuguese and Spanish, and, as exclusion criteria, not meeting inclusion eligibility. Twenty-nine articles were found, of which 21 were analyzed for this study.

Figure 1: Flowchart of the article selection process



4 RESULTS

According to the cross-sectional descriptive study by Rodrigues et al. (2002), it was possible to infer, through the sample of 172 participants, that there was an increase in the general average of the SDE score from 9.38 ± 4.06 at the beginning of the semester to 10.72 ± 4.03 at the end of the semester, besides which the prevalence of sleepiness at some point during the period was 61.62%, considering the statistically significant analysis (p=0.002). This inference can also be highlighted in the research of Veldi et al. (2005), since on a four-point scale of a questionnaire and in a total of 413 students, 10% reported their academic progress as excellent; 62% as good;

26% as satisfactory and 2% as insecure. Another study with a total of 121 participants showed that 46% considered satisfaction with their personal and academic life balance as a stressful factor and 73% satisfaction with their academic life, factors that aggravate SDE (Santen et al., 2010).

An important test for checking sleep quality is the Pittsburgh Sleep Quality Index (PSQI), whose research conducted on the questionnaire displayed results indicating poor sleep quality (PSQI >5) in preparation for school exams for 59% of students, showing a mean score of 6.3 ± 2.6, while the percentage of people who slept poorly was 29% during the semester and dropped to 8% post exams (mean PSQI score of 3.1 ± 1.9). The subscales that mainly contribute to these high test scores are sleep latency, daytime dysfunction due to sleepiness, and subjective sleep quality (Ahrberg et al., 2012). A cross-sectional design with second-year medical students in Niteroi showed that about 65% of students had moderate to severe difficulty with sleep quality and considering seven hours of sleep as an average needed for mental and physical rest, 20% of participants slept less than this amount per night (Pagnin et al., 2014).

From the same point of view, another study verified that the students took, on average, 21.83 minutes to sleep and that the average duration of sleep of the sample (n=157) was 6.80 hours, besides observing that 72.61% (n=114) considered the quality of sleep during the last month as good or very good, while 27.39% (n=43) classified it as bad or very bad. Despite these results, the analysis of the PSQI components inferred that 44.59% (n=70) of the total sample had poor quality sleep patterns, since it was identified, in the month prior to the application of the exam, the presence of bad dreams or nightmares at least once a week in 33.12% (n=52); problems sleeping or feeling very hot one or more times a week in 24.84% (n=39); feeling very cold at least once a week in 23.57% (n=37); and problems staying awake while driving, eating or doing any other social activity in 15.9% (n=24) (Moraes et al., 2013).

In another study, 14.9% of medical students (n=41) also had poor quality sleep patterns, with different prevalence among the years of medical training (Cardoso et al., 2009). In the same study, 32% of the sample (n=88) had bad dreams or nightmares less than once a week; 24% (n=66) had problems sleeping because they felt too hot; and 22.1% (n=61) woke up in the middle of the night or very early in the morning once or twice a week. Thus, these data revealed a statistically significant association between EDS and sleep quality, as 66.7% (n=42) of participants who reported poor sleep quality also had EDS. Not only that, in the cross-sectional observational analytical study by Silva et al. (2018) also found that there was poor sleep quality in 36.2% (n=79) of medical students at the University Center of Patos de Minas - UNIPAM according to the global component of the PSQI.

Still in the research of Silva et al. (2018), 42.7% (n=93) of the academics reported feeling very cold at least once a week; 37.2% (n=81) felt very hot at least once a week; 37.6% (n=82) had bad dreams at least once a week; and 61.9% (n=135) woke up in the middle of the night or very early in the morning at least once a week and an average sleep per night equivalent to 6 hours and 20 minutes was demonstrated. In the study by Ribeiro et al. (2014), the application of the PSQI questionnaire inferred that 72.1% of 184 students enrolled in the medical course at UFAC in 2012 reported difficulty sleeping because they felt too hot, besides an oscillation in the poor quality of sleep between 54% and 70%, with the third period presenting the highest number of students with poor quality of sleep, and the seventh period the highest proportion of students with sleep disorders, totaling an occurrence of 23.3%. In the same paper, 34.3% (n=62) students had EDS in the morning and/or afternoon hours.

According to Medeiros et al. (2010), the analysis of the PSQI showed that 38.9% of students sleep poorly; this high percentage is the result of the contribution of subjective sleep quality and sleep duration. Also in this study, 42.8% presented an irregular pattern of the sleep-wake cycle and the correlation between sleep irregularity and PSQI was statistically significant ($p<0.05$).

Using this same test, in relation to total sleep time, 85.54% had 5 hours or less of duration (Escobar-Córdoba et al., 2011). On the other hand, there was a study that differentiated the PSQI scores according to the academic semester of the medical student, since those present in the third period presented an average of 5 ± 1.5; those in the fourth period presented 3.86 ± 1.5; and those in the seventh period were found values of 5.57 ± 2.8, thus, the poor quality of sleep was 42.3%, 11.5% and 60% respectively in the aforementioned periods (Lima et al., 2009).

