Mediterranean Journal of Clinical Psychology

ISSN 2282-1619

MJCP

Volume 10, n 3, 2022

Clinical Psychology

Assessing Sleep Habits in Italian Community-Dwelling Adolescents: Psychometric Properties of the School Sleep Habits Survey Scales

*Antonella Somma [1 §], Sara Marelli [1, 2 §], Vincenza Castronovo [2], Giulia Gialdi [1], Alessandra Castelnuovo [2], Samantha Mombelli [2], Irene Lonati [3], Giovanni Masso [4], Andrea Fossati [1 *], Luigi Ferini-Strambi [1, 2], Luana Nosetti [3]*

Abstract

Background. In the field of adolescent sleep research, different sleep surveys have been implemented; however, psychometric properties of these instruments have been investigated only minimally.

Methods. In order to assess the psychometric properties of the Sleep–Wake Problems Behaviour Scale (SWP), the Sleepiness Scale (SLS), and the Morningness/Eveningness Questionnaire (ME), a moderately large sample of community-dwelling Italian adolescents (N = 778; 59.8% female; mean age = 15.77 years) was administered the Italian translation of the School Sleep Habits Survey.

Results. Internal consistency estimates values were satisfactory for all measures; dimensionality analyses suggested a unidimensional structure for SWP, SLS and ME, respectively. Goodness-of-fit statistics for the one-factor model of the SLS, SWP, and ME scale items were adequate for all measures. Non-redundant taxometric analysis results consistently suggested a dimensional latent structure for the SLS, SWP, and ME, respectively.

Conclusion. Our findings supported the use of the SLS, SWP, and ME total scores as measures of sleepiness, sleep-wake problem, and morningness/eveningness, at least among Italian community-dwelling adolescents, and encourage practitioners to rely on the conventional percentiles in order to interpret the SLS, SWP, and ME total scores.

[1] School of Psychology, Vita-Salute San Raffaele University, Milan, Italy

[2] Neurology – Sleep Disorder Center, IRCCS San Raffaele Scientific Institute, Milan, Italy

[3] Division of Pediatrics, "F. Del Ponte" Hospital, University of Insubria, 21100 Varese, Italy

[§] These authors contributed equally to this work and should be considered co-first authors.

E-mail corresponding author: fossati.andrea@hsr.it

Keywords:
Sleep–Wake Problems Behaviour Scale; Sleepiness Scale; Morningness/Eveningness Questionnaire; High school student adolescents; Factor structure; Taxometrics.

Received: 29 August 2022
Accepted: 14 December 2022
Published: 28 December 2022

Citation: Somma, A., Marelli, S., Castronovo, V., Gialdi, G., Castelnuovo, A., Mombelli, S., Leonati, I., Masso, G., Fossati, A., Ferini-Strambi, L., Nosetti, L. (2022). Assessing Sleep Habits in Italian Community-Dwelling Adolescents: Psychometric Properties of the School Sleep Habits Survey Scales. *Mediterranean Journal of Clinical Psychology 10*(3).
https://doi.org/10.13129/2282-1619/mjcp-3557

1. Introduction

The numerous physical, psychological and social changes that characterize adolescence, can affect also sleep's structure and habits (e.g., Crowley, Wolfson, Tarokh, & Carskadon, 2018). In adolescents, the most frequent sleep disorders are: Insufficient sleep, Delayed Sleep-Wake Phase Disorder, Excessive daytime sleepiness, Narcolepsy and Restless legs syndrome (Kotagal & Pianosi, 2006). During adolescence, a lifestyle that sacrifices sleep (for other activities, like study or socialization) can cause insufficient sleep (Kliegman et al., 2015). Not surprisingly, insomnia is the most frequent sleep disorder in adolescence, with a prevalence between 11 and 47% (Fernandez-Mendoza et al., 2016) while DSM-5 reports a prevalence of 18.5% (23.6% females and 12.5% males) between 16 and 18 years.

Notwithstanding these discrepancies, previous studies showed that insomnia is underdiagnosed in adolescence (de Zambotti et al., 2018) and that untreated insomnia during adolescence can lead to a persistence of insomnia during adulthood (Fernandez-Mendoza et al., 2016). Moreover, previous studies (e.g., Ballesio, Aquino, Kyle, Ferlazzo & Lombardo, 2019; Somma et al., 2020) showed that individuals with insomnia may have some impairments in executive functioning (e.g., inhibitory control, cognitive flexibility, and working memory), as compared to controls. Indeed, a wide range of cognitive functions may be influenced by insufficient or poor sleep, particularly during adolescence (e.g., Astill, Van der Heijden, Van IJzendoorn, & Van Someren, 2012; de Bruin, Dewald-Kaufmann, Oort, Bögels, & Meijer, 2015).

Notably, Delayed Sleep-Wake Phase Disorder is a circadian disorder characterized by a significantly late synchronized sleep pattern compared to the general population, and it becomes incompatible with daily activities (e.g., attending school and doing morning activities). From an epidemiological point of view, it is the most frequent among circadian rhythm disorders, with a prevalence of 7 - 16%, especially in adolescents and young adults (Gradisar et al., 2011). Furthermore, insomnia and delayed sleep-wake phase disorder are often associated (Sivertsen et al., 2013). Delayed Sleep-Wake Phase Disorder is characterized by the tendency to postpone the time when you go to sleep and the time when you wake up; however, during school days, there is a reduction in sleep hours and an increase in daytime sleepiness. Moreover, sleep is characterized by a great difficulty in falling asleep and in wake up early, despite the prospect of an interesting activity, and accompanied by drowsiness. Teenagers with this disorder have more school absences and poorer test performance than peers (Gradisar et al., 2011). Notably, this disorder can represent an amplification of physiological characteristics in adolescent sleep, namely, the tendency to go to sleep later and the conversion of the chronotype to the nocturnal

type. For this reason, it can be difficult to distinguish between what can be considered normal and what is pathological (Gradisar et al., 2011).

Several studies found a high prevalence (52.7%) in adolescents of somnolence, another sleep-related disorder (Gradisar et al., 2011). Observing high schools and universities, daytime sleepiness is so widespread among adolescents that it seems almost "normal" (Carskadon, 1990). Against this background, systematic screening for sleep issues might assist in early identification of academic, behavioral, health and quality of life problems, which if treated will result in better outcomes for both adolescents and their families (e.g., Spruyt & Gozal, 2011).

In the field of child and adolescent sleep research, different large-scale sleep surveys have been implemented (e.g., Spruyt & Gozal, 2011); however, psychometric properties for these instruments have been investigated only for a minority of these assessment instruments (e.g., Spruyt & Gozal, 2011). Consequently, survey instruments have been created, adapted or translated with little scrutiny regarding their reliability, factor structure, and validity, and therefore, concerns regarding findings are justified (e.g., Spruyt & Gozal, 2011). Moreover, the sparseness of reliability and validity data hampers direct comparisons of child and adolescent sleep problems, as well as the understanding of their impact on everyday functioning (e.g., Spruyt & Gozal, 2011). Likewise, the treatment of sleep disorders in children and adolescents should benefit from well-designed, psychometrically sound tools.

