Article published online: 2024-05-13

Sleep Hygiene Intervention Improves Sleep Time and Duration in High School Students

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Sleep Sci

Abstract

Objective To evaluate the effects of a sleep hygiene education program for adolescents to address excessive daytime sleepiness, insomnia, and sleep-related behaviors.

Materials and Methods The participants were 98 high school students from the 11th and 12th grades. A day-long health promotion action was conducted at their school science fair to disseminate relevant information about sleep disorders. Social status and sleep perception and habits were evaluated through the following validated questionnaires: the Brazilian Economic Classification Criteria, a questionnaire on sleep habits for adolescents, the Pediatric Daytime Sleepiness Scale, the Insomnia Severity Index, and the Sleep Time-Related Information and Communication Technology questionnaire. The questionnaires were administered before the fair and 12 months after participation, and the results before and after the intervention were compared by means of the Student *t*-test and the Fisher exact test. For the correlations involving the results, the Pearson correlation was used with the level of significance of $p < 0.05$.

Results A qualitative reduction in poor bedtime habits was observed after the intervention, such as watching television and leaving a cell phone on with sound. A higher frequency of use of electronic devices can affect school performance and contribute to later bedtime on weekends ($p < 0.001$). Excessive daytime sleepiness was correlated with the excessive use of electronic devices ($p = 0.017$).

Conclusion Some habits changed after the awareness intervention. There was an impact of the use of electronic devices on academic performance, on the regularity of bedtimes, and on excessive daytime sleepiness. We emphasize the importance of health education programs with sustainable actions following actual changes in behavior.

Keywords
- sleep
- adolescent
- sleep hygiene
- health promotion
- technology

received
March 15, 2023
accepted
November 8, 2023

DOI https://doi.org/10.1055/s-0044-1782169.
ISSN 1984-0659.

Thieme Revinter Publicações Ltda., Rua do Matoso 170, Rio de Janeiro, RJ, CEP 20270-135, Brazil

Introduction

Due to puberty and school demands,[1–3] the sleep of adolescent undergoes changes such as delays in the sleep phases, which contribute to late sleep time and wake-up time,[3,4] as well as changes in the duration of some sleep phases, such as slow-wave sleep.[5]

Behavioral factors, including social demands, household tasks, extracurricular activities, work after school, and increased time spent using electronic devices, influence the sleep of adolescents[4,6,7] and lead to fewer hours of sleep, poor sleep quality, and an increase in daytime sleepiness.[8] Sleep deprivation is significantly associated with low academic performance, as it affects major learning processes such as memory and attention.[3,8,9]

Currently, efforts have been made to promote sleep health given that sleep is a fundamental factor for the well-being of adolescents. One of the proposals discussed in the literature is changing the school schedule.[10–12] Associação Brasileira do Sono (Brazilian Sleep Association) proposed a delay: starting classes at 8:30 am for high school students aged 13 to 17 years in Brazilian educational institutions with the aim of reducing sleep restriction.[13] This initiative was justified by the association of a delay in the start of classes with positive effects in terms of academic performance and mood and reduction in fatigue.

In this age group, poor sleep habits are common,[6] and few interventions have been developed to teach adolescents about the importance of sleep hygiene.[14] Sleep hygiene is defined by a set of guidelines comprising behavioral and environmental components, such as avoiding the intake of alcoholic drinks and caffeine, practicing regular physical exercise, and reducing the use of technology before bedtime.[15] If these interventions are held within school settings, they can reach a younger audience and consequently enhance their sleep-related knowledge.[3,16]

Activities developed with adolescents must be appropriate for the context. Thus, creativity, dynamism, and interactivity are necessary to make teenagers interested in participating, and the use of technological devices may be helpful to approach the target audience more effectively.[17,18]

Interventions for the promotion of sleep health are only the first step in effective learning. For the assessment of behavioral changes, it is crucial to measure the long-term changes in the sleep habits of adolescents. Subjective sleep assessment instruments may help to monitor such programs[19] and determine whether new habits are incorporated into the participants' lifestyle.[20]

In the present study, an intervention in a school setting was conducted during a science fair in which interactive activities were conducted. After 12 months, the extent to which the intervention was able to provoke changes in the adolescents' lifestyle was assessed. The current study aimed to evaluate the effects of a sleep hygiene education program for adolescents for excessive daytime sleepiness, insomnia, and sleep-related behaviors.

