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The BEARS sleep screening tool: Sex, age and circadian typology differences in Spanish adolescents

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ABSTRACT

Background: The aim of this study was to carry out a detailed analysis of the BEARS, providing data on the prevalence of sleep problems according to sex, age and circadian typology in a large sample of Spanish adolescents.
Methods: A total of 2182 adolescents aged 12–17 years completed the BEARS sleep problem questionnaire, which measures bedtime problems (B), excessive daytime sleepiness (E), awakenings during the night (A), regularity and duration of sleep (R), and snoring (S), and the Morningness-Eveningness Questionnaire, which differentiates between evening, intermediate and morning types.
Results: The results indicate a higher prevalence of sleep problems, including late bedtimes on both school days (85 %) and weekends (84 %), excessive daytime sleepiness (47.8 %), sleep less than 8 h during school days (42 %), problems falling asleep at bedtime (32.6 %) and struggling to return to sleep after nocturnal awakenings (26.2 %).
Conclusions: The prevalence of these problems was greater in girls and in evening types. These findings highlight the need to consider individual differences in the clinical management of sleep problems in adolescents.

1. Introduction

Sleep problems during adolescence have increased in recent decades, constituting a true epidemic [1]. One of the primary concerns for educators and families revolves around the repercussions of insufficient sleep on school days and the methods used to identify potential sleep-related issues associated with them. The demand for screening tools applicable in the school setting has increased among educators. Considering the significant impact of poor sleep on adolescents' emotional, behavioural, cognitive, and physical functioning—effects that may persist into adulthood—early detection is crucial to ensuring timely access to treatment [2]. In a recent artificial intelligence-based longitudinal study on adolescent mental health risk prediction that assessed the relative importance of diverse predictors in making these prognostications, sleep disturbances stood out as a robust predictor of high psychiatric illness risk, beyond prosocial behaviours, adverse childhood experiences, family mental health history and family conflict [3].

Sleep duration is influenced by environmental factors such as daylight hours [4] and cultural factors such as the family environment, parental sleeping, eating habits and school start times [5]. Additionally, individual factors such as age, sex, and circadian typology also play significant roles [6]. Understanding these aspects is essential for making general sleep recommendations given that adolescence is a period when health habits may begin to structure the development of health status in adulthood.

This study analysed one of the most well-known screening questionnaire for identifying potential sleep problems in adolescents, the BEARS, which stands for bedtime issues (B), excessive daytime sleepiness (E), awakenings during the night (A), regularity and duration of sleep (R), and snoring (S).

2. Prevalence of sleep problems during adolescence

During adolescence, there is a progressive shift to eveningness and a decrease in sleep length due to the biological and psychosocial changes that occur at this stage of development [7]. Both changes in circadian and homeostatic systems are expressed mainly as delays in bedtime and

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rise time, although this tendency towards eveningness is also moderated by psychosocial factors, which, in turn, most likely feed back into it [8]. The preference for performing activities in the afternoon is clearly manifested during the weekend because, without time restrictions, adolescents follow their own rhythm, tending towards an eveningness orientation. Consequently, during school days, with school starting early, they experience sleep debt. Thus, the number of hours of sleep during school days is progressively reduced during adolescence, leading to an insufficient number of hours of sleep according to the guidelines of the American Academy of Sleep Medicine [9] and American National Sleep Foundation guidelines [10]. Furthermore, since the shift to eveningness during adolescence occurs earlier in girls, the onset of sleep problems begins earlier in these individuals [11].

These changes in the sleep habits of adolescents have negative effects on their daily functioning, both emotionally and cognitively, which can have an impact on poor academic performance and on their relationships with teachers, family and friends [12,13]. This delay in the sleep–wake cycle and chronic sleep debt during school days can lead to possible sleep problems during early adulthood [14].