The School Sleep Habits Survey (SSHS; Carskadon, Seifer, & Acebo, 1991; Wolfson & Carskadon, 1998; Wolfson et al., 2003) was developed by the Bradley Hospital/Brown University Sleep Research Lab in 1994; it is a self-report, paper-and-pencil measure and requires approximately 20 minutes for completion. The SSHS represents one of the most widely used instruments for gathering valuable demographic and behavioral information, including sleep schedule regularity, daytime sleepiness, sleep-wake problems, and preference for morningness or eveningness (Carskadon et al., 1991). The SSHS was originally administered to over 3,000 high school students in Rhode Island; then, Acebo and Carskadon (2002) reported results from the large high school survey. Several studies have been subsequently conducted relying on this instrument in a number of countries (e.g., Loessl et al., 2008), including Italy (e.g., Russo, Bruni, Lucidi, Ferri, & Violani, 2007).

Notwithstanding its usefulness and widespread diffusion, the SSHS psychometric properties have been analyzed only minimally (Shahid & Wilkinson, 2012). Specifically, previous studies focused exclusively on the internal consistency reliability for the three main scales included in the SSHS, namely, the Sleep–Wake Problems Behaviour Scale (SWP; i.e., 15 items assessing sleep-wake problems), the Sleepiness Scale (SLS; i.e., 10 items evaluating daytime sleepiness),

and the Morningness/Eveningness Questionnaire (ME; i.e., 10 items assessing circadian preference). Previous studies (e.g., Becker et al., 2020; Russo et al., 2007) reported acceptable internal consistency (i.e., Cronbach's alpha values higher than .70) for the SWP, SLS, and ME, with findings in line with the results of the original validation study of the SSHS (Carskadon et al., 1991). However, to the best of our knowledge, no previous study was specifically devoted to the assessment of the SSHS psychometric properties.

Although understanding the latent structure of sleep problems represent a relevant research topic (e.g., Ren, Wang, Phull & Zhang, 2015), empirical evaluations testing the hypotheses that sleep disturbances should be considered a qualitatively distinct syndrome (i.e., a taxon) or whether it possesses a dimensional latent structure (i.e., existing along a continuum of severity), are still scarce. These issues are not trivial because the development and selection of assessment instruments should be consistent with the latent structure of the variable. For instance, the assessment of dimensional constructs should aim at discriminating effectively in all areas of the dimension, whereas for taxonic constructs assessment instruments should attempt to sort individuals at an optimal cut off and maximize valid classifications (e.g., Ruscio et al., 2018). Recently, Ren and colleagues (2015) relied on taxometric procedures to examine the latent structure of sleep problems in a sample of 912 participants with age ranging from 6 to 14 years and showed that the latent structure of sleep problems was better categorized as dimensional rather than categorical. The results of Ren and colleagues' (2015) study suggested that a dimensional assessment of sleep disorders need to be entertained in childhood and adolescence in order to provide a more appropriate assistance. However, further investigation of this topic is needed (e.g., Ren et al., 2015), and normative data for adolescent samples may be useful for screening purposes.

Against this background, in the present study we administered the SSHS to a moderately large sample of community-dwelling Italian adolescents in order to assess: (a) the internal consistency reliability and factor structure of the SWP, SLS, and ME, respectively; (b) the latent structure of sleep problems in adolescence; and (c) the normative scores for the SLS, SWP, and ME total scores in Italian adolescent high school students.

2. Methods

2.1 Participants

Participants were 778 adolescent high school students with a mean age of 15.77 years, *SD* = 1.49 years (range = 13-19 years); 465 participants (59.8%) were female and 311 (40.1%) were male, whereas two participants (0.3%) refused to disclose his/her gender. Participants were

attending public high school in the North of Italy. In order to participate in the present study, subjects had to be in their "teen" years (i.e., 13 years - 19 years) and were required to speak Italian as their first language in order to avoid cultural and lexical bias in questionnaire responses.

2.2 Procedures

After obtaining Institutional Review Board approval from the principals of the schools, researchers recruited adolescents from classrooms. The Italian translation of the SSHS (e.g., Russo, Bruni, Lucidi, Ferri, & Violani, 2007) was administered anonymously during class time by graduate research assistants when teachers were not present in the classrooms. Written informed consents from parents and the adolescent were obtained prior to study participation.

Participants were all volunteers who received no incentive for taking part in the research. Although socio-economic status was not directly controlled for, it should be emphasized that participants were selected from public high schools. Data from the National Institute of Statistics of Italy (ISTAT, 2017) showed that 95.8% of Italian adolescents were attending high school during 2015/2016, thus suggesting that samples of adolescents attending public high schools used in the present set of studies are likely representative of the Italian adolescent population.

2.3 Measures

School Sleep Habits Survey (SSHS; Wolfson & Carskadon, 1998). The SSHS includes three different measures: (a) a Sleepiness Scale (SLS) developed to assess daytime sleepiness. The SLS includes 10 items assessing difficulty staying awake in various situations (e.g., studying, at school, watching television). Items were measure on a four-point Likert scale ranging from *1 = no difficulty to stay awake* to *4 = struggling to stay awake and falling asleep*. In line with previous studies (e.g., Becker, Kapadia, Fershtman, & Sciberras, 2020; Russo et al., 2007), the item regarding sleepiness during driving was removed in the current study because all participants were below driving age; (b) a Sleep-Wake Problems Behavior Scale (SWP) which consists of 15 items assessing irregular sleep habits, prolonged sleep latency and difficulties waking in the morning on a Likert-type scale (*1 = Never*, *2 = Once*, *3 = Twice*, *4 = Several Times*, *5 = Everyday/night*); (c) a Morningness/Eveningness Questionnaire (ME) to measure circadian preference. The ME is composed by 10 forced choice items assessing preference for morningness or eveningness, with lower scores indicating extreme eveningness and higher scores indicating extreme morningness.

2.4 Data analysis

Cronbach's α was used as an internal consistency measure; item-total *r* coefficient corrected for part-whole overlap ($r_{p\text{-}w}$) was used to assess item validity.

Quasi-inferential parallel analysis (PA; Buja & Eyuboglu, 1992) and minimum average partial statistic (MAP; Zwick & Velicer, 1986) were used to assess the number of latent dimensions underlying the item polychoric correlation matrix of each scale. Both quasi-inferential PA and MAP dimensionality analyses were carried according to unweighted least square factor analyses; thus, quasi-inferential PA were expressed as percentage of variance explained by each factor. In quasi-inferential PA, only real-data factors that exceed the 95th percentile of the distribution of the corresponding factors based on 1,000 random polychoric correlation matrices (obtained by random permutations of the original data) should be retained. Rather, MAP analysis suggests retaining the number of factors that minimizes the MAP statistic value.

Weighted least square mean and variance adjusted (WLSMV) confirmatory factor analyses (CFAs) were carried out to test the goodness of fit of the one-factor model of the items of each scale. Goodness-of-fit of individual models was assessed using fit indices and cut-off values suggested in Hu and Bentler' (1999) study.