Materials and Methods

The current experimental, nonrandomized study with pre- and postintervention assessments was approved by the institutional Ethics Board on Research with Human Beings (approval number 1.997.072). This study was conducted in partnership with X.

Participants

An invitation to participate in the research was extended to 120 high school students in the 11th and 12th grades. In the preintervention stage, 98 students (52 female subjects) participated effectively, and in the postintervention stage, 85 students (46 female subjects) participated; the age of the sample ranged from 15 to 18 years. The inclusion criteria were students who were willing to participate and delivered a consent form signed by their legal guardians. Students who turned in an incomplete form were excluded.

Intervention

The intervention was conducted in three phases: health promotion planning, application of the intervention, and assessment. The planning phase comprised the development of studies on sleep by the three student organizers followed by meetings of the students and researchers to define strategies to extend their knowledge to other students. Therefore, the planning started with a guiding meeting for the initial studies. The researchers encouraged the students to study the physiological benefits of sleep, sleep deprivation, and sleep habits. In addition, guidance was provided on searches in scientific databases (PubMed and LILACS). In the second meeting, brainstorming on the topic was conducted to transform the content considered most relevant by the team into topics and mind maps.

The intervention was held during the science fair at the school. A specific action on sleep was organized by three students so that they could choose the most interesting strategies for the other students (their peers), oriented by sleep expert researchers, to address the theme "Influences of sleep disorders in current times". During the intervention, by means of banners and flyers, information was provided on the causes and consequences of several sleep disorders, as well as tips for to achieve better sleep quality. The science fair took place at the school multisport court, where a stand was set up comprising two banners as well as balloons and folders on the topic of sleep. To increase the involvement of the other students, a cultural contest was proposed with the following question: "Currently, are people concerned enough about their sleep quality?" The students who visited the stand talked to the organizers, who presented the topic and exemplified it by means of the supporting material. Subsequently, the students were invited to write on a sheet of paper an answer to the challenge of the cultural contest and place the paper in a box. At the end of the fair, all answers were analyzed by the organizing team, and the most creative was selected and awarded a gift.

Evaluation Instruments

The participants provided information on their gender, weight, height, Portuguese and mathematics marks and the extra assignments that they performed. All participants filled out the questionnaires before and 12 months after the intervention during the science fair (pre- and postintervention) to verify whether there were changes in their sleep habits. The questionnaires used were as follows:

- The Brazilian Economic Classification Criteria (2018 version, by Associação Brasileira de Empresas de Pesquisa) aims to compute purchasing power and is subdivided into three parts. The first verifies the number of possessed items, with scores ranging from 0 to 14 and higher scores indicating a greater number of possessions. The second part identifies the householder's level of schooling, ranging from illiterate to the completion of higher education, with scores from 0 to 8. In the third part, the item possession scores and family schooling scores are added to enable the profiling of economic classification with the following stratum possibilities and respective scoring: A1 (4-46, the highest stratum), A2 (35-41), B1 (29-34), B2 (23-28), C1 (18-22), C2 (14-17), D (8-13), and E (0-7).[21]
- For the questionnaire on the sleep habits for adolescents, the fourth part of the protocol was used regarding sleep habits and frequent medical symptoms. This part comprised four questions with the possibility of providing more than one answer. A qualitative analysis was conducted to verify the presence or absence of a certain sleep-related habits in the routine of adolescents.[22]
- The Sleep Time-Related Information and Communication Technology (STRICT) questionnaire aims to quantify the use of technological devices near sleep time by means of 11 questions with 4 answer options and scores ranging from 0 to 3 each. The questions regarding the number of messages sent/received in bed per night and sleep duration and sleep time on weekdays and weekends have 5 answer options and scores ranging from 0 to 4, while the items concerning time spent with technological devices have 6 answer options and scores ranging from 0 to 5. Higher scores reveal high use of technologies.[23]
- The Pediatric Daytime Sleepiness Scale (PDSS) is a tool to assess excessive daytime sleepiness in children and adolescents. It has 8 questions, 5 answer options and scores ranging from 0 to 4 points. The total score ranges from 0 to 32 points, with the highest scores indicating excessive daytime sleepiness.[24]
- The Insomnia Severity Index (ISI) aims to detect and evaluate insomnia severity by means of 7 questions with 5 answer options with scores ranging from 0 to 4. The total score ranges from 0 to 28, and it is interpreted as follows: absence of insomnia (0-7), subthreshold insomnia (8-14), moderate insomnia (15-21), and severe insomnia (22-28).[25]

Analysis of the Results

The questionnaire results were tabulated and expressed as percentages and mean and standard deviation values. Inferential statistical analysis was performed. To compare the results before and after the science fair, we used a paired *t*-test for the quantitative data and the Wilcoxon test for the qualitative data. The correlations involving the parameters considered in the present study were also assessed using the Pearson correlation (as the sample showed a normal distribution). The level of significance adopted was $p < 0.05$. The program used was Jamovi (open source), version 1.2.25.

