

# Sleep Quality, School Grades, and Quality of Life in Italian Adolescents

Author(s):

Goracci Ariannaaffiliation: MD Department of Neuroscience, Psychiatry Division, University of Siena, Italy

Santomauro Toninoaffiliation: MD Mental Health Center, Castelfranco V.to, ULSS8 Asolo, Veneto

Forgione Rocco Nicolaaffiliation: Department of Neuroscience, Psychiatry Division, University of Siena, Italy

Martellucci Pietro Marioaffiliation: P Local Health Service 7 Siena, Italy

Salviulo Carmenaffiliation: Department of Pharmacology "Giorgio Segre", Division of Occupational Medicine and Environmental Toxicology

A.Fagioliniaffiliation: MD Department of Neuroscience, Psychiatry Division, University of Siena, Italy

Corresponding author:

Arianna Goracci M.D., Department of Neuroscience, Psychiatry Division, University of Siena School of Medicine,

Address: Viale Bracci 1, 53100 Siena, Italy,

Phone: +39-0577-586275, Fax: +39-0577-233451,

E-mail: [goracci3@unisi.it](mailto:goracci3@unisi.it)

## Riassunto

**Introduzione:** Abbiamo valutato la qualità del sonno in un gruppo di adolescenti italiani e il rapporto con i voti scolastici e una la qualità di vita.

**Materiali e metodi:** Sono stati valutati con il Pittsburgh Sleep Quality Index (PSQI) e il Quality of Life Enjoyment and Satisfaction Questionnaire (Q-LES-Q) 402 studenti di una scuola media superiore di Siena (età media 16 anni, SD 1.34, range 14-20 anni, 229 femmine).

**Risultati:** 194 soggetti (48%) hanno ottenuto un punteggio al PSQI superiore alla soglia di rilevanza clinica per una scarsa qualità del sonno. Questi soggetti hanno riportato una qualità di vita significativamente peggiore nei domini del QLESQ di attività fisica ( $p < 0,0001$ ), umore ( $p < 0,0001$ ), attività scolastiche ( $p < 0,01$ ) e attività generali ( $P < 0,0001$ ). I soggetti con una scarsa qualità del sonno avevano più probabilità di avere voti peggiori ( $p < 0,035$ ) durante l'anno scolastico in corso.

**Conclusioni:** Una scarsa qualità del sonno è molto diffusa tra gli adolescenti italiani ed è associata con peggiori voti scolastici e peggiore qualità di vita. Interventi specifici per migliorare la qualità del sonno negli adolescenti dovrebbero essere sviluppati e testati.

**Parole chiave:** Veglia; Adolescenti, la qualità della vita scolastica

## Abstract

**Introduction:** We evaluated the quality of sleep in a group of Italian adolescents and its relationship to worse school grades and poorer quality of life.

**Materials and Methods:** Four-hundred-two high school students (mean age 16 years, SD 1.34, range 14-20 years, 229 females) were evaluated with the Pittsburgh Sleep Quality Index (PSQI) and the Quality of Life Enjoyment and Satisfaction Questionnaire (Q-LES-Q). One-hundred-ninety-four (48%) subjects scored above the PSQI threshold of clinical significance for poor sleep quality.

**Results:** These subjects reported a significantly worse quality of life in the physical activities ( $p < 0.0001$ ), feelings ( $p < 0.0001$ ), school ( $p < 0.01$ ) and general activities ( $P < 0.0001$ ) QLESQ domains. Subjects with poor sleep quality were more likely to have failed at least a class ( $p < 0.035$ ) during the current school year.

**Conclusions:** Poor sleep quality is highly prevalent among Italian adolescents and is associated with worse school grades and quality of life. Specific interventions to improve sleep quality in adolescents should be developed and tested.

**Key Words:** Sleep; Quality of Life; Adolescents; School

## Introduction

The widespread diffusion of sleep disorders, still today commonly underestimated, calls for more studies in their assessment and treatment. Sleep disorder and poor sleep quality affect people of all ages, including adolescents. Many adolescents prefer to go to sleep later at night and wake up later in the day [1,2,3]. Survey and field studies have shown that teenagers usually get less sleep than younger children, and the mean sleep time changes from 10 hours during childhood to less than 7,5-8 hours by age 16 [1,4,5]. As a result of sleeping less, high school students frequently endorse a "wish for more sleep" [6]. In fact, laboratory data demonstrates that the sleep need seems not to change or even to increase during adolescence [4].