Taxometric analyses were carried out relying on three non-redundant methods, namely, mean-above-minus-mean-below-a-cut (MAMBAC), maximum eigenvalue analysis (MAXEIG), and latent mode (L-Mode) analysis (see Ruscio et al., 2011 for a description of the techniques). Based on Ruscio and colleagues' (2018) indications, comparison curve fit index (CCFI) with values close to 0 indicating dimensional distribution and values close to 1 indicating categorial distribution; CCFI values in the .45-.55 range are considered to indicate inconclusive findings.

3. Results

Item descriptive statistics, internal consistency estimates (i.e., average and median inter-item *r* values), and $r_{p\text{-}w}$ values for the SLS, SWP, and ME scale items, respectively, are listed in Table 1.

Table 1. Sleepiness Scale, Sleep-Wake Problems Behavior Scale, and Morningness/ Eveningness Questionnaire Item Analysis Results: Descriptive Statistics, Internal Consistency Estimates (i.e., Average and Median Inter-Item r Values) and Item-Total r Values Corrected for Part-Whole Overlap (N = 778)

Sleepiness Scale	*M*	*SD*	$r_{p\text{-}w}$
1. In a class at school	1.08	0.32	.52
2. While doing homework …	1.86	0.90	.38
3. Reading, studying or doing …	1.36	0.72	.61
4. While taking a test.	2.02	1.07	.47
5. Traveling in a bus, train, plane or car.	1.64	0.83	.63
6. Attending a performance …	1.08	0.31	.38
7. Watching television or listening …	1.56	0.66	.59
8. Playing video games	1.30	0.62	.72
10. In a face-to-face conversation …	1.20	0.58	.74
Average inter-item *r* value			.23
Median inter-item *r* value			.21

Sleep-Wake Problems Behavior Scale			
Item 2	1.41	0.85	.41
Item 3	1.30	0.70	.60
Item 4	1.15	0.62	.46
Item 6	3.48	1.03	.43
Item 7	1.40	0.79	.49
Item 8	1.74	0.99	.51
Item 9	3.52	1.12	.43
Item 10	2.40	1.49	.46
Item 11	2.21	1.21	.39
Item 13	2.30	1.14	.24
Average inter-item *r* value			.19
Median inter-item *r* value			.20
Morningness/Eveningness Questionnaire			
1. Ideally, when would be the best …	2.20	0.79	.48
2. Imagine you have to take …	2.46	0.96	.55
3.	2.60	0.77	.37
Item 4	3.40	0.75	.40
Item 5	2.62	0.82	.50
Item 6	3.13	0.73	.37
Item 7	2.26	0.73	.64
Item 8	3.55	0.75	.26
Item 9	2.30	1.07	.57
Item 10	2.80	0.98	.60
Average inter-item *r* value			.21
Median inter-item *r* value			.20

Note. $r_{p\text{-}w}$: item-total *r* coefficient corrected for part-whole overlap.

The dimensionality analysis results for the polychoric correlation matrices of the SLS, SWP, and ME scale items are summarized in Table 2.

Table 2. Sleepiness Scale, Sleep-Wake Problems Behavior Scale, and Morningness/ Eveningness Questionnaire: Dimensionality Analysis Results for the Corresponding Item Polychoric Correlation Matrices (N = 778).

	Quasi-Inferential Parallel Analysis		
	Real Data % of S^2	Random Data % of S^2	
Sleepiness Scale Item N. of Dimensions		95th Percentile	MAP
1	45.3*	28.3	.04*
2	13.7	23.3	.09
3	12.6	19.3	.28
4	9.6	16.2	--
5	7.5	13.4	--
6	4.4	11.2	--
7	3.5	8.9	--
8	3.2	5.8	--
9	0.0	0.0	--
Sleep-Wake Problems Behavior Scale Item N. of Dimensions			
1	34.1*	25.6	.03*
2	15.3	21.1	.06
3	12.8	17.8	.17
4	11.3	15.2	--
5	9.4	13	--
6	7.2	11.1	--
7	6.0	9.1	--
8	2.7	7	--
9	1.3	4.9	--
10	0.0	0.00	--

Morningness/Eveningness Questionnaire Item N. of Dimensions			
1	36.5*	25.6	.03*
2	20.9	21.3	.06
3	11.7	17.7	.19
4	8.7	15.2	--
5	6.6	13	--
6	5.6	10.9	--
7	4.4	9.1	--
8	3.9	7.1	--
9	1.6	4.5	--
10	0.0	0.0	--

Note. S2: Variance; MAP: Minimum average partial statistic. Quasi-inferential parallel analyses 95th percentile values were based on 1,000 random polychoric correlation matrices that were obtained by randomly permuting the original data.
*: Advised number of factors to be retained; --: Statistic not computed.

WLSMV CFA standardized factor loadings and goodness-of-fit statistics for the one-factor model of the SLS, SWP, and ME scale items, respectively, are summarized in Table 3.

Table 3. Weighted Least Square Mean and Variance Adjusted Confirmatory Factor Analysis Results for the One-Factor Model of the Sleepiness Scale, Sleep-Wake Problems Behavior Scale, and Morningness/Eveningness Questionnaire Items: Standardized Factor Loadings and Goodness-of-Fit Indices (N = 778).

Sleepiness Scale		Sleep-Wake Problems Behavior Scale		Morningness/Eveningness Questionnaire	
Item	λ	Item	λ	Item	λ
Item 1	.46***	Item 2	.41***	Item 1	.54***
Item 2	.37***	Item 3	.48***	Item 2	.70***
Item 3	.40***	Item 4	.27***	Item 3	.41***
Item 4	.29***	Item 6	.53***	Item 4	.31***
Item 5	.57***	Item 7	.49***	Item 5	.33***
Item 6	.64***	Item 8	.57***	Item 6	.16***
Item 7	.67***	Item 9	.48***	Item 7	.79***
Item 8	.44***	Item 10	.48***	Item 8	-.02
Item 9	.45***	Item 11	.41***	Item 9	.60***
		Item 13	.19***	Item 10	.70***
Median λ value	.45		.48		.48
GoF Indices					
χ^2 (df)	72.04 (26)***		86.71 (31) ***		157.19 (32) ***
RMSEA (90% CI)	0.048 (0.035, 0.061)		0.048 (0.036, 0.060)		0.071 (0.060, 0.081)
CFI/TLI	.95/0.92		.94/0.91		.95/0.93
SRMSR	.05		.04		.04

Note. λ: Standardized factor loadings; GoF: Goodness-of-fit; RMSEA: Root mean square error of approximation; CI: Confidence interval; CFI: Comparative fit index; TLI: Tucker-Lewis Index; SRMSR: Standardized root mean square residual. Error correlations: Sleepiness Scale: Item 8 with Item 9, $r = .58$, $p < .001$; Sleep-Wake Problems Behavior Scale: Item3 with Item 4, $r = .46$, $p < .001$; Item 8 with Item 9, $r = -.29$, $p < .001$; Item 13 with Item 9, $r = .25$, $p < .001$; Item 13 with Item 6, $r = -.27$, $p < .001$; Morningness/Eveningness Questionnaire: Item 4 with Item 5, $r = .31$, $p < .001$; Item 5 with Item 8, $r = .24$, $p < .001$; Item 6 with Item 8, $r = .64$, $p < .001$.
* $p < .05$; ** $p < .01$; *** $p < .001$

Taxometric analysis results of the SLS, SWP, and ME scales are summarized in Table 4.

