

Self-reported sleep disorders in secondary school students: an epidemiological and risk behavioural analysis

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Key words

Sleep disorders • Secondary school • Students • Italy

Summary

Purpose. To estimate the prevalence of self-reported sleep disorders (SD), to examine associations among demographic characteristics and familiar factors with SD, between SD and daytime sleep-related disorders (DD) and between evening habits and SD.

Methods. An anonymous questionnaire was proposed to 1563 students (aged 14-21 years, mean age 16.5 ± 1.5 ; 42.8% males, 57.2% females) attending all classes of two high schools in Verona (North-East of Italy). Data were analyzed by some personal and familial characteristics, by definition of three sleeper groups (non problem, occasional problem or problem-sleepers). Moreover SD were put in relation with DD and with some personal evening attitudes.

Results. The 75.5% of the subjects report at least one SD. Difficulty falling asleep is the most frequent SD. The DD concern 91.2% of the sample. Females are more involved than males in SD and DD. All SD result strongly associated with the referred DD, except for sleepiness.

Sport is significantly correlated with a minor prevalence of SD. Smoking and studying appear to be associated with SD.

Conclusions. Since SD in youth constitute an important Public Health matter with a severe social impact they would be accurately studied to offer youth appropriate counselling given the importance of lifestyle in determining good sleep.

Introduction

A good quality of sleep is essential to good health and wellbeing, while lifestyle and environmental factors may be among the causes of sleeping difficulties [1].

The Diagnostic and Statistical Manual of Mental Disorders considers four categories of sleep disorder (SD), i.e. I) primary sleep disorders including dyssomnias; II) parasomnias; III) sleep disorders related to medical/psychiatric disorders including insomnia and hypersomnia; and IV) sleep disorders including those due to a general medical condition or to a substance inducing them.

Several indicators can be used to describe a disturbed sleep or SD, e.g. sleep latency, number and duration of nocturnal awakenings, total time asleep, changes in amount and rhythms of particular sleep stages, number of nights of sleep disruption per week or month, and self-reported sleep problems, the last of which is objectively considered the least reliable, but perceived as the most important by the individual.

Approximately one third of American adults report experiencing sleep problems and nearly half of these insomniacs consider their problem serious [2, 3]. An altered sleep quality can affect young people too, particularly adolescents. Studies conducted in Europe, Asia

and the USA suggest that 6-37% of adolescents report one or more changes in sleeping behavior, including late onset [4], difficulty falling asleep [5], nocturnal awakenings [6, 7], early morning awakenings [6], poor sleep. Up to 16% of adolescents are thought to have clinically significant insomnia [8, 9].

There is ample evidence that inadequate sleep quantity and quality has a negative fallout on several aspects of an adolescent's and youth life. Inattention and demotivation, worse academic results, hyperactivity and slowed reflexes have been documented [10-12]. Daytime sleepiness may cause road accidents, which represent one of the most important death risk factors among young people. Poor-quality sleep also seems to influence somatic, psychological and interpersonal functioning, though the causal relationship remains unclear. Young people with psychiatric, behavioral and emotional problems frequently have sleep disorders. Studies have documented a higher percentage of psychological dysfunction among youths with SD [13-15]. Youth without adequate sleep reports more depression, anxiety, irritability, behavioral problems and drug or alcohol use.

Kahn studied infants, children and adolescents with and without sleep deprivation and its short- and medium-term effects [16]. The short-term effects of sleep

deprivation in school-age children only appeared to be daytime fatigue, while the medium-term effects included daytime sleepiness and behavior problems. The effects of repeated sleep deprivation in infants, children, adolescents and youth are multifactorial and complex, but repeated or chronic sleep disruption in children can have a pervasive influence on the child's mood and physical and cognitive wellbeing. Cardiovascular side effects, such as hypertension, have also been considered as long-term sequelae of SD [17, 18].

All research on sleep and health in children needs to follow very strict ethical rules, which partly explains the relative shortage of such research.

Little is known about SD in youth, adolescents and children in our geographical area and this study is a preliminary assessment of sleeping problems in a group of boys and girls in North Eastern Italy, with a view to providing the basis for further epidemiological and clinical studies, and for prevention schemes.