Results

The analysis of the answers of the cultural contest was performed at the end of the fair considering criteria such as objectivity, clarity and information, contextualization of knowledge on the topic, and the proposal of possible changes in poor sleep habits and how those would affect people's daily lives. The winning answer was by a high school senior: "After the First Industrial Revolution in the eighteenth century, the time used by human beings in a single day was rationalized. Some things considered simpler, such as quality sleep, deteriorated and currently do not get the necessary attention as people do not have quality sleep hours. Quality sleep may be influenced by a number of factors, such as diet, use of medication without previous prescription, bed ways and position, among others. Quality sleep may positively influence an individual's life, making mthe healthier, smarter and with a better mood than before".

Concerning the participants' answers on the pre- and postintervention questionnaires, 98 adolescents with a mean age of 16.08 ± 0.39 years participated in the preintervention, and 85 adolescents with a mean age of 17.03 ± 0.48 years participated in the postintervention. In total, 13 participants were excluded for quitting or for handing over incomplete questionnaires.

The students presented a statistically significant reduction in their postintervention mathematics marks (20.4 ± 5.31) when compared to the preintervention stage (24.8 ± 4.11; $p < 0.001$). The same result occurred for Portuguese marks (preintervention: 24.7 ± 2.69; postintervention: 20.5 ± 6.14; $p < 0.001$)

Symptoms and sleep habits were compared before and after the intervention, resulting in a percentage between 30% and 69% in the pre-intervention period. Despite a reduction in the frequency of reported habits of up to 12%, there was no significance when compared to the postintervention period. Thus, even after the educational intervention, the adolescents maintained their deleterious sleep habits (►**Table 1**).

►**Table 2** shows that behavioral habits did not change with the applied intervention. However, the intervention positively affected sleep duration and sleep time on school days and decreased the differences between sleep time on school days and weekends (preintervention $= -0.888 \pm 0.745$; postintervention $= -0.605 \pm 0.785$; $p = 0.015$); a reduction in sleepiness in the classroom (preintervention $= 2.61 \pm 0.899$; postintervention $= 2.31 \pm 0.949$; $p = 0.032$) was also observed.

The correlation analysis showed that young people who perform more extracurricular activities have a lower likelihood of presenting sleepiness ($p = 0.001$). Regarding the use

Table 1 Distribution of the comparison of sleep habits and symptoms pre- and postintervention – Questionnaire for adolescents on sleep habits.

Sleep habits and symptoms	Preintervention	Postintervention	Difference	*p*-value*
Headaches	69%	60%	−9%	0.271
Staying on the computer	68%	63%	−5%	0.751
Watching television	63%	52%	−11%	0.229
Drinking coffee and other caffeine-containing drinks	43%	38%	−5%	0.651
Going out with friends	41%	35%	−6%	0.449
Leaving the mobile device on with sound	36%	24%	−12%	0.148
Suddenly falling asleep anywhere	31%	20%	−11%	0.128

Notes: Wilcoxon exact test; *statistical significance at $p < 0.05$.

Table 2 Associations involving sleepiness, insomnia and the impact of the use of electronic devices pre- and postintervention in the STRICT, ISI, ans PDSS instruments.