Table 4. Sleepiness Scale, Sleep-Wake Problems Behavior Scale, and Morningness/ Eveningness Questionnaire: Taxometric Analysis Result Summary Table (N = 778)

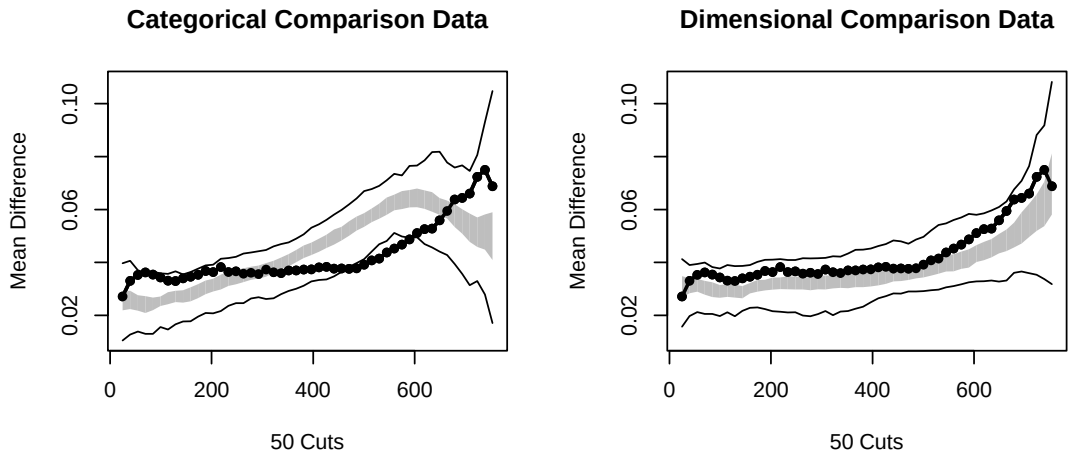
Sleepiness Scale	MAMBAC	MAXEIG	L-Mode
Mean between-group validity (mean Cohen's *d* value)	0.89	0.93	1.80 (factor scores)
Between-group validity range (min./max. Cohen's *d* values)	0.74/1.07	0.74/1.13	--
Average taxon base rate estimate	.29	.26	.61
Taxon base rate estimate *SD*	.16	.24	--
Within-taxon/within-complement average inter-indicator *r* values	-.03/-.01	-.03/.00	.03/-.04
Comparative Curve Fit Index value	.35	.20	.31
Sleep-Wake Problems Behavior Scale			
Mean between-group validity (mean Cohen's *d* value)	0.82	0.87	2.29 (factor scores)
Between-group validity range (min./max. Cohen's *d* values)	0.42/1.05	0.54/1.12	--
Average curve taxon base rate estimate	.41	.31	.59
Taxon base rate estimate *SD*	.25	.06	--
Within-taxon/within-complement average inter-indicator *r* values	-.01/-.02	-.03/.00	.02/-.04
Comparative Curve Fit Index value	.41	.21	.28
Morningness/Eveningness Questionnaire			
Mean between-group validity (mean Cohen's *d* value)	0.93	0.93	2.42 (factor scores)
Between-group validity range (min./max. Cohen's *d* values)	0.41/1.23	0.41/1.22	--
Average curve taxon base rate estimate	.56	.55	.53
Taxon base rate estimate *SD*	.11	.14	--
Within-taxon/within-complement average inter-indicator *r* values	.04/.02	.04/.02	.03/.02
Comparative Curve Fit Index value (CCFI)	.23	.25	.17

Note. MAMBAC: Mean-above-minus-mean-below-a-cut analysis; MAXEIG: Maximum eigenvalue analysis; L-Mode: Latent mode analysis; --: Statistic not computed. CCFI values can range from 0 (dimensional) to 1 (categorical). CCFI values <.45 suggest a dimensional latent distribution, whereas CCFI values >.55 are suggestive of a categorical latent structure. When .45 < CCFI < .55, this should be interpreted with caution.

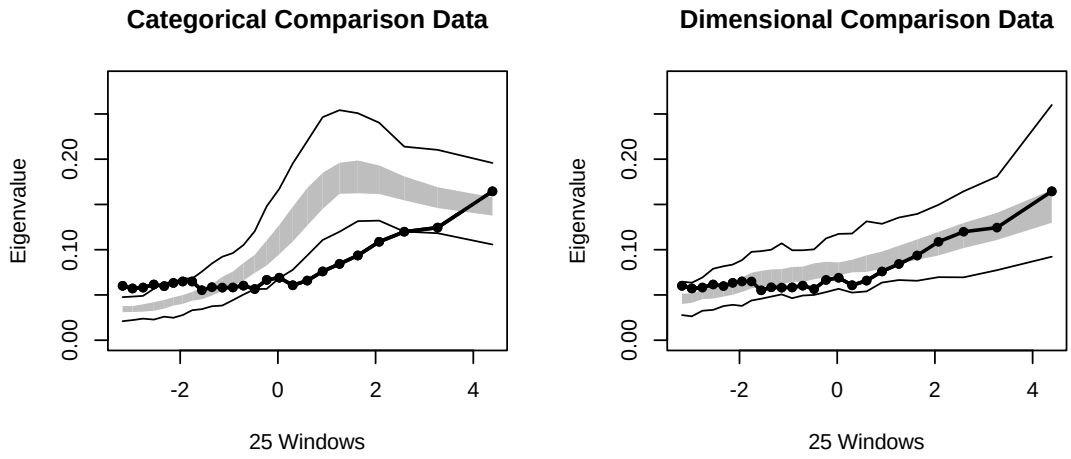
CCFI values averaged across MAMBAC, MAXEIG, and L-Mode analyses (Ruscio et al., 2018) were .29, .30, and .22 for SLS, SWP, and ME scales, respectively. Taxometric curves for SLS, SWP, and ME scales are depicted in Figure 1, Figure 2, and Figure 3, respectively.