Methods

The study was conducted between September and October 2006 in Verona area (North East Italy).

To better represent the youth living in the studied area, two schools were randomly extracted from a list of *liceo* (a kind of secondary Italian school) and a list of technical ones. A scientific *liceo* (a secondary school specializing in scientific studies) and a technical school were then picked out. Data were collected with an anonymous questionnaire administered to students attending all classes (from first to fifth).

The Italian "privacy" law and the Helsinki Declaration on human subjects testing were fully respected.

The questionnaire included items referred on the last year of life on personal details (age, sex and nationality), family (place of residence, number of family members, father's and mother's education), sleeping habits (whether they sleep alone, number of hours they sleep at night and number of afternoon naps), reported SD, daytime sleep-related disorders understood as disorders that interfere with quality of life and performance during the period of wakefulness (sleepiness, inattention, poor memory, irritability, headache, depression) and usual evening habits (after 6 p.m.), e.g. use of caffeine-containing drinks (CD) such as coffee, smoking (SM), sport (SP), PC use and/or TV watching (PC/TV), studying (ST).

Moreover, to identify cases of secondary sleep disorders, there were questions on whether the youth suffered from organic diseases capable of disturbing their sleep (cardiac, respiratory or others). We were also interested in their habitual use of drugs or medicines.

In accordance with the World Health Organization (WHO) definition, we assessed any presence of SD in terms of the amount, quality, or timing of the youths' and adolescents' sleep. We considered "difficulty falling asleep" (DFA) as a problem reported by the students as a sensation of not falling asleep soon after going to

bed; "not refreshing sleep" (NRS) as an SD affecting the person's physical and mental wellbeing as well as their performance at school and in other social activities; "night awakenings" (NA) as times when the person sleeps lightly and wakes up for no apparent reason (e.g. discomfort or a loud noise); "early awakenings" (EA) when the student reported being awake before the alarm clock went off.

Questions on SD were answered using a three-level scale (no, sometimes, often). As defined by other Authors [17], we took "often" to mean a sleeping behavior occurring 5-7 times a week, "sometimes" to mean 2-4 times a week, and "no" to mean never or once a week.

Questions regarding usual activities after 6 p.m. were answered as yes/no.

STATISTICAL ANALYSIS

The distribution of continuous variables was expressed as mean \pm standard deviation. Categorical variables were presented as numbers and percentages.

Quantitative data were assessed using Student's t-test, or ANOVA with Tukey's post-hoc test, as appropriate. Associations between qualitative variables were analyzed with the chi square test or Fisher's exact test, as necessary.

A P value of less than 0.05 was considered significant. All statistical analyses were performed with the SPSS 13.0 statistical package (SPSS Inc., Chicago, IL).

Results

Data were collected with the anonymous questionnaire administered to 1628 youth (aged 14-21) attending all the classes (from first to fifth). The response rate was of 96.0%. The final number of questionnaires collected was 1563 (1119 from grammar school and 444 from technical college).

Among the students taking part in the study, 42.8% were males and 57.2% females, aged 14-21 years, mean age 16.5 ± 1.5 . The two different population of the two schools resulted homogeneous for the principle characteristics as gender, age class, residence distribution.

The characteristics of the students' families are summarized in Table I. The parents were mostly educated to high school or university level (70.2% of the fathers and 72.1% of the mothers).

Students usually slept more than 7 hours a night (mean 7.4 ± 1.1 ; range 2-12 hours). The 49.5% of the sample did not sleep in the afternoon during the week, while 32.9% had a nap 3 times a week and only 5.3% 6 or more times a week.

SLEEP DISORDERS

SD were reported at least once, sometimes or often by 75.5% of the 1563 youth.