In the Epworth Sleepiness Scale (ESS), which assesses EDS, the analysis of the data obtained showed that 36.31% (n=57) have EDS that needs investigation. In this case, no statistically significant differences in ESE results were found between age groups regardless of gender and year (Moraes et al., 2013). Frasson et al. (2014) demonstrated in his research, through the SES, that 47.1% of students suffer from EDS, and there was no presence of the significant correlation between this questionnaire and the PSQI (p=0.5). This same scale was also applied in a descriptive and prospective study conducted with 719 students of the medical course at the Pereira University of Technology, finding a mean value of 8.4 ± 3.7, but indices of absence of sleepiness in 33.6% (n=73) of the participants; indices of moderate daytime sleepiness in 16.6% (n=36); and SDE in 49.8% (n=108) can also be evaluated (Machado-Duquea et al., 2015). Not only that, in the research of Cardoso et al. (2009) EDS can be found in 51.5% (n=138) of the

sample, with no statistical difference between graduation and residency years (p=0.90), as well as between genders (p=0.53).

Under this same bias, a cross-sectional analytical observational study conducted in 452 medical students at the Autonomous University of Bucaramanga, found that 80.75% (n=365) of students obtained scores indicating EDS - with a higher proportion in females, 82.81% (n=236), than in men, 77.25% (n=129) - in which students in the third academic semester had a higher prevalence of severe EDS (4.69%) and those in the ninth semester a higher prevalence of mild daytime sleepiness (69.23%) (Garcia et al., 2018). Using the same questionnaire, the article by Escobar-Córdoba et al. (2011) showed that normal sleepiness without the need for medical treatment corresponds to 39.76% (n=33), but that which requires clinical help, for being pathological and presenting functional repercussions in basic daily activities, is found in 60.24% (n=50) of the medical course participants, in addition to the fact that 60.56% of the students with five hours of sleep or less suffer from pathological EDS.

As clinical consequences of EDS, students showed depressive symptoms, in which most were mild to moderate, and anxiety symptoms ranging from mild to severe intensity (Pagnin et al., 2014). A cross-sectional study conducted on 342 first- to fourth-year students from the largest medical school in the state of Rio Grande do Sul obtained a prevalence of minor psychiatric disorders in 22.81% of the sample, since a 9,06% (n=31) reported a history of psychopathologies, such as depression, drug abuse/dependence, anxiety and panic disorders, besides inferring that 10.20% of the participants used drugs from the class of benzodiazepines, antidepressants and buspirone (Hidalgo et al., 2002).

The study by Frasson et al. (2014) showed that eight students reported the use of sleeping drugs such as alprazolam. Regarding the drugs used as mechanisms to stay awake, it was observed in this same study that 27 students admitted to using methylphenidate at least once, while 11 reported using another type of substance (guarana pill and caffeine). In this same line of research, another article showed that 31.8% (n=69) of the participants reported using some medication in the last month, such as antidepressants; 63.6% (n=138) consumed alcohol in the last month and 16.6% (n=36) reached intoxication. Another 17.1% (n=37) used tobacco; 7.4% (n=16) acknowledged psychoactive substance use and 41.9% (n=91) drank at least one cup of coffee per day (Machado-Duquea et al., 2015). Importantly, among the elements promoting wakefulness, 52.84% of students reported consuming coffee and 39.52% energy drinks (Garcia et al., 2018); 8.7% (n=24) used sleeping medication (Cardoso et al, 2009); 11% (n=24) at least once a week used prescription medication or self-medicated to help sleep (Silva et al., 2018); 6% (n=10) used

sedative or stimulant substances more than three times a week (Ribeiro et al., 2014); and 6.02% (n=7) used hypnotics (Escobar-Córdoba et al., 2011).

5 DISCUSSION

SDE can be defined as the inability to maintain an adequate level of wakefulness that compromises the learning process, as sleep deprivation in physicians can reduce the performance of intellectually demanding tasks (Rodrigues et al., 2002; Abdulghani et al., 2012; Ahrberg et al., 2012; Veldi et al., 2005). In the academic setting, the tired and sleepy medical student exhibits poor mood and can often become depressed, exacerbating EDS and providing a hostile educational environment within colleges, with high levels of stress and low ability to concentrate (Rodrigues et al., 2002). Not only that, this ineffective student performance interferes with cognitive functions, self-evaluation, memory, executive function, and attention during learning (Pagnin et al., 2014). This low academic efficacy can negatively affect knowledge of medical techniques, as well as cause higher prevalence of medical errors, burnout, other sleep disorders, and impaired interaction effects (Pagnin et al., 2014; Zailinawati et al., 2009).