Figure 1. Sleepiness Scale: MAMBAC, MAXEIG, and L-Mode Analysis Curves

MAMBAC



MAXEIG



L-Mode

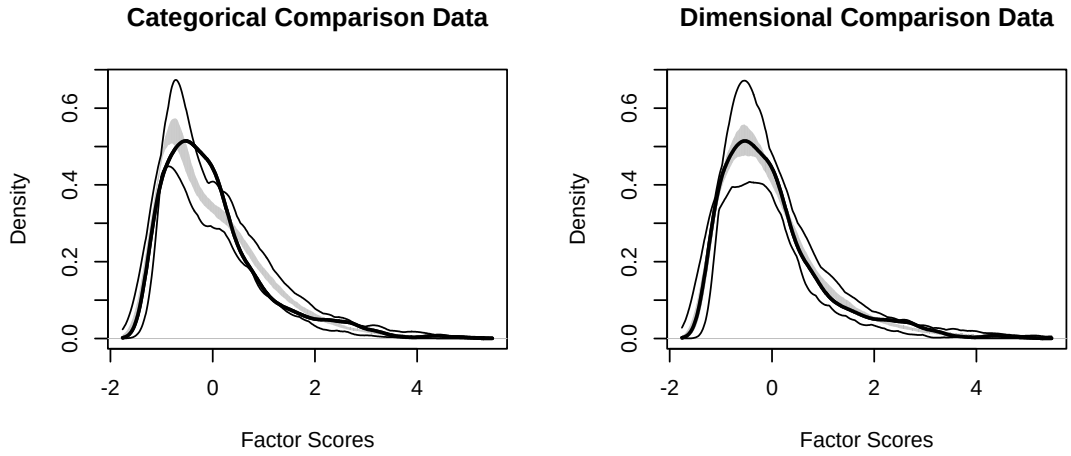
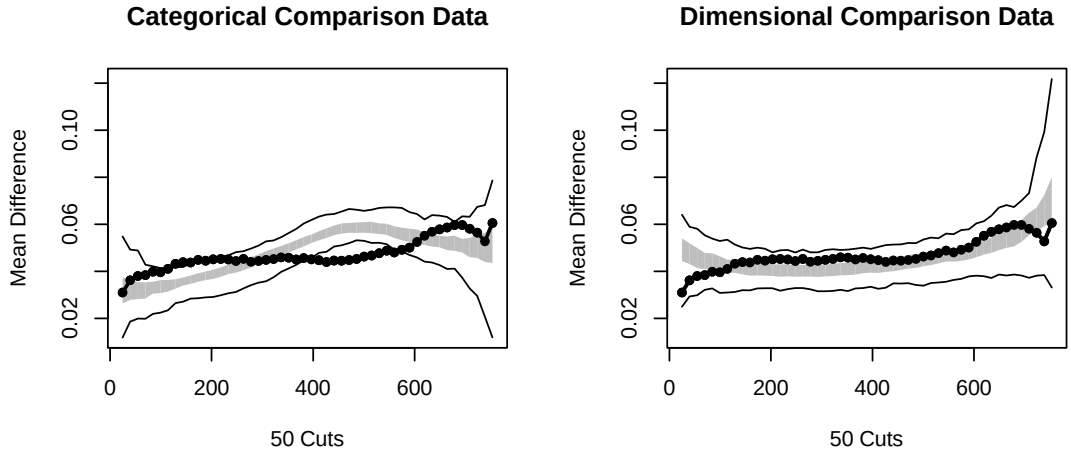
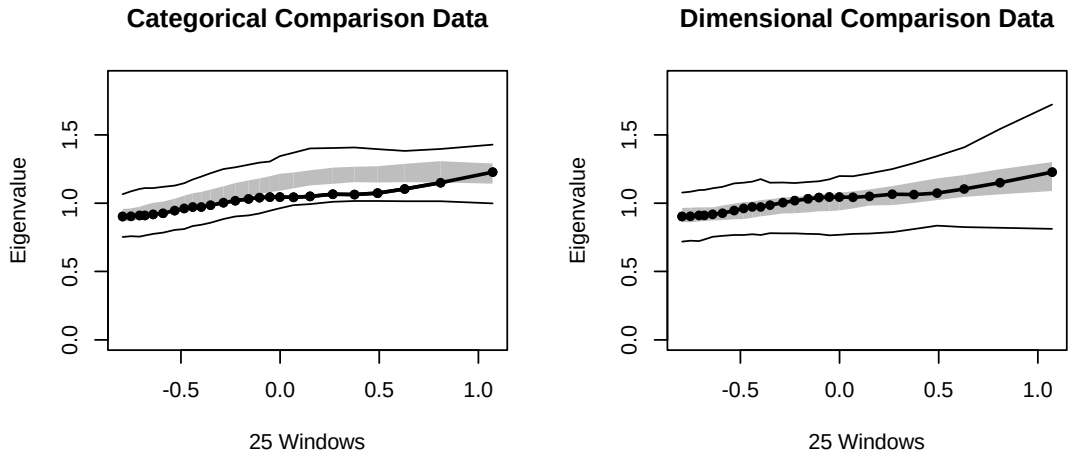


Figure 2. Sleep-Wake Problems Behavior Scale: MAMBAC, MAXEIG, and L-Mode Analysis Curves

MAMBAC



MAXEIG



L-Mode

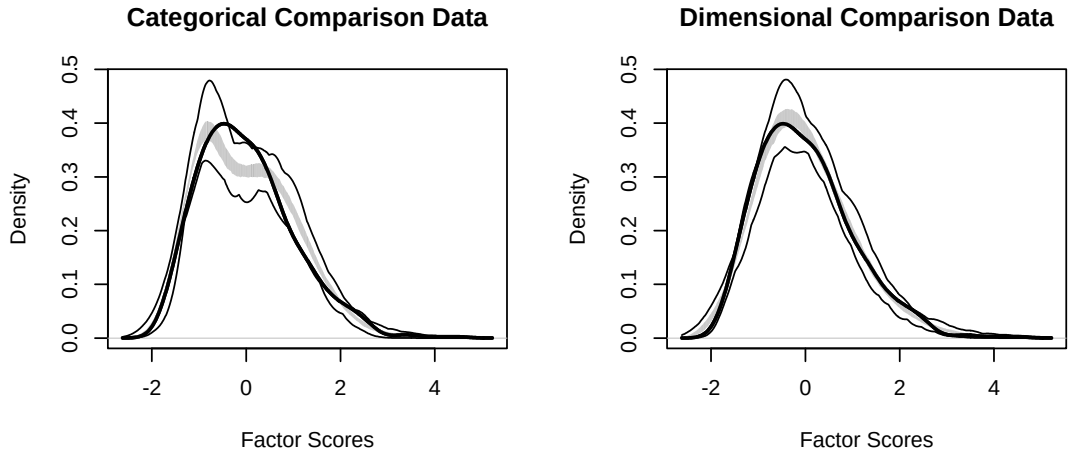
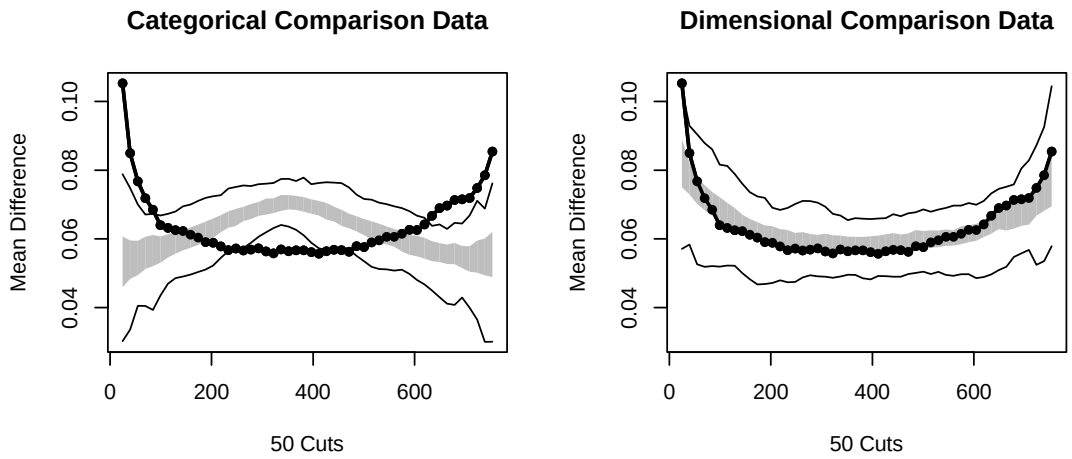
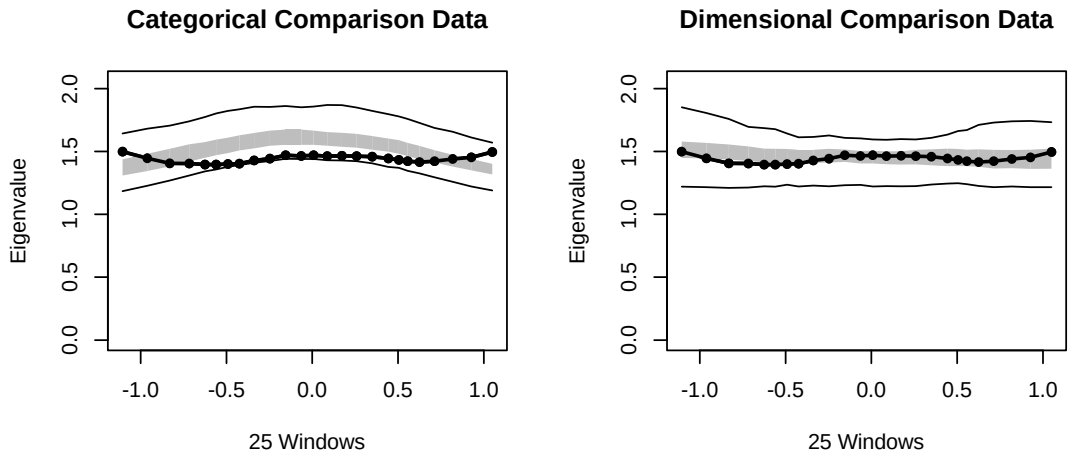