The type and recurrence of these SD are given in Table II. Each individual could report more than one SD. The most often reported SD was difficulty falling asleep. All

Tab. I. Family characteristics of the 1563 enrolled students.	
Country of origin	
Italy	1409 (90.2%)
Other	118 (7.5%)
Not specified	36 (2.3%)
Residence	
Town center	363 (55.9%)
Suburbs	875 (23.2%)
Other	311 (20.0%)
Not specified	14 (0.9%)
Family components (N.)	
Mean	4.14
Standard deviation	± 1.06
Range	1 - 12
Educational qualification	
<i>Father</i>	
Middle school	418 (26.7%)
High school	784 (50.2%)
University	314 (20.1%)
Not specified	47 (3.0%)
<i>Mother</i>	
Middle school	418 (26.7%)
High school	836 (53.5%)
University	264 (16.9%)
Not specified	45 (2.9%)

self-reported SD (Tab. II) were significantly more common in females than in males ($p < 0.001$).

Of the 1563 enrolled students, 143 (9.15%) reported organic conditions (respiratory, cardiac or other diseases) interfering with their sleep. Cardiac diseases seemed to correlate with DFA, NA and NRS, while respiratory and other conditions seemed to be associated with NA.

DAYTIME SLEEP-RELATED DISORDERS

Nearly the whole sample (91.2%) reported experience of DD.

In particular, 59.1% (41.0% males and 59.0% females) reported sleepiness; 35.7% (36.0% males and 64.0% females) inattention or poor memory; 21.3% (30.7% males and 69.3% females) depression; 38.2% (31.9% males and 68.1% females) irritability; and 30.6% (26.5% males and 73.5% females) headache. The male/female ratio for these DD was always $> 1:2$, and headache was nearly three times (2.8) more common in females than in males.

All SD correlated strongly ($p < 0.001$) with the DD reported, with the sole exception of sleepiness, which was only significantly associated with DFA ($p < 0.001$) (Tab. III). Moreover, an increasing frequency of SD seemed to be associated with a greater likelihood of developing DD: students reporting SD often had a two-fold chance of manifesting DD.

EVENING HABITS

The questions on evening habits (after 6 p.m.) showed that watching television was the favorite pastime (reported by 60.8% of the sample, with a male predominance, i.e. 66.6% of males and 56.5% of females; $p < 0.001$). More than half of the youth (54.7%) said they played sport after 6 p.m. and 49.4% used the PC before going to bed, with a male predominance in both activities (respectively 65.7% of males vs 46.4% and 61.7% of males vs 40.1%, $p < 0.001$). The evening activity least often recorded (41.1%) was studying and mainly involved females (46.1% vs 34.3%; $p < 0.001$).

In equal proportions among males and females, 19.1% of the sample smoked after 6 p.m. and 19.3% used caffeine drinks.

Most of the students (92.0% of the sample) took nothing to help them sleep, while 1.3% used medication and 4.8% used infusions.

Table IV correlates the reported SD and evening habits. Sport correlated significantly with a lower prevalence of all SD investigated: the majority of the youth reporting no SD played sport in the evenings. SM and ST corre-

Tab. II. Distribution of SD by recurrence, type and sex.							
Sleep disorders	Males (n. 668)		Females (n. 891)		Males/females*	Total (n. 1559)	
	N.	%	N.	%		N.	%
Sometimes + often reported*							
Difficulty falling asleep	320	47.9	567	63.7	1/1.77	887	56.9
Nightly awakenings	162	24.3	383	43.0	1/2.36	545	34.9
Early awakenings	149	22.3	322	36.1	1/2.16	471	30.2
Not refreshing sleep	210	31.4	364	40.8	1/1.75	574	36.8
Often reported*							
Difficulty falling asleep	53	7.9	93	10.4	1/1.74	146	9.3
Nightly awakenings	16	2.4	70	7.8	1/4.37	86	5.5
Early awakenings	48	7.2	88	9.9	1/1.83	136	8.7
Not refreshing sleep	39	5.8	64	7.2	1/1.64	103	6.6

% of enrolled students reporting SD out of total number of males or females
* male vs female (for each SD and frequency): $p < 0.001$.

Tab. III. Distribution rate (%) of daytime sleep-related disorders vis-à-vis reported frequency of SD.