Sleep quality is a factor that should be essential in the lives of medical students, but it is closely related to complaints of insomnia, difficulty in inducing and maintaining sleep, and EDS (Veldi et al., 2005). In the case of sleep deprivation, it can often happen because it is associated with a merit, as if recounting the time without sleep was a symbol of their dedication to the profession, however, in reality there is a drastic reduction in productivity and professional performance as well as good interpersonal relationships, even if the sleepiness generated by this deprivation is of moderate intensity (Hidalgo et al., 2002; Cardoso et al., 2009; Zailinawati et al., 2009; Ribeiro et al., 2014). Not only that, it is also common to observe that there is a disagreement between the self-perception of sleep quality and the reality, because many students accept this irregular sleep pattern as inevitable or even adequate, which drives the development of bad habits among them and this can be demonstrated by the PSQI, whose evaluation presented results that reflect a poor quality of sleep (Moraes et al., 2013). If this deprivation is chronic, there is a greater chance of it being the origin of EDS, however, the required amount of sleep has individual variations and seems to be genetically determined and, therefore, those who need 10 hours of sleep, but sleep only 8 hours, may present drowsiness, which highlights the difference in the behavior of EDS in each student (Ribeiro et al., 2014).

Sleep quality may also be different between the periods, since in the first academic semesters, besides the academic concern, there is also the transition to university life and new

social demands, which exposes students to an unknown environment in which they must socialize, create new groups of friends and adapt to a change in the pedagogical model and in the qualification system (Pagnin et al., 2014). Another factor that can be related to better academic performance is the sleep-wake cycle, as sleep fragmentation impairs the consolidation of newly learned information and the formation of permanent memory traces during sleep (Medeiros et al., 2010). Some factors that can interfere with the circadian rhythm are constant exposure to bright spaces and ultraviolet light emitted by digital devices, such as smartphones and tablets, altering the regulation of this cycle and reducing sleep time (Purim et al., 2016).

It is well known that the demands of medical training require greater effort from the student given the peculiarities of this course, emphasizing the importance of maintaining individual health (Purim et al., 2016). In the sample of this study, the average number of weekly working hours of residents exceeded the recommended 60 hours, probably due to other external professional ties. These findings demonstrate the fatigue of students and health professionals due to long hours of study and are of concern for the potential detrimental effect on academic training, physical, mental and psychological well-being, and the availability of time for leisure, physical activities, social interaction and rest (Purim et al., 2016; Lima et al., 2009). For these reasons, many times, the lives of these individuals and other people around can be at risk, because the EDS is associated with some pathological disorders that deteriorate personal functionality and negatively impact health, which worsens the clinical picture and demands help from other professionals, making physicians a special and continuous risk population that needs better recommendations for sleep hygiene and good habits (Escobar-Córdoba et al., 2011).

Several medical students may find themselves in a strange limbo between academic and real life, as they live in a profession that ends up causing many more damages than other diseases they deal with on a daily basis (Rodrigues et al., 2002). The results of some articles show that anxiety and stress pictures are very common in academics, leading to increased alcohol consumption and drug abuse as an escape mechanism, and that it also interferes with the sleep-wake cycle and low sleep quality scores, so as to result in delayed sleep onset and increased daytime dysfunction due to sleepiness (Almondes et al., 2003; Ahrberg et al., 2012). Thus, prolonged and accumulated lack of sleep can result in a high prevalence of mental disorders and decreased productivity, which highlights the need for the inclusion of regular bedtimes and wake-up times, sufficient sleep duration, adequate environment, and organization of studies through a schedule; However, these practices are little applied and there is still a prejudice in relation to such psychological disorders, either in the identification of symptoms or in the recognition that they

have clinical repercussions that affect performance, being an important cause for undertreatment and lack of demand for other medical care (Lima et al., 2009; Hidalgo et al., 2002).

There is also an excessive and frequent consumption of coffee and tobacco once a day and hours before bedtime, with the purpose of voluntarily depriving oneself of sleep, and alcohol intoxication cases are also common (Machado-Duquea et al., 2015; Pagnin et al., 2014). This frequent use of substances, whether sedative or sleep stimulants, can cause irreparable consequences in the quality of life of medical students, such as episodes of insomnia, memory impairment, and chemical dependence (Ribeiro et al., 2014).

6 CONCLUSION

The routine of college students brings numerous consequences to their health, since they need to reconcile the extensive academic workload with internships and extracurricular activities and even with paid work. In this perspective, the medical course is recognized for demanding great dedication, for being a full-time course, and for the responsibility that comes from a formation capable of training physicians of excellence. However, the workload and the emotional load can lead to problems such as EDS and mental exhaustion that, by interfering in the consolidation of memory and cognition, cause stress and low concentration capacity. Thus, it is necessary to adopt measures that balance the student's routine, prioritizing their quality of life, in order to reduce the occurrence of psychopathological symptoms and substance use by this population.

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