Figure 3. Morningness/Eveningness Questionnaire: MAMBAC, MAXEIG, and L-Mode Analysis Curves

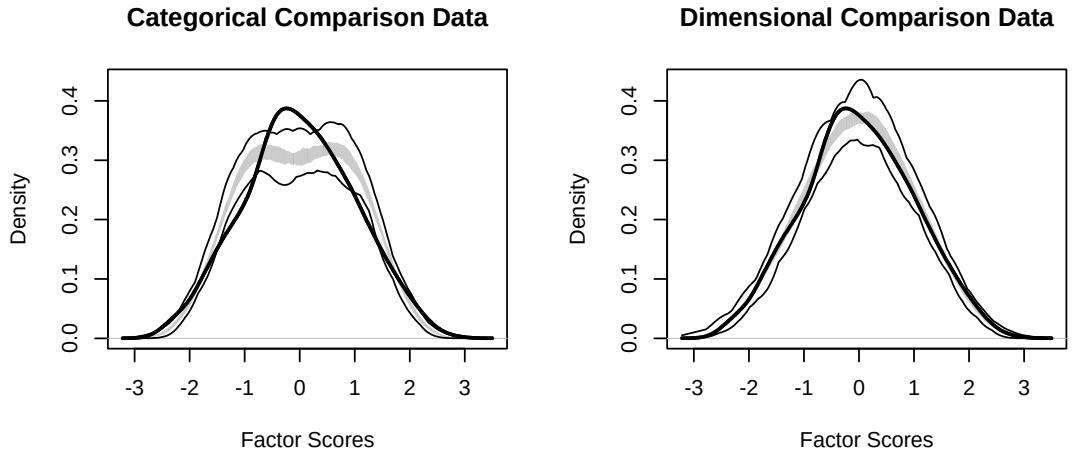
MAMBAC



MAXEIG



L-Mode



The descriptive statistics, internal consistency reliability estimates (i.e., Cronbach's α values) and inter-correlations (i.e., Pearson *r* values) for the SLS, SWP, and ME total scores are reported in Table 5. Pearson *r* values for the associations between participant's age and SLS, SWP and ME total scores were .01, .01, and-.01, all *p*s >.80, respectively. No significant gender effect on the ME total score was observed, $t(774) = -0.93$, $p > .30$, Cohen's $d = -0.07$. On average, female adolescents scored significantly, albeit modestly, higher than male adolescents on the SLS total score (female adolescents: $M = 13.56$, $SD = 2.97$; male adolescents: $M = 12.37$, $SD = 2.82$), $t(774) = 5.61$, $p < .001$, Cohen's $d = 0.41$, and on the SWP total score (female adolescents: $M = 21.64$, $SD = 4.71$; male adolescents: $M = 19.76$, $SD = 4.54$), $t(774) = 5.53$, $p < .001$, Cohen's $d = 0.41$.

Table 5. Sleepiness Scale, Sleep-Wake Problems Behavior Scale, and Morningness/ Eveningness Questionnaire Total Scores: Descriptive Statistics, Cronbach's Alpha Coefficient Values, and Inter-Correlations (i.e., Pearson r Values) (N = 778)

				Pearson *r* Values		
Total Scores	*M*	*SD*	α	*1*	*2*	*3*
Sleepiness Scale	13.09	2.97	.73	--		
Sleep-Wake Problems Behavior Scale	20.89	4.72	.70	.48***	--	
Morningness/Eveningness Questionnaire	27.32	4.42	.73	-.32***	-.46***	--

Note. α: Cronbach's α coefficient value; --: Statistic not computed.
* p <.05; ** p <.01; *** p <.001

Percentile value estimates (i.e., normative scores) for the SLS, SWP, and ME total scores in Italian adolescent high school students are listed in Table 6.

Table 6. Percentile Value Estimates of the Sleepiness Scale, Sleep-Wake Problems Behavior Scale, and Morningness/Eveningness Questionnaire Total Scores in Italian Adolescent High School Students (N = 778)

Percentile	Sleepiness Scale	Sleep-Wake Problems Behavior Scale	Morningness/Eveningness Questionnaire
1	9	13	16
2.5	9	13	18
5	9	14	20
10	10	15	22
20	11	16	24
25	11	17	24
33	11	18	25
50	13	21	27
66	14	23	29
75	15	24	30
80	15	25	31
90	17	27	33
95	19	29	34
97.5	20	31	36
99	22	32	37

4. Discussion

To the best of our knowledge, the present study represents the first attempt to provide factor validity data on the three main scales of the SSHS in adolescence. In this respect we aimed at filling the well-known gap between measure development and psychometric evaluation in child and adolescent sleep medicine (Spruyt & Gozal, 2011). Confirming and extending previous findings (e.g., Becker et al., 2020; Russo et al., 2007), in our study all SSHS scales showed average inter-item *r* values that laid in the .15-.50 range, which is suggestive of adequate internal consistency (Clark & Watson, 2019). Moreover, the SLS, SWP and ME showed bivariate item-total *r* values corrected for part-whole overlap that were at least moderate in size and suggestive

of good item discrimination (Clark & Watson, 2019). These data seemed to indicate adequate item sampling in constricting the SLS, SWP, and ME.