Several studies conducted in Colombia, Turkey and Spain suggest that approximately 16.8 %–22 % of adolescents experience difficulties initiating sleep at bedtime, whereas 22 %–66 % report significant daytime sleepiness during school days. Additionally, between 2 % and 16 % of these individuals frequently awaken during the night, and 8.8 %–34.7 % exhibit nocturnal snoring, indicating potential disruptions in sleep quality [15–17]. Garaulet et al. [18] reported that approximately one in three European adolescents between the ages of 12.5 and 17.5 did not meet the minimum sleep recommendations (>8 h) for this age group. Girls tend to report more sleep problems than boys do, but not all studies report prevalence rates or individual differences according to sex, age, and circadian typology [19].

3. The BEARS

Thus, the detection of possible sleep problems in the school environment seems to be increasingly needed by educators, who need early detection tools [20]. Among the most widely used screening instruments for sleep problems is the BEARS. The BEARS was created by Owens & Dalzell [21] for primary health care settings, and the simplicity of its questions allows it to be applied by teachers in school settings. The BEARS includes a number of questions with a “yes or no” response format, allowing for quick detection of possible sleep problems, which may or may not constitute a possible sleep disorder. The BEARS, in its version for parents, was validated in the Spanish population via the Children’s Sleep Habits Questionnaire (CSHQ; [15,22]). However, no data are available for the adolescent version of the BEARS in the Spanish population. Additionally, previous studies using the BEARS [17,23,24] do not specify the cut-off points at which bedtime and the number of hours of sleep might constitute a potential sleep problem. Owens et al. (2005:66) reported that "a regular of later than 22:00 h was recorded and used to define a probable or definite problem with sleep regularity and duration", but nothing is said about the cut-off point for weekend sleep duration. According to the United States National Sleep Foundation [10], for the adolescent population between 12 and 18 years of age, a possible sleep problem could derive from a bedtime later than 22:00 h during school days and a night sleep duration of less than 8 h. Considering that adolescents reported a social jetlag of 2 h on average, bedtime later than 24:00 h on weekends could be used as a cut-off [25].

Adolescents are predisposed to later sleep onset times due to a combination of biopsychosocial factors, including circadian phase delay, alterations in the accumulation of homeostatic sleep pressure, and increasing academic and social demands. Additionally, the widespread use of electronic devices, such as computers, mobile phones, and music players, after bedtime further contributes to delayed sleep onset. Consequently, parental reports may not provide accurate estimates of adolescent sleep patterns [26,27]. However, an exception may exist for wake times, as parents typically become less involved in regulating bedtimes but remain actively engaged in waking their children in the morning. As a result, parental reports are likely to overestimate total sleep duration and underestimate actual bedtime delays.

The aim of this study was to carry out a detailed analysis of the BEARS, providing data on the prevalence of sleep problems according to sex, age and circadian typology in a large sample of Spanish adolescents. A greater number of sleep problems are expected in girls, evening types and as adolescence progresses from 12 to 17 years of age.

4. Methods

4.1. Participants

The participants were 2182 adolescents aged 12–17 years (M = 14.7, SD = 1.65). Among this sample, 49.1 % were girls. All adolescents were enrolled in compulsory secondary education at 42 high schools in the city of Zaragoza, which has a population of over 600,000 people. The active population works in the service (72.03 %) and industry (18.14 %) sectors. The board of directors authorized the study after parents’ permission was obtained. Participation was voluntary, unpaid and anonymous. This study was performed according to international ethical standards [28], and its procedures complied with the ethical standards outlined in the Helsinki 169 Declaration of 1975 (revised in 1983) and were previously approved by the institutional research committee (Ref. CE_20240711_15_SOC).