DD	SD	Sleepiness (%)			Inattention/ poor memory (%)			Irritability (%)			Headache (%)			Depression (%)		
		yes	no	p	yes	no	p	yes	no	p	yes	no	p	yes	no	p
DFA	No N = 673	57.4	42.6		28.5	71.5		29.3	70.7		23.3	76.7		14.9	85.1	
	St N = 742	58.6	41.4	**	38.4	61.6	**	43.7	56.3	**	34.6	65.4	**	23.6	76.4	**
	Oft N = 146	69.2	30.8		55.5	44.5		52.1	48.0		43.8	56.2		39.7	60.3	
NA	No N = 1013	58.8	41.2		31.9	68.1		32.2	67.8		25.0	75.0		17.3	82.7	
	St N = 461	59.0	41.0	n.s.	40.1	59.9	**	48.8	51.2	**	40.1	59.9	**	26.9	73.1	**
	Oft N = 86	61.6	38.4		57.0	43.0		53.5	46.5		45.6	54.7		39.5	60.5	
EA	No N = 1088	59.1	40.9		32.7	67.3		34.4	65.6		25.9	74.1		17.8	82.2	
	St N = 337	60.2	39.8	n.s.	39.2	60.8	**	43.6	56.4	**	40.1	59.9	**	25.8	74.2	**
	Oft N = 136	55.2	44.9		51.5	48.5		54.4	45.6		43.4	56.6		38.2	61.8	
NRS	No N = 981	57.0	43.0		29.5	70.5		32.5	67.5		24.6	75.4		16.3	83.7	
	St N = 474	62.2	37.8	n.s.	42.8	57.2	**	44.7	55.3	**	38.0	62.0	**	25.7	74.3	**
	Oft N = 103	65.1	35.0		62.1	37.9		63.1	37.0		53.4	46.6		49.5	50.5	

DD: daytime sleep-related disorders; SD: sleep disorders
SD: DFA: Difficulty falling asleep; NA: Nightly awakenings; EA: Early awakenings; NRS: Not refreshing sleep.
No: never; St: sometimes; Oft: often.
N = number of enrolled students
**= p < 0.001 n.s.: not significant

lated with 3 of the 4 SD and showed no significant correlation with EA or DFA, respectively and appear to be associated with a greater likelihood of having SD. The use of CD was not related with any statistical significance to a higher number of early/nightly awakenings or DFA, but it showed a weak correlation with NRS. Coffee, in particular, correlated only with NA, but revealed no association with DFA, EA or NRS.

Discussion

We investigated the frequency of self-reported SD and their impact on daily life in 14-21 year-old students. Sleep disorders in children have been extensively discussed in recent times. The large number of publications on this issue in the last few years is proof of pediatricians' efforts to deal with the paucity of information on sleeping problems in youth and children [19, 20]. Although a recall bias could have partially influenced the study, our findings have confirmed that SD in young

people are an important public health issue with a severe social impact. SD affect a large number of youth: 75% of our sample reported sometimes or often experiencing a poor quality of sleep and about 7% of the sample suffered from SD 5-7 times a week – a considerable proportion for this young age group. Insomnia is usually considered exclusive to adults but our study shows that this condition should not be underestimated in young people too. Insomnia is a chronic condition, so youth with SD are potentially insomniacs in adult life and senescence, too, adding to the prevalence of the condition in the general population. Our results are consistent with numerous community and school-based studies conducted in Asia and the United States in recent years showing how common this problem is [21]. The prevalence of DFA and NA reported here is much the same as in reports on early adolescents and youth in other populations [22]. DFA was the most common SD in our sample, affecting 56.9% of the students, with a male/female ratio of 1/1.77.

Tab. IV. Distribution rate of sleep disorders (%) in relation to evening habits (after 6 p.m.).