Multivariate analyses of the SLS, SWP, and ME items seemed to largely support these findings. Dimensionality analyses strongly supported the one-factor model of the polychoric correlation matrices of the three main SSHS scales. Not surprisingly, the one-factor model, in which selected item errors were allowed to correlate each other because of content overlap, showed adequate fit index in CFAs for the SLS, SWP, and ME, respectively. This finding supported the use of the SLS, SWP, and ME total scores as measures of sleepiness, sleep-wake problem, and morningness/eveningness, at least among Italian community-dwelling adolescents. Confirming the bivariate $r_{p\text{-}w}$ analysis results, our CFA findings suggested adequate standardized item loading values, with the partial exception of ME item 8 and possibly SWP item 13. However, all SSHS main scales showed on average substantial item loadings (i.e., media λ values ≥.45) on the corresponding latent dimensions.

Extending previous reports on the general latent structure of sleep disturbances in adolescence (Ren et al., 2015), our taxometric analyses yielded consistent support for the dimensional distribution of the SLS, SWP, and ME scores, respectively. The logic behind the SLS, SWP, and ME development was highly consistent with our dimensional findings. Our taxometric analysis results encourage practitioners to rely on the conventional percentiles in order to interpret the SLS, SWP, and ME total scores. From this perspective, future studies should evaluate the functional impairment associated with different percentiles of the SSHS main scale scores distribution. Accordingly, in the present study we reported the percentiles of the raw score distribution of the SLS, SWP, and ME total scores.

In our study, Cronbach's α coefficient values were adequate (i.e., all αs ≥.70), suggesting that the three SSHS main scales yielded reliable scores, which could be safely used in screening for sleep disorder at least among Italian adolescents (even when relying on score percentiles). Highly consistent with Becker and colleagues' (2020) findings, in our adolescent sample the SLS, SWP, and ME total scores were significantly and moderately inter-correlated, with measures of mornigness/eveningness being negatively correlated with measures of sleepiness and sleep-wake problems. The moderate, positive and significant association between the SLS and SWP total score suggested that sleepiness and irregular sleep habits (i.e., sleep-wake problems) represent dissociable, albeit correlated constructs.

5. Conclusions

As a whole, our findings supported the use of the SLS, SWP, and ME as measures of sleepiness, sleep-wake problem, and morningness/eveningness in adolescence. Given the relevance of sleep disturbances and the impact of the COVID-19 on sleep quality among both children (e.g., Ragni, Capitello, Gentile, Pons, & De Stasio, 2022), and young adults (Zafar, & Ansari, 2020), particularly during the COVID-19 (e.g., Somma et al., 2020), the availability of sound measures of sleep disturbances in adolescence may represent a useful addition to the available literature. Indeed, screening for different sleep problems with sound psychometric measures may relevant starting point for carrying out preventive interventions.

6. Limitations and Strengths

Although the present study has some relevant strengths (e.g., large sample size), and may provide clinicians and researchers with normative data (i.e., percentile value estimates) for the SLS, SWP, and ME total scores in Italian adolescents, our findings should be considered in the light of several limitations. Although we relied on large samples of community-dwelling participants, they were not randomly selected sample representative of Italian general population; this limits the generalizability of our findings and stresses the need for further studies. Although we relied on multiple measures of sleep difficulties and habits, taxometric studies based on different instrument might yield different results. Finally, our data were based exclusively on community-dwelling participants and should not be extended to clinical samples. Even keeping these limitations in mind, we feel that our findings may be useful in improving our knowledge on the psychometric properties of SLS, SWP, and ME and latent structure of sleep habits in community-dwelling participants.

Ethical approval

Institutional Review Board was obtained for all the aspects of the study.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

Data available upon request from the corresponding author.

Conflict of interest statement

The authors declare that the research was conducted in the absence of any potential conflict of interest.

Author Contributions

Antonella Somma: Conceptualization; Methodology; Formal analysis; Writing - Original Draft

Sara Marelli: Conceptualization; Writing - Original Draft

Vincenza Castronovo: Conceptualization; Writing - Review & Editing

Giulia Gialdi: Data Curation; Writing - Review & Editing

Alessandra Castelnuovo: Data Curation; Writing - Review & Editing

Samantha Mombelli: Data Curation; Writing - Review & Editing

Irene Lonati: Data Curation; Writing - Review & Editing

Giovanni Masso: Writing - Review & Editing

Andrea Fossati: Conceptualization; Methodology; Formal analysis; Writing - Original Draft

Luigi Ferini-Strambi: Conceptualization; Supervision; Writing - Review & Editing

Luana Nosetti: Conceptualization; Project administration; Writing - Review & Editing

References

1. Acebo, C., & Carskadon, M. A. (2002). Influence of irregular sleep patterns on waking behavior. In Carskadon, M. A. (Ed.) *Adolescent sleep patterns: Biological, social and psychological influences* (pp. 220-235). New York: Cambridge University Press.
2. Astill, R. G., Van der Heijden, K. B., Van IJzendoorn, M. H., & Van Someren, E. J. W. (2012). Sleep, cognition, and behavioral problems in school-age children: A century of research meta-analyzed. *Psychological Bulletin, 138*(6), 1109–1138. https://doi.org/10.1037/a0028204
3. Ballesio, A., Aquino, M. R. J., Kyle, S. D., Ferlazzo, F., & Lombardo, C. (2019). Executive functions in insomnia disorder: A systematic review and exploratory meta-analysis. *Frontiers in Psychology, 10*, 101. https://doi.org/10.3389/fpsyg.2019.00101
4. Becker, S. P., Kapadia, D. K., Fershtman, C. E., & Sciberras, E. (2020). Evening circadian preference is associated with sleep problems and daytime sleepiness in adolescents with ADHD. *Journal of Sleep Research, 29*(1), e12936. https://doi.org/10.1111/jsr.12936
5. Buja, A., & Eyuboglu, N. (1992). Remarks on parallel analysis. *Multivariate Behavioral Research*, *27*(4), 509-540. https://doi.org/10.1207/s15327906mbr2704_2
6. Carskadon, M. A. (1990). Patterns of sleep and sleepiness in adolescents. *Pediatrician*, *17*(1), 5-12.
7. Carskadon, M. A., Seifer, R., & Acebo, C. (1991). Reliability of six scales in a sleep questionnaire for adolescents. *Sleep Research, 20*, 421. https://doi.org/10.1016/j.pedn.2008.03.004
8. Clark, L. A., & Watson, D. (2019). Constructing validity: New developments in creating objective measuring instruments. *Psychological Assessment, 31*(12), 1412-1427. https://doi.org/10.1037/pas0000626
9. Crowley, S. J., Wolfson, A. R., Tarokh, L., & Carskadon, M. A. (2018). An update on adolescent sleep: New evidence informing the perfect storm model. *Journal of Adolescence*, *67*, 55-65. https://doi.org/10.1016/j.adolescence.2018.06.001
10. de Bruin, E. J., Dewald-Kaufmann, J. F., Oort, F. J., Bögels, S. M., & Meijer, A. M. (2015). Differential effects of online insomnia treatment on executive functions in adolescents. Sleep medicine, 16(4), 510-520. https://doi.org/10.1016/j.sleep.2014.12.009
11. de Zambotti, M., Goldstone, A., Colrain, I. M., & Baker, F. C. (2018). Insomnia disorder in adolescence: Diagnosis, impact, and treatment. *Sleep Medicine Reviews*, *39*, 12-24. https://doi.org/10.1016/j.smrv.2017.06.009
12. Fallone, G., Owens, J. A., & Deane, J. (2002). Sleepiness in children and adolescents: Clinical implications. *Sleep Medicine Reviews, 6*, 287–306. https://doi.org/10.1053/smrv.2001.0192