4.2. Variables and instruments

4.2.1. Sleep problems

The BEARS is a brief questionnaire that includes questions about the most common sleep problems affecting children/adolescents aged 2–18 years [21]. This instrument includes a set of basic questions that evaluate sleep-related areas such as bedtime problems (B), including difficulty going to bed and falling asleep; excessive daytime sleepiness, which includes behaviours typically associated with daytime somnolence in children (E); awakenings during the night (A); regularity and duration of sleep (R); and snoring (S). In this study, the version of the BEARS for adolescents published on the website of the Spanish Association of Primary Care Paediatrics (http://www.aepap.org/gtsiaepap/) was used, which includes the following questions: 1. Do you have any problems falling asleep at bedtime? (*B*edtime problems); 2. Do you feel sleepy a lot during the day, in school? (*E*xcessive daytime sleepiness). The original question also included “while driving”, but the legal age of driving in Spain is 18 years, so these words were deleted. 3. Do you wake up a lot at night? (*A*wakenings during the night); 4. Have trouble getting back to sleep?; 5. What time do you usually go to bed on school nights?; 6. Weekends? How much sleep do you usually get? (*R*egularity and duration of sleep); 7. Have you ever been told that you snore at night? (*S*noring). The original questions were directed to parents (“Does your teenager snore loudly or nightly?”) and we changed the wording so that it was answered by adolescents. Two new supplementary questions were added: “8. What time do you usually go to bed on weekends?” and “9. School? How much sleep do you usually get?”. The response format for questions 1, 2, 3, 4, and 7 was "yes or no". In addition, we scored delayed bedtime on weekends, calculating the difference between bedtime on weekends and bedtime on school days (Question 8 minus Question 5). A difference of more than 2 h was coded as "yes". Question 5 was recoded as "yes" in those cases where bedtime during school days was later than 22:00, whereas Question 8 was recoded as "yes" in those cases where bedtime during weekends was later than 24:00. Questions 6 and 9 were recoded as "yes" in those cases whose sleep duration was less than 8 h. Concurrent validity of the Spanish translation of the BEARS to detect sleep problems in paediatric nursing assessments was tenable via the Children Sleep Habits Questionnaire (CSHQ, [15,22]). Acceptable psychometric properties have also been found in Colombian adolescents via

a continuous response scale ranging from 1 to 7 for each item [17].

4.2.2. Circadian typology

The Morningness-Eveningness Questionnaire (MEQ) is composed of 19 items aimed at measuring whether a person's peak of alertness occurs in the morning, afternoon/evening or intermediate times of the day. Fourteen items are related to the preference of activities at different times of the day without specifying the specific time of day, and the remaining five items use specific times [29]. MEQ-15 Spanish version for adolescents was used [30]. The total MEQ-15 score ranges from 19 (eveningness) to 62 (morningness), with acceptable reliability (Cronbach's alpha, $\alpha = .76$ and McDonald's omega, $\omega = 0.78$). The values corresponding to the 20th and 80th percentiles of the MEQ-15 (33 and 44 scores, respectively) were used to determine the evening, intermediate and morning types.

4.2.3. Procedure and data analysis

Forty-two high schools in the city of Zaragoza (41.65° N latitude and 0.89° W longitude) that were enrolled in the Educational Activities Program of the Education Service participated in the study. This educational program was proposed by the City Council and consists of different educational talks on time use, nutrition, physical activity and sleep hygiene. At the beginning of the first session of the program, the BEARS and MEQ-15 were administered along with demographic information (age and sex). The questionnaires were completed in a counterbalanced order during the usual school schedule (approx. 8:30–15:00 h) in groups of approximately 25–30 adolescents. The assessment sessions lasted approximately 15 min. The chi-square (χ^2) test was used to assess the associations between BEARS and sex, age, and circadian typology separately, whereas the contingency coefficient (C) was calculated to measure the strength of the associations. In the second step, the associations of BEARS with circadian typology adjusted by sex and age were analysed via multivariable logistic regression. Multivariate odds ratios (OR) and their corresponding confidence intervals (CI) were reported. IBM SPSS®, v 25.0 (SPSS Inc., Chicago, IL, USA) was used for data analyses.