SD	Evening habits	DFA (%)			NA (%)			EA (%)			NRS (%)		
		No	St	Oft	No	St	Oft	No	St	Oft	No	St	Oft
CD	Yes N = 583	40.7	48.7	10.6	62.3	30.9	6.8	68.9	21.5	9.6	60.4	31.9	7.7
	No N = 920	45.0	47.0	7.9	66.8	28.6	4.6	70.8	21.3	7.9	66.7	27.5	5.8
	p		n.s.			n.s.			n.s.			*	
SM	Yes N = 288	40.3	45.8	13.9	59.6	31.7	8.7	69.8	20.5	9.7	53.3	36.2	10.5
	No N = 1213	43.5	48.2	8.2	65.8	29.4	4.8	69.9	21.7	8.4	64.7	29.7	5.6
	p		*			*			n.s.			**	
SP	Yes N = 833	46.6	45.8	7.6	68.4	27.9	3.7	72.6	20.2	7.2	66.5	28.9	4.6
	No N = 691	38.9	50.1	11.0	60.4	31.9	7.7	67.0	22.8	10.3	58.5	32.7	8.9
	p		*			**			*			**	
PC/ TV	Yes N = 930	44.5	45.6	9.9	66.8	28.5	4.7	71.7	20.4	8.0	64.3	29.2	6.5
	No N = 599	38.5	53.9	7.5	58.8	33.1	8.1	63.4	25.4	11.2	62.0	30.2	7.8
	p		n.s.			*			n.s.			n.s.	
ST	Yes N = 627	41.3	48.2	10.5	61.7	31.6	6.7	66.0	25.1	8.9	56.3	33.9	9.8
	No N = 898	45.3	46.7	8.0	67.4	28.2	4.4	72.6	19.2	8.2	67.8	28.0	4.1
	p		n.s.			*			*			**	

SD: sleep disorders;

SD: DFA: Difficulty falling asleep; NA: Nightly awakenings; EA: Early awakenings; NRS: Not refreshing sleep;

Evening habits: CD: caffeine drinks; SM: smoking; SP: sports; TV/PC: watching TV/using the PC; ST: studying.

No: never; St: sometimes; Oft: often. N = number of enrolled students

* = $p < 0.05$; ** = $p < 0.001$; n.s.: not significant

Like various other works based on self-reports [23, 24], this study confirms a significant gender difference in adolescent sleeping patterns, with more self-reported SD in females ($p < 0.001$). Our findings show that NA and EA, in particular, affect girls at least twice as much as boys: this may be due in part to girls being more sensitive in their analysis and in recognizing their symptoms. Studies using clinical and polysomnographic evaluations demonstrated a higher prevalence of these SD in the female gender, although not all studies have confirmed such gender-related differences [25].

In the literature, SD seem to be more common in older than in younger adolescents [26]. On dividing our sample into three age groups (14-16, 17-19 and > 19), we found a rising prevalence of SD with age, which seemed to occur earlier in females. Some Authors [27] have suggested a transient, puberty-related increase in SD - and girls reach puberty earlier than boys. Further studies on large populations of youth, recording sleep in the laboratory with concomitant measures of hormone status will be needed to clarify this issue.

As for the impact of inadequate sleep on daily life in adolescence, a significant correlation emerged between SD and DD. The most frequent DD was sleepiness, that correlated with DFA. The other DD (inattention, poor memory, irritability, headache and depression) seem to correlate with all SD investigated ($p < 0.001$), suggesting that sleeping poorly can influence wellbeing and productivity over the days that follow. It may also induce a chronic indisposition causing a decline in quality of life, a loss of learning capacity and greater risk of road accidents [28, 29].

In a recent critical review, Wolfson and Carskadon extensively analyzed academic performance and sleep [11], identifying worse school results for youth with SD. Studies clearly suggest that fewer total hours of sleep and irregular sleeping patterns are strongly associated with poor academic performance in youth.

As several Authors have seen, SD can cause both behavioural and learning problems, and a consequent poor performance at school [30-32]. Recent studies demonstrated an impairment of higher cognitive func-

tions, such as verbal creativity and abstract thinking, even after a single night of restricted sleep [33]. The relationship between sleepiness and mood in youth also emerges from our study and should be considered both ways: patients with clinically relevant mood disorders (particularly major depressive disorder) are at higher risk of SD and complaints [34, 35], while SD can exacerbate negative mood and/or mood regulating difficulties [25, 36].