13. Fernandez-Mendoza, J., Calhoun, S., Vgontzas, A., Li, Y., Gaines, J., Liao, D., & Bixler, E. (2016). Insomnia phenotypes based on objective sleep duration in adolescents: depression risk and differential behavioral profiles. *Brain sciences*, *6*(4), 59, 1-14. https://doi.org/10.3390/brainsci6040059
14. Gradisar, M., Gardner, G., & Dohnt, H. (2011). Recent worldwide sleep patterns and problems during adolescence: A review and meta-analysis of age, region, and sleep. *Sleep Medicine*, *12*(2), 110-118. https://doi.org/10.1016/j.sleep.2010.11.008
15. Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, *6*, 1-55. https://doi.org/10.1080/10705519909540118
16. ISTAT (2017). Studenti e scuole dell'istruzione primaria e secondaria in Italia [Primary and Secondary schools and students in Italy]. Roma: Istituto Nazionale di Statistica.
17. Kliegman, R. M., Staton, B. F., & Gene, J. W. (2015). *Nelson Textbook of Pediatrics* 20th, vol. 1.
18. Kotagal, S., & Pianosi, P. (2006). Sleep disorders in children and adolescents. *BMJ*, *332*(7545), 828-832. https://doi.org/10.1136/bmj.332.7545.828
19. Kronholm, E., Puusniekka, R., Jokela, J., Villberg, J., Urrila, A. S., Paunio, T., ... & Tynjälä, J. (2015). Trends in self-reported sleep problems, tiredness and related school performance among Finnish adolescents from 1984 to 2011. *Journal of Sleep Research*, *24*(1), 3-10. https://doi.org/10.1111/jsr.12258
20. Loessl, B., Valerius, G., Kopasz, M., Hornyak, M., Riemann, D., & Voderholzer, U. (2008). Are adolescents chronically sleep-deprived? An investigation of sleep habits of adolescents in the Southwest of Germany. *Child: Care, Health and Development*, *34*(5), 549-556. https://doi.org/10.1111/j.1365-2214.2008.00845.x
21. Norell-Clarke, A., & Hagquist, C. (2018). Child and adolescent sleep duration recommendations in relation to psychological and somatic complaints based on data between 1985 and 2013 from 11 to 15 year-olds. *Journal of Adolescence*, *68*, 12-21. https://doi.org/10.1016/j.adolescence.2018.07.006
22. Paiva, T., Gaspar, T., & Matos, M. G. (2015). Sleep deprivation in adolescents: correlations with health complaints and health-related quality of life. *Sleep Medicine*, *16*(4), 521-527. https://doi.org/10.1016/j.sleep.2014.10.010
23. Ragni, B., Grimaldi Capitello, T., Gentile, S., Pons, F., De Stasio, S. (2022). Infant temperament, parental depression and sleep in healthy children and children born with congenital anomalies. *Mediterranean Journal of Clinical Psychology, 10*(1). https://doi.org/10.13129/2282-1619/mjcp-3231
24. Ren, F., Wang, G., Phull, G., & Zhang, J. (2015). Taxometric analysis of the Children's Sleep Habits Questionnaire. *Sleep and Biological Rhythms, 13*(3), 261-270. https://doi.org/10.1111/sbr.12113

25. Ruscio, J., Carney, L. M., Dever, L., Pliskin, M., & Wang, S. B. (2018). Using the Comparison Curve Fix Index (CCFI) in taxometric analyses: Averaging curves, standard errors, and CCFI profiles. *Psychological Assessment 30*, 744-754. https://doi.org/10.1037/pas0000522

26. Ruscio, J., Ruscio, A. M., & Carney, L. M. (2011). Performing taxometric analysis to distinguish categorical and dimensional variables. *Journal of Experimental Psychopathology, 2*, 170-196. https://doi.org/10.5127/jep.010910

27. Russo, P. M., Bruni, O., Lucidi, F., Ferri, R., & Violani, C. (2007). Sleep habits and circadian preference in Italian children and adolescents. *Journal of Sleep Research*, *16*(2), 163-169. https://doi.org/10.1111/j.1365-2869.2007.00584.x

28. Shahid, A., Wilkinson, K., Marcu, S., & Shapiro, C. M. (Eds.). (2012). *STOP, THAT and one hundred other sleep scales*. Springer Science & Business Media.

29. Sivertsen, B., Pallesen, S., Stormark, K. M., Bøe, T., Lundervold, A. J., & Hysing, M. (2013). Delayed sleep phase syndrome in adolescents: prevalence and correlates in a large population based study. *BMC Public Health*, *13*(1), 1163. https://doi.org/10.1186/1471-2458-13-1163

30. Somma, A., Marelli, S., Barranca, M., Gialdi, G., Lucini, C., Castelnuovo, A., Mombelli, S., Ferini-Strambi, L., Fossati, A. (2020). Executive functioning and personality traits in insomnia disorder: A preliminary report on the clinical importance of objective and subjective reduction of total sleep time. *Mediterranean Journal of Clinical Psychology, 8*(1). https://doi.org/10.6092/2282-1619/mjcp-2325

31. Somma, A., Marelli, S., Gialdi, G., Castelnuovo, A., Mombelli, S., Ferini-Strambi, L., & Fossati, A. (2020). Latent changes in perceived quality of sleep related to the COVID-19 quarantine measures in Italian university students: Understanding the role of personality and internalizing symptoms. *Mediterranean Journal of Clinical Psychology, 8*(3). https://doi.org/10.6092/2282- 1619/mjcp-2550

32. Spruyt, K., & Gozal, D. (2011). Pediatric sleep questionnaires as diagnostic or epidemiological tools: a review of currently available instruments. *Sleep Medicine Reviews*, *15*(1), 19-32. https://doi.org/10.1016/j.smrv.2010.07.005

33. Wolfson, A. R., & Carskadon, M. A. (1998). Sleep schedules and daytime functioning in adolescents. *Child Development, 69*, 875–887. https://doi.org/10.2307/1132351

34. Wolfson, A. R., Carskadon, M. A., Acebo, C., Seifer, R., Fallone, G., Labyak, S. E., & Martin, J. L. (2003). Evidence for the validity of a sleep habits survey for adolescents. *Sleep*, *26*(2), 213-216. https://doi.org/10.1093/sleep/26.2.213

35. Zafar, M., & Ansari, K. (2020). Sleep disorders among undergraduate health students in Bristol, United Kingdom. *Mediterranean Journal of Clinical Psychology, 8*(3). https://doi.org/10.6092/2282-1619/mjcp-2494

36. Zwick, W. R., & Velicer, W. F. (1986). Comparison of five rules for determining the number of components to retain. *Psychological Bulletin*, *99*(3), 432-442. https://doi.org/10.1037/0033-2909.99.3.432

DOI: 10.13129/2282-1619/mjcp-3557