5. Results

The prevalence of possible sleep problems based on the BEARS questions is shown in Table 1. The most important signs of possible sleep problems were late bedtime during the school days (Question 5), with 85 % of the adolescents going to bed later than 22:00 h, and late bedtime during the weekend (Question 8), with 84 % of the adolescents going to bed later than 24:00 h. Excessive sleepiness during the school day (Question 2), with 47.8 % of the adolescents reporting feeling sleepy; delaying bedtime by more than 2 h during the weekend (Question 10), with 46.6 %; and sleeping less than 8 h during the school days (Question 9), with 42 %. Problems falling asleep at bedtime (Question 1) were reported by 32.6 %, and trouble returning to sleep (Question 4) was reported by 26.2 % of the adolescents. The percentages of adolescents who snore (Question 7) and wake up a lot during the (Question 3) night were 22.4 % and 17.2 %, respectively. Finally, 13.5 % of the adolescents reported sleeping less than 8 h during the weekends (Question 6).

Sex differences ($p < .001$) in responses to the BEARS questions (see Table 1) indicated that girls reported greater difficulties falling asleep at bedtime (C = 0.19), slept longer on school days (C = 0.13), woke up frequently during the night (C = 0.07), and had more difficulty falling back asleep (C = 0.06). Additionally, they reported shorter sleep durations on school nights (C = 0.09). In contrast, boys were more likely to delay bedtime by more than 2 h on weekends (C = 0.08). No significant differences were found in response to the questions regarding bedtime on school nights, sleep duration on weekends, reports of snoring at night, or bedtime on weekends.

Regarding circadian typology differences ($p < .001$; see Table 1), a greater number of evening-type adolescents reported difficulties falling asleep at bedtime (C = 0.18), experiencing excessive daytime sleepiness at school (C = 0.27), and having trouble falling back asleep (C = 0.08). They also reported later bedtimes on school nights (C = 0.18) and weekends (C = 0.24), as well as shorter sleep durations on weekends (C = 0.12) and school days (C = 0.20). Additionally, evening-type adolescents were more likely to delay bedtime on weekends (C = 0.17). However, no significant differences were observed in reports of frequent night-time awakenings and nocturnal snoring.

With respect to age differences ($p < .001$; percentages for 12, 13, 14, 15, 16 and 17 years old in parentheses), there was a progressive increase with increasing age of sleepiness during the school days (37.7 %, 42.2 %, 48.8 %, 50.9 %, 51.6 % and 55.6 %; $\chi^2 = 39.90$, C = 0.11), a progressive delay in bedtime on school days (66.8 %, 73.5 %, 84.5 %, 89.9 %, 93.1 % and 93.5 %; $\chi^2 = 158.26$, C = 0.26) and weekends (60.4 %, 75.6 %, 86.2 %, 88.9 %, 91.4 %, and 93.1 %; $\chi^2 = 202.89$, C = 0.28), a progressive reduction in sleep length during the school days (16.9 %, 27.2 %, 37.8 %, 49 %, 55.8 %, and 59.2 %; $\chi^2 = 205.89$, C = 0.28), and finally, a progressive delay in bedtime on weekends compared with the school days (35.8 %, 46.8 %, 44.9 %, 45.9 %, 52.9 %, and 53.9 %; $\chi^2 = 29.96$, C = 0.11).

Finally, the association of BEARS with circadian typology adjusted by sex and age was analysed via multivariable logistic regression (see Tables 2 and 3), which revealed that difficulty falling asleep at the desired time (Q1) was associated with being a girl and evening types. Frequent daytime sleepiness at school (Q2) was also more common among girls, as well as at ages 14, 16, and 17, while it was least prevalent among morning types. Waking up frequently during the night (Q3) was associated with being a girl, whereas difficulty returning to sleep (Q4) was linked to being a girl and was most common at age 13. Compared with that of 12-year-olds, the usual bedtime on school nights (Q5) was later than 22:00 h for adolescents aged 14 to 17, compared to 12-year-olds, with a lower prevalence of intermediate and morning types than evening types. With respect to weekend sleep duration (Q6), 13-year-olds were the least likely to sleep less than 8 h, as were intermediate

Table 1
Percentages of sleep problems in each question of the BEARS questionnaire according to sex and circadian typology (Evening, Intermediate and Morning Types).