Recent studies focusing on the micro-architecture of sleep in depressed young people provide evidence of more subtle SD also being predictive of a worse clinical course for youth with mood disorders [37].

Sleep deprivation can also be a cause of road accidents, causing death among young people due to inattention and dozing at the wheel. Compared with sleeping 8 or more hours a night, sleeping 6-7 hours was associated with a 1.8-fold risk of being involved in a sleep-related accident rather than any other type of road accident, and sleeping fewer than 5 hours a night coincided with a 4.5-fold risk [38].

Moreover, the chronic indisposition that can be caused by SD may induce youth to use substances (drugs, alcohol) in an attempt to remedy their bodily discomfort, with the consequent social fallout on our future generations [39].

Some Authors have said that excessive sleepiness results in most cases from lack of sleep, often due to an excessively short time spent in bed, associated with intrinsic changes in the sleeping/waking cycle as well as extrinsic reasons for going to bed later and getting up earlier. In childhood, school influences the sleeping-waking cycle and children tend to go to bed and get up at the same time every day [40]. Major changes in sleeping patterns occur when they reach adolescence, when they tend to go to bed later at night and to sleep later in the morning [26].

In our survey, 91.2% of the enrolled high school students reported having DD, as opposed to 75.5% reporting SD: this is probably because youth tend to go to bed late in the evening but are forced to get up early to go to school, consequently sleeping well but not long enough.

Other Authors have reported that the school timetable and parental control induce children to go to bed earlier during the week than at weekends. Adolescents tend to sleep longer at weekend [26], possibly to catch up on their shortage of sleep during the week [37].

Our investigation into students' habits after 6 p.m. and their possible relationship with SD shows that watching television is a favorite pastime, while about 50% of the youth play sport or use the PC before

going to bed, while studying was the least common evening activity among those we asked about. We found studying correlated with NA, EA and NRS. Some studies [41] have reported that adolescents and youth often reading before bedtime (sometimes for lengthy periods of time) do not have SD: reading a novel is not the same as studying, however, since it demands less concentration and may be relaxing. Smoking appears to correlate with SD: nicotine is known to have a stimulating effect, boosting adrenaline secretion, raising blood pressure and heart rate, and thus increasing the likelihood of SD [42].

Unlike American findings [43] we found no greater probability of SD in adolescents watching TV or using the PC before going to bed. This may be attributable to differences in the type of programs available in different countries, or to the number of hours spent in front of the TV/PC and the interval between the activity and falling asleep.

Playing sport seems to correlate with sleeping well: youth who play sport report fewer SD than their more sedentary counterparts. This may seem to contradict the ample evidence that physical exercise increases adrenergic activity, but any sports are usually played some time before going to bed, helping to make people physically tired and sleepy once its stimulating effect has faded [44].

Our enrolled students that use caffeine drinks in the evening did not generally suffer from NA, EA or DFA, but their sleep was not refreshing. Coffee, in particular, seemed to be associated with NA.

Eight per cent of our sample reported using remedies to sleep: in particular, 1.3% took hypnotic substances.

Conclusion

Medical system and General Practitioners in particular are not yet fully aware of the clinical relevance of SD because they are not always contacted by young people, who sometimes resort to self medication [45]. This may be one of the reasons why the problem is underestimated. Given the importance of lifestyle in determining a good night's sleep (as confirmed by our results), it is important to identify SD accurately and give youth appropriate counseling.

Sleeping well is also fundamental to a good quality of life and helps to prevent attitudes that can cause personal and social damage, such as drugs or alcohol use, and the related implications (e.g. road safety). Hence the need to further study the problem and design educational schemes for youth and their families.

List of text abbreviations

SD	Sleep disorders
DD	Daytime sleep-related disorders
DFA	Difficulty falling asleep
NRS	Not refreshing sleep
NA	Night awakenings

EA	Early awakenings
CD	Caffeine containing drinks
SM	Smoking
SP	Sport
PC/TV	Watching TV/using the PC
ST	Studying

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■ Received on June 10, 2008. Accepted on February 27, 2009.

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