	Preintervention (n = 98): mean ± SD	Postintervention (n = 85) : mean ± SD	*p*-value*
BMI (in kg/m^2)	22.4 ± 3.99	22.4 ± 3.29	0.909
Portuguese exam mark	24.7 ± 2.69	20.5 ± 6.14	< .001*
Mathematics exam mark	24.8 ± 4.11	20.4 ± 5.31	< .001*
Extracurricular activities	0.363 ± 0.548	0.417 ± 0.575	0.542
Socioeconomic status	21.3 ± 6.96	20.6 ± 7.69	0.506
STRICT – Sleep duration on school days	1.65 ± 0.644	1.44 ± 0.628	0.026*
STRICT – Sleep time on school days	1.83 ± 0.626	2.05 ± 0.679	0.024*
STRICT – Difference between sleep time on school days and weekends	−0.888 ± 0.745	−0.605 ± 0.785	0.015*
STRICT Total	21.5 ± 4.98	20.9 ± 4.47	0.454
ISI Total	11.7 ± 4.71	11.1 ± 4.64	0.373
PDSS – Frequency of falling asleep or getting sleepy in the classroom	2.61 ± 0.899	2.31 ± 0.949	0.032*
PDSS Total	19.6 ± 4.87	19.7 ± 4.69	0.950

Abbreviations: BMI, Body Mass index; ISI, Insomnia Severity Index; PDSS, Pediatric Daytime Sleepiness Scale; SD, standard deviation; STRICT, Sleep Time-Related Information and Communication Technology questionnaire.
Notes: paired *t*-test, *statistical significance at $p < 0.05$.

of technology, a correlation was found between insomnia complaints ($p < 0.001$) and excessive daytime sleepiness ($p = 0.002$) (►**Table 3**).

Discussion

In the present study, we found that the sleep hygiene intervention applied in our one-day protocol for high school students contributed to decreasing the differences between sleep time on school days and weekends, in addition to reducing the frequency of excessive daytime sleepiness. These results were obtained from the comparison of the pre- and postintervention (after 12 months) findings, and they are in line with those of articles[26] in the literature on this rapid intervention model, which resulted in improvements in the onset and duration of sleep. Maeda et al.[26] (2019) further developed the relationship between these sleep findings and school refusal in a five-year follow-up study.

The science fair enabled interaction and knowledge sharing in addition to being a pleasant event. One of the observed outcomes was a decrease in deleterious sleep hygiene habits that affected sleep quality, without any significant differences. More frequent interventions with more systematic follow-up may result in greater change and maintenance of such behaviours.[3,27]

A North American study[28] assessed sleep hygiene behaviors of adolescents and found that the habit of caffeine consumption delayed sleep time. Thus, the intake of caffeine-containing drinks was a method to avoid sleepiness and obtain considerable daytime energy. Moreover, the study[28] suggested the use of other methods to measure sleep-related behaviors, such as actigraphy and sleep diaries to enable greater precision in the collection of these findings.

Table 3 Correlations regarding the use of technologies, insomnia and sleepiness pre- and postintervention through the STRICT, ISI, ans PDSS instruments.

		STRICT (total)	ISI (total)	PDSS (total)
Extracurricular activity		r = −0.044 $p = 0.577$	r = −0.050 $p = 0.531$	r = −0.258 $p = 0.001^*$
STRICT	Perception of the effect of the technology use on academic performance	r = 0.502 $p \leq 0.001^*$	r = 0.046 $p = 0.543$	r = 0.180 $p = 0.017^*$
	Perception of the use of technology over sleep	r = 0.518 $p \leq 0.001^*$	r = 0.223 $p = 0.003^*$	r = 0.168 $p = 0.026^*$
	Time spent on technological devices before sleep time	r = 0.681 $p \leq 0.001^*$	r = 0.224 $p = 0.002^*$	r = 0.152 $p = 0.046^*$
	Time spent on technological devices in bed	r = 0.715 $p \leq 0.001^*$	r = 0.199 $p = 0.008^*$	r = 0.191 $p = 0.011^*$
	Amount of sent/received texting in bed per night	r = 0.634 $p \leq 0.001^*$	r = 0.090 $p = 0.230$	r = 0.092 $p = 0.226$
	Time you wake up per night due to texting	r = 0.294 $p \leq 0.001^*$	r = 0.135 $p = 0.070$	r = 0.008 $p = 0.913$
	Times you wake up for other reasons per night	r = 0.274 $p \leq 0.001^*$	r = 0.476 $p \leq .001^*$	r = 0.237 $p = 0.002^*$
	Sleep duration on the weekends	r = 0.252 $p \leq 0.001^*$	r = −0.074 $p = 0.325$	r = −0.072 $p = 0.346$
	Sleep time on school days	r = 0.287 $p \leq 0.001^*$	r = −0.011 $p = 0.883$	r = 0.013 $p = 0.861$
	Sleep time on the weekends	r = 0.412 $p \leq 0.001^*$	r = 0.135 $p = 0.073$	r = 0.174 $p = 0.022^*$
	Total		r = 0.249 $p \leq 0.001^*$	r = 0.236 $p = 0.002^*$
ISI	Difficulty in falling asleep			r = 0.179 $p = 0.019^*$
	Difficulty in staying asleep			r = 0.136 $p = 0.077$
	Trouble in waking up before the expected time			r = 0.134 $p = 0.080$
	The extent to which the sleep disorder affects your daily functioning			r = 0.508 $p \leq 0.001^*$
	How perceptible your sleep disorder is in terms of affecting your quality of life			r = 0.431 $p \leq 0.001^*$
	How concerned/unconcerned you are with your current sleep disorder			r = 0.356 $p \leq 0.001^*$
	Total			r = 0.409 $p \leq 0.001^*$