Items of the BEARS adolescent version	Total	Boys	Girls	χ^2	E-Types	I- Types	M – Types	χ^2
1. Do you have any problems falling asleep at bedtime?	32.6	23.9	41.9	84.08***	45.6	31.4	19.7	70.77***
2. Do you feel sleepy a lot during the day, in school?	47.8	41.9	54.4	36.64***	65.8	47.1	24.9	152.43***
3. Do you wake up a lot at night?	17.2	14.3	20.1	12.86***	21.4	15.7	16.1	8.08***
4. Have trouble getting back to sleep?	26.2	23.4	29.1	9.24***	32.4	23.8	26.5	12.75***
5. What time do you usually go to bed on school nights? (1)	85	84.3	85.6	0.65	92.5	86.2	73.5	66.61***
6. Weekends? How much sleep do you usually get? (2)	13.5	15.7	11.4	4.48	19.6	10.1	11.2	14.20**
7. Have you ever been told that you snore at night?	22.6	24.8	20.4	5.53	23.6	23.5	21.3	0.22
New supplementary questions								
8. What time do you usually go to bed on weekend? (3)	84	84.5	83.4	1.33	94.7	84.7	67.8	121.98***
9. School? How much sleep do you usually get? (2)	42	37.6	46.6	18.11***	57.6	38.2	29.1	84.04***
10. Delayed bedtime on weekends (4)	46.6	50.4	42.7	14.99***	60.9	43.4	37.2	60.43***

Note: (1) "yes" = bedtime later to 22:00 h; (2) "yes" = less than 8 h; (3) "yes" = bedtime later to 24:00 h; (4) "yes" = more than 2 h later than during school days. **$p < .01$; ***$p < .001$.

Table 2
Adjusted odds ratios and 95 % CIs of associations of BEARS' questions (1–5) by sex, age and circadian typology in multivariate logistic regressions.