Abbreviations: ISI, Insomnia Severity Index; PDSS, Pediatric Daytime Sleepiness Scale; STRICT, Sleep Time-Related Information and Communication Technology questionnaire.
Notes: Pearson correlation; *significant at $p < 0.05$; STRICT, ISI and PDSS totals: sum of the scores.

Overall, in the present study, no reduction in the use of technological devices after the intervention was observed (►**Table 2**). The use of electronic devices has become essential, mainly among younger individuals. Another Brazilian study reported the frequency of their use among 84.3% of adolescents; in another study,[29] conducted in China, the frequency of use among adolescents was of 75%. This high use is related to recreational and academic purposes at any moment during the day or night and frequently without any preestablished hours, so it is likely to extend for long periods.[29]

The absence of a difference in the Body Mass Index (BMI) of the participants pre- and postintervention was observed (►**Table 2**). This variable was controlled due to the possibility of influencing sleep parameters, such as the amount of sleep hours per day.[30,31] Adolescents should sleep between 8.5 and 10.5 hours a day to support their metabolism and other biological functions, which may be altered by sleep deprivation.[32]

The students' Portuguese and mathematics marks were higher before the intervention, which may be related to the

time the questionnaires were applied. The postintervention questionnaire was administered at the end of the school year, which was stressful due to academic demands. A Spanish study[33] found an association regarding hours of internet use, sleep quality, and academic performance. Adolescents with satisfactory sleep quality and fewer hours of internet use performed better in mathematics. Concomitantly, American studies have verified that their findings were consistent with sleep efficiency and were significantly associated with better marks in mathematics, English, and French after an intervention programme.[3]

Sleep duration on school days decreased after the intervention, which may be associated with the students' academic routine. Likewise, research conducted in Hong Kong showed a reduction in sleep time throughout the week as the semester progressed.[27] Therefore, short sleep duration on weekdays may be related to academic stress. High school students have to prepare for school exams as well as college entrance examinations, which demands long hours of study.[34] However, it was not possible to correlate a decrease in marks to this finding.

The difference between sleep time on school days and on weekends pre- and postintervention was significant ($p = 0.015$). Therefore, the guidance was effective from this perspective. The current study, in conformity with others,[30,32,34,35] shows that sleep compensation during the weekends is a relevant factor and requires guidance to prevent adolescents from delaying sleep time on school days.

There was no reduction in insomnia complaints after the intervention. Insomnia is a disorder that requires further investigation and educational measures, as it may be related to disturbances in mental health, academic performance, and risk behaviours.[36] Daytime sleepiness did not change, which differed from other studies whose education programs were efficient in the reduction of daytime sleepiness.[20]

There was a correlation between the use of technologies, insomnia, and sleepiness. Daytime sleepiness was higher on the weekends when there was greater use of technological devices as well as delayed sleep time. The literature corroborates this finding by correlating the perception of the effects of using technological devices with school performance, sleep time, and a significant delay in sleep time.[37] A study from the United Kingdom verified that the use of mobile devices in bed by adolescents contributes to shorter sleep.[38]

A positive correlation was found between symptoms of insomnia and adolescents' excessive daytime sleepiness, showing that sleep deprivation affects daily functioning. The literature also shows that the use of devices is related to insomnia and sleepiness.[23] Similarly, sleep fragmentation upon successive awakenings caused by texts received after sleep time may cause insomnia.[23]

Performing extracurricular activities, such as practicing sports, may contribute to fighting a sedentary lifestyle and is a relevant option to reduce daytime sleepiness. The current study found that the greater the number of activities performed by adolescents, the lower their sleepiness. This finding can be compared to that of an American study, which found that longer sleep hours were associated with a reduction in the time spent engaging in sedentary behaviors.[8]