	1. Do you have any problems falling asleep at bedtime?		*2. Do you feel sleepy a lot during the day, in school?*		*3. Do you wake up alot at night?*		*4. Have trouble getting back to sleep?*		*5. What time do you usually go to bed on school nights? (1) *	
	B (*SE*)	*OR* and 95 % CI	B (*SE*)	*OR* and 95 % CI	B (*SE*)	*OR* and 95 % CI	B (*SE*)	*OR* and 95 % CI	B (*SE*)	*OR* and 95 % CI
Sex (boys)	**0.67*** (0.18)**	1.96 (1.39,2.77)	**0.65** (0.19)**	1.91 (1.32,2.76)	**0.69* (0.22)**	2.01 (1.3,3.07)	**0.43* (0.19)**	1.53 (1.06,2.22)	−0.05 (0.26)	0.95 (0.57,1.59)
Age (13)	0.1 (0.41)	1.1 (0.50,2.45)	0.48 (0.41)	1.62 (0.73,3.6)	0.88 (0.47)	2.42 (0.97,6.02)	**0.92* (0.41)**	2.51 (1.13,5.59)	0.49 (0.42)	1.63 (0.72,3.71)
Age (14)	0.28 (0.33)	1.32 (0.69,2.52)	**0.74* (0.34)**	2.1 (1.08,4.1)	0.27 (0.41)	1.31 (0.59,2.9)	−0.42 (0.35)	0.66 (0.33,1.3)	**1.32*** (0.37)**	3.75 (1.82,7.73)
Age (15)	0.11 (0.33)	1.11 (0.58,2.14)	0.46 (0.34)	1.59 (0.82,3.09)	0.26 (0.41)	1.3 (0.58,2.9)	−0.2 (0.35)	0.82 (0.42,1.63)	**2.43*** (0.49)**	11.32 (4.31,29.74)
Age (16)	0.21 (0.31)	1.23 (0.67,2.26)	**0.64* (0.31)**	1.91 (1.03,3.52)	−0.34 (0.4)	0.71 (0.32,1.57)	−0.21 (0.32)	0.81 (0.43,1.51)	**2.35*** (0.42)**	10.51 (4.66,23.72)
Age (17)	0.34 (0.32)	1.41 (0.74,2.66)	**0.99* (0.34)**	2.7 (1.38,5.26)	0.65 (0.39)	1.91 (0.89,4.11)	−0.39 (0.34)	0.68 (0.35,1.33)	**2.38*** (0.47)**	10.78 (4.31,26.98)
Circadian Typology (intermediate types)	**−0.74* (0.35)**	0.48 (0.24,0.94)	−0.52 (0.34)	0.59 (0.31,1.15)	−0.18 (0.45)	0.83 (0.35,2.01)	−0.44 (0.36)	0.64 (0.32,1.3)	**−0.8* (0.36)**	0.45 (0.22,0.9)
Circadian Typology (morning types)	**−0.93* (0.38)**	0.39 (0.19,0.83)	**−0.94** (0.36)**	0.39 (0.19,0.79)	−0.33 (0.48)	0.72 (0.28,1.83)	−0.56 (0.38)	0.57 (0.27,1.19)	**−1.11** (0.37)**	0.33 (0.16,0.69)
Constant	−0.7 (0.28)		−0.23 (0.28)		−1.9 (0.36)		−0.79 (0.29)		0.25 (0.3)	

Note: All interactions were not significant, so they are not included in the table.
Sex (reference group = boys); Age (reference group = 12 years-old); Circadian typology (reference = evening types); B = Beta Coefficient; *SE* = Standard Error; *OR* = Odd Ratio; CI = confidence interval; $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

and morning-year-olds, who also had the lowest likelihood of insufficient sleep. Snoring at night (Q7) was more common among adolescents aged 13–16 years and was also more common among intermediate-aged individuals. Compared with 12-year-olds, weekend bedtime later than 22:00 h (Q8) was more prevalent across all ages and was less common among morning types. Sleeping less than 8 h on school nights (Q9) was more common among girls and across all age groups. Finally, delayed bedtime on weekends was most pronounced at ages 13, 15, 16, and 17.

6. Discussion

In this study, adolescents independently completed the BEARS sleep problem screening questionnaire. Differences based on sex, age, and circadian typology were analysed across the seven core questionnaire items, along with three additional questions assessing weekend bedtime, total sleep duration on school days, and delayed bedtime on weekends.

The results indicate that key indicators of sleep problems include late bedtimes on both school days (later 22:00 h) and weekends (later 24:00 h) for 85 % and 84 % of adolescents, excessive daytime sleepiness (47.8 %), and sleep deprivation during school days, with 42 % of adolescents reporting less than 8 h of sleep. Additionally, a substantial proportion of adolescents reported sleep difficulties, with 32.6 % experiencing sleep problems and 26.2 % struggling to return to sleep after nocturnal awakenings, which may be indicative of poor sleep quality. Differences between school days and weekends became evident at the onset of adolescence, marked by the emergence of a shift to eveningness. On weekends, both bedtime and rise time are significantly later, and total sleep duration is longer than that on weekdays. This pattern is characteristic of this age group, reflecting a well-documented biological shift in sleep preference, where adolescents tend to bed later and wake up much later than both children and adults do (Galland et al., 2021). These patterns reflect a lack of regularity in sleep habits across school days and weekends. Such sleep disturbances are chronic among adolescents and result from multiple factors inherent to this developmental stage, described as the "perfect storm" [7,31].