Some limitations were perceived in the current study regarding the reduction in deleterious sleep habits. The choice of a school setting was important for educational interventions aimed at the improvement of sleep quality. However, these interventions may be more efficient with education programs that feature several knowledge-dissemination strategies as well as diversified measures for behavior control. Further studies may seek to involve teachers and family members in sleep education programs.[3] The greatest challenge for further studies pursuing this goal is to develop and implement relevant measures to optimize the time for the use of electronic devices. Education institutions could also consider the inclusion of sleep-related content in their curricula for a more efficient follow-up of such measures.

Conclusion

The health promotion action positively affected sleep duration and sleep time on school days and contributed to the reduction in daytime sleepiness. Other symptoms and sleep habits did not show a difference, which may have been influenced by the fact that the postintervention evaluation was performed longitudinally and the health promotion action was timely.

The implementation of sleep health programs in school environments with continued actions may be recommended. In addition, the use of technologies was correlated with insomnia and increased drowsiness, which highlights the importance of greater focus on the responsible use of such electronic devices for better quality of sleep.

Funding Source

The authors declare that they have received no funding from agencies in the public, private or non-profit sectors for the conduction of the present study.

Conflict of Interests

The authors have no conflict of interests to declare.

References

1 Buysse DJ. Sleep health: can we define it? Does it matter?. Sleep 2014;37(01):9–17
2 Pereira EF, Moreno C, Louzada FM. Increased commuting to school time reduces sleep duration in adolescents. Chronobiol Int 2014; 31(01):87–94
3 Gruber R, Somerville G, Bergmame L, Fontil L, Paquin S. School-based sleep education program improves sleep and academic performance of school-age children. Sleep Med 2016;21:93–100
4 Oliveira G, Batista da Silva I, Araújo de Oliveira ER. Sleep in adolescence and factors associated with inadequate sleep. Rev Bras Pesq Saúde/Brazilian J Heal Res 2019;21(01):135–145
5 Kurth S, Jenni OG, Riedner BA, Tononi G, Carskadon MA, Huber R. Characteristics of sleep slow waves in children and adolescents. Sleep 2010;33(04):475–480
6 Del Ciampo LA, Louro AL, Del Ciampo IRL, Ferraz IS. Characteristics of sleep habits among adolescents living in the city of Ribeirão Preto (SP). J Hum Growth Dev 2017;27(03):307–314
7 Oliveira LF, Corrêa CC, Ramalho MM, Vieira M, Blasca WQ, Brasolotto AG. Intervention via teleducation about vocal mutation and vocal habits. Audiol Commun Res 2018;23:e1899