In addition to reporting the prevalence of BEARS items related to potential sleep disturbances in self-reported adolescents, this study also provides prevalence data stratified by sex and circadian typology. The results suggest that girls and evening types are at greater risk of developing future sleep problems. The prevalence of potential sleep problems in adolescence, as measured by the BEARS questionnaire, is greater among girls, particularly concerning difficulties falling asleep at bedtime, excessive daytime sleepiness at school, frequent nocturnal awakenings, and difficulty returning to sleep. These results are in line with those previously obtained in the Spanish population, which indicated that girls reported earlier rise times on weekdays, later rise times on weekends, longer sleep lengths on weekends, and greater social jetlag and weekend rise time delays [32]. Additionally, these findings may be attributed to the earlier onset of pubertal development in girls than in boys [33] in interactions with family and school environment factors. Less parental control over boys could be one hypothesis explaining their longer delayed bedtimes on weekends [34].

Finally, sleep problems were more prevalent among evening chronotypes across all BEARS questions, except for snoring at night. These results were expected since the consequences of increased eveningness for health, performance, and peer relationships are well known [35]. These findings highlight the need to consider circadian preference in the clinical management of youth sleep problems, and although the prevalence of possible sleep problems is high, risk is potentially favourable, as sleep disturbances are modifiable with evidence-based behavioural interventions [40]. Although several associations reached statistical significance, effect sizes of sex differences (e.g., contingency coefficients between 0.07 and 0.19) indicate only modest relationships. The largest effect sizes observed for circadian typology differences—specifically excessive daytime sleepiness at school and later bedtimes on weekends, both more prevalent in evening types—may be considered clinically

Table 3
Adjusted odds ratios and 95 % CIs of associations of BEARS' questions (6–7) and additional questions (8-10) by sex, age and circadian typology in multivariate logistic regressions.

	*6. Weekends? How much sleep do you usually get? (2) *		*7. Have you ever been told that you snore at night?*		*8-B6. 8. What time do you usually go to bed on weekend? (1)*		*9-B7. 9. School? How much sleep do you usually get? (2)*		*10- B6-5. 10. Delayed bedtime on weekends (3)*	
	B (*SE*)	*OR* and 95 % CI	B (*SE*)	*OR* and 95 % CI	B (*SE*)	*OR* and 95 % CI	B (*SE*)	*OR* and 95 % CI	B (*SE*)	*OR* and 95 % CI
Sex (boys)	0.46 (0.32)	1.59 (0.85,2.95)	−0.09 (0.2)	0.92 (0.61,1.37)	−0.11 (0.42)	8.89 (0.44,2.3)	**0.76*** (0.19)**	2.13 (1.47,3.11)	−0.29 (0.19)	0.75 (0.52,1.08)
Age (13)	**−1.44* (0.51)**	0.24 (0.09,0.64)	**1.14* (0.5)**	3.14 (1.18,8.37)	**1.73 (0.8)**	5.67 (1.19,26.93)	**1.08* (0.43)**	2.96 (1.26,6.91)	**1.67 (0.46)**	5.3 (2.13,13.17)
Age (14)	0.29 (0.63)	1.33 (0.39,4.57)	**0.86* (0.44)**	2.37 (0.99,5.67)	**2.21*** (0.66)**	9.14 (2.5,33.45)	**1.38*** (0.36)**	3.97 (1.95,8.07)	0.59 (0.34)	1.8 (0.93,3.47)
Age (15)	−0.1 (0.58)	0.9 (0.29,2.83)	**0.9* (0.45)**	2.46 (1.02,5.91)	**3.24*** (1.05)**	25.62 (3.27,20.05)	**1.64*** (0.37)**	5.14 (2.5,10.58)	**1.4 (0.36)**	4.07 (2.03,8.17)
Age (16)	−0.3 (0.54)	0.74 (0.26,2.14)	**0.87* (0.42)**	2.4 (1.05,5.5)	**2.02*** (0.55)**	7.57 (2.57,22.28)	**1.93*** (0.35)**	6.9 (3.49,13.66)	**0.97 (0.32)**	2.63 (1.4,4.93)
Age (17)	−0.35 (0.55)	0.71 (0.24,2.1)	0.5 (0.45)	1.64 (0.68,3.97)	**2.68*** (0.78)**	14.61 (3.17,67.31)	**2.21*** (0.37)**	9.08 (4.36,18.92)	**1.11 (0.34)**	3.03 (1.55,5.89)
Circadian Typology (intermediate types)	**−0.86* (0.35)**	0.42 (0.22,0.93)	**0.9* (0.45)**	2.46 (1.02,5.92)	−0.64 (0.45)	0.53 (0.22,1.29)	−0.77 (0.43)	0.46 (0.21,1.06)	0.11 (0.34)	1.12 (0.57,2.2)
Circadian Typology (morning types)	**−0.79* (0.38)**	0.31 (0.17,0.82)	0.66 (0.47)	1.94 (0.78,4.83)	**−1.28** (0.45)**	0.28 (0.11,0.67)	−0.27 (0.42)	0.77 (0.33,1.76)	−0.48 (0.36)	0.62 (0.3,1.26)
Constant	1.56 (0.43)		−1.88 (0.4)		1.21 (0.4)		−1.57 (0.32)		−0.33 (0.29)	