8 Kim Y, Umeda M, Lochbaum M, Sloan RA. Examining the day-to-day bidirectional associations between physical activity, sedentary behavior, screen time, and sleep health during school days in adolescents. PLoS One 2020;15(09):e0238721
9 Kronholm E, Puusniekka R, Jokela J, et al. Trends in self-reported sleep problems, tiredness and related school performance among Finnish adolescents from 1984 to 2011. J Sleep Res 2015;24(01): 3–10
10 Lewin DS, Wang G, Chen YI, et al. variable school start times and middle school student's sleep health and academic performance. J Adolesc Health 2017;61(02):205–211
11 Hafner M, Stepanek M, Taylor J, Troxel WM, van Stolk C. Why Sleep matters-the economic costs of insufficient sleep: a cross-country comparative analysis. Rand Health Q 2017;6(04):11
12 Lo JC, Lee SM, Lee XK, et al. Sustained benefits of delaying school start time on adolescent sleep and well-being. Sleep 2018;41(06): zsy052
13 Bacelar AM, Castro CR, Alves R, Araújo P, coords. Dossiê: horários escolares e implicações no sono de adolescentes. e-Coleções FSP/USP. 2018
14 Maia Í, Pinto F. Hábitos de sono. Nascer e Crescer. Rev Hosp Crianças Maria Pia 2008;17(01):9–12
15 Mead MP, Irish LA. Application of health behaviour theory to sleep health improvement. J Sleep Res 2020;29(05):e12950
16 Mental Health Commission of Canada. Changing directions, changing lives: the mental health strategy for Canada. Calgary: Mental Health Commission of Canada; 2012
17 Blunden S, Rigney G. Lessons learned from sleep education in schools: A review of don'ts. J Clin Sleep Med 2015;11(06): 671–680
18 Díaz-Morales JF, Prieto PD, Barreno CE, Mateo MJC, Randler C. Sleep beliefs and chronotype among adolescents: The effect of a sleep education program. Biol Rhythm Res 2012;43(04):397–412
19 Tarokh L, Saletin JM, Carskadon MA. Sleep in adolescence: Physiology, cognition and mental health. Neurosci Biobehav Rev 2016; 70:182–188
20 John B, Bellipady SS, Bhat SU. Sleep promotion program for improving sleep behaviors in adolescents: A randomized controlled pilot study. Scientifica (Cairo) 2016;2016:8013431
21 Associação Brasileira de Empresas de Pesquisa. Critério de classificação econômica Brasil [Internet]. São Paulo: ABEP; 2012
22 Pinto T, Amaral C, Silva V, Silva J, Leal I, Paiva T. Hábitos de sono e ansiedade, depressão e stress: Que relação? Actas do 12° colóquio. Psicol Educ 2012:990–1006
23 Polos PG, Bhat S, Gupta D, et al. The impact of Sleep Time-Related Information and Communication Technology (STRICT) on sleep patterns and daytime functioning in American adolescents. J Adolesc 2015;44:232–244
24 Felden ÉP, Carniel JD, Andrade RD, Pelegrini A, Anacleto TS, Louzada FM. Translation and validation of the Pediatric Daytime Sleepiness Scale (PDSS) into Brazilian Portuguese. J Pediatr (Rio J) 2016;92(02):168–173
25 Castro LS. Adaptação e Validação do Índice de Gravidade de Insônia (IGI): Caracterização Populacional, Valores Normativos e Aspectos Associados. Dissertation [Master of Science]. Escola Paulista de Medicina, Universidade Federal de São Paulo; 2011
26 Maeda T, Oniki K, Miike T. Sleep education in primary school prevents future school refusal behavior. Pediatr Int 2019;61(10): 1036–1042
27 Wing YK, Chan NY, Man Yu MW, et al. A school-based sleep education program for adolescents: a cluster randomized trial. Pediatrics 2015;135(03):e635–e643
28 Tagler MJ, Stanko KA, Forbey JD. Predicting sleep hygiene: a reasoned action approach. J Appl Soc Psychol 2017;47(01):3–12
29 Zhou HQ, Shi WB, Wang XF, et al. An epidemiological study of sleep quality in adolescents in South China: a school-based study. Child Care Health Dev 2012;38(04):581–587
30 Corrêa MM, Borges MAS, Oliveira ERA. Sleep duration and overweight: is there a relationship in adolescence? Rev Bras Epidemiol 2021;24:e210031
31 de Lima TR, de Sousa GR, de Castro JAC, Silva DAS. Simultaneous presence of excess weight and insufficient hours of sleep in adolescents: prevalence and related factors. J Hum Growth Dev 2017;27(02):148–157
32 Mitchell JA, Rodriguez D, Schmitz KH, Audrain-McGovern J. Sleep duration and adolescent obesity. Pediatrics 2013;131(05): e1428–e1434
33 Adelantado-Renau M, Diez-Fernandez A, Beltran-Valls MR, Soriano-Maldonado A, Moliner-Urdiales D. The effect of sleep quality on academic performance is mediated by Internet use time: DADOS study. J Pediatr (Rio J) 2019;95(04):410–418
34 Alves FR, de Souza EA, de França Ferreira LG, de Oliveira Vilar Neto J, de Bruin VMS, de Bruin PFC. Sleep duration and daytime sleepiness in a large sample of Brazilian high school adolescents. Sleep Med 2020;66:207–215
35 Carskadon MA. Sleep in adolescents: the perfect storm. Pediatr Clin North Am 2011;58(03):637–647
36 Bruni O, Angriman M. Insomnia in children. Medico e Bambino. 2015;34(04):224–233
37 Hale L, Guan S. Screen time and sleep among school-aged children and adolescents: a systematic literature review. Sleep Med Rev 2015;21:50–58
38 Lytle LA, Murray DM, Laska MN, Pasch KE, Anderson SE, Farbakhsh K. Examining the longitudinal relationship between change in sleep and obesity risk in adolescents. Health Educ Behav 2013;40 (03):362–370