Note: All interactions were not significant, so they are not included in the table.
Sex (reference group = boys); Age (reference group = 12 years-old); Circadian typology (reference = evening types); B = Beta Coefficient; *SE* = Standard Error; *OR* = Odd Ratio; CI = confidence interval; $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

relevant. Similarly, regarding age differences, the progressive reduction in sleep duration on school days and the progressive delay in bedtime on both school days and weekends (contingency coefficients ranging from 0.26 to 0.28) could also be regarded as clinically meaningful. Smaller associations, although statistically significant, may have limited practical implications and should be confirmed in future studies with longitudinal or clinical designs.

This study reported the prevalence of BEARS questions in adolescents, with them reporting their answers themselves. Limitations of the study include the lack of collection of more detailed demographic data. The family's socioeconomic status was not controlled, and low socioeconomic status is known to be related to a shorter duration of sleep [36], as well as a greater number of sleep disorders, such as disorders of initiating and maintaining sleep, disorders of arousal, and disorders of excessive somnolence [37]. The interaction between age and sex in relation to sleep problems may be confounded by pubertal stage; therefore, future studies should control for this variable. Moreover, participants' mental health was not assessed, not only with respect to sleep disorders but also regarding other conditions known to affect sleep, such as neurodevelopmental disorders, which have a significant and increasing prevalence in the population [38]. Investigating the use of the BEARS in educational settings with afternoon or evening schedules would also be a valuable avenue for future research to examine the impact of school schedules on sleep problems [39]. Finally, future studies should assess the sensitivity and specificity of the BEARS in adolescents by comparison with validated measures of sleep disorders (e.g., the Children's Sleep Habits Questionnaire; [22]), objective measures such as actigraphy, and other chronobiological markers including peripheral skin temperature and light exposure.

CRediT authorship contribution statement

José Luis Manjón-Caballero: Writing – review & editing, Visualization, Validation, Methodology, Data curation. **Juan F. Díaz-Morales:** Writing – review & editing, Writing – original draft, Supervision, Software, Resources, Project administration, Funding acquisition, Formal analysis, Conceptualization.

Patient consent statement

The parents of the participants and the participating adolescents themselves gave their consent to participate.

Data availability statement

Data are available upon request from the authors.

Ethics approval statement

The study has followed international ethical recommendations and has been approved by the Ethics Committee of the Complutense University of Madrid Ref: CE_20240711_15_SOC.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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