Several studies [7, 8, 9, 10] classified adolescents in morning-types (advanced phase, marked preference for waking up at an early hour and finding it difficult to remain awake beyond their usual bedtime) and evening-types (delayed phase, sleep at later hours and often find it difficult to get up in the morning), and suggested that that morningness-eveningness is a strong predictor of sleep quality among high school students. These and other studies [11, 12, 14] also highlighted that poor sleep is

highly prevalent in adolescents, and that the chronic partial sleep loss may exert negative effects on neurocognitive performance, mood, and health of the adolescents. For instance, Manni and colleagues [15] evaluated subjective sleep quality in a large sample of 17-year-old Italian adolescents, reported that 16.5% were poor sleepers and found a significant association between chronic poor sleep and female gender, worries, anxiety, depression, poor sleep hygiene and arousal related parasomnia. Nevertheless, few studies [16, 17] so far have evaluated the association among quality of sleep, quality of life, and school grades. Our study was conducted as a part of the Project for Promoting Mental Health, sponsored by the Siena Health Care Service USL 7, with the goal to evaluate: 1) the quality of sleep in a sample of high school students; 2) the relationship between quality of sleep and quality of life; and 3) the relationship between poor sleep quality and lower school grades. We hypothesized that the prevalence of poor sleep quality was high, and that poor sleep quality would significantly correlate with poor quality of life and worse school performance.

## Materials and Method

The School Council and the University of Siena Institutional review Board (Ethical Committee) approved the study. Both subjects and parents provided their informed consent after receiving a complete description of the study and having an opportunity to ask questions.

A convenience sample of 402 high school students (mean age 16 years, SD 1.34, range 14-20 years, median 229 females) attending the Scientific High School "Galileo Galilei" and Art Institute "Duccio di Boninsegna" in Siena (Italy) agreed to participate in this study. Unless they fail a grade, Italian students attend primary school (5 grades) from age 6 to age 11, secondary school (3 grades) from age 12 to 14, and high school from age 15 to 20. The demographic characteristics of the high school students who participated in this study are reported in Table 1.

TABLE 1 - Demographic Characteristics of the study sample

Demographic characteristics		
Gender	Male (N=173)	43%
	Female (N=229)	57%
Area of living	Urban (N=147)	37%
	sub urban (N=133)	33%
	Rural (N=122)	30%
FAILED CLASSES IN THE FIRST TERM (FALL)*	None (N=184)	46%
	At least one (N=216)	54%
AGE	Mean	16.17
	Median	16
	Std. Deviation	1.36
	Minimum	14
	Maximum	20

\* missing values: n=2

Study subjects completed the Pittsburgh Sleep Quality Index (PSQI) [18] and the Quality of Life Enjoyment and Satisfaction Questionnaire (Q-LES-Q) [19].

The Pittsburgh Sleep Quality Index (PSQI) is a self-rated instrument that measures sleep quality and patterns in the previous 1-month period. The questionnaire explores seven areas and includes 19 items assessing seven subscales: 1) subjective quality, 2) sleep duration, 3) sleep efficacy, 4) sleep perturbations, 5) time to fall asleep, 6) use of sleep medication, and 7) sleepiness during the day.

The first questions address the patient's usual bedtime and rising time, how long it takes to fall asleep and how many hours of sleep are obtained per night. The following questions quantify specific physical and psychological events, such as waking during the night, using the bathroom, being unable to breathe easily, coughing or snoring, feeling too hot or cold, having bad dreams, and having pain. The patient is also asked how often she or he uses sleep-promoting medications, how often it has been hard to stay awake during daylight activities, and how often it has been difficult to get things done. Finally, the patient rates overall sleep quality on a semantic scale ranging from "very good" to "very bad." A score above 5 indicates a significant sleep disturbance.

The Quality of Life Enjoyment and Satisfaction Questionnaire (Q-LES-Q) is a self-report instrument used to assess the degree of enjoyment and satisfaction experienced by subjects in eight areas, including: physical health/activities (13 items), feelings (14 items), work (13 items), household duties (10 items), school/course work (10 items), leisure time activities (6 items), social relations (11 items), and general activities (14 items). The three areas of work, household duties, and school/course work are filled out by the respondent only if applicable. Items are rated on a 5-point scale. Higher scores denote higher levels of satisfaction. There are two additional items which explore medication satisfaction and life satisfaction and contentment over the last week. The Italian version of the Q-LES-Q has recently been validated by Rossi [20].

Chi square test was used to look for differences between subjects with and without a sleep disturbance on qualitative demographic variables. T-test was used to evaluate if there was a significant age difference between the two groups (subjects with and without a sleep disturbance). Mann-Whitney U-test was used to evaluate the differences in QLES Q score.

## Results

One-hundred-ninety-four (48%) subjects scored above the threshold (PSQI=5) of clinical significance for poor sleep quality (Table 2). These subjects were significantly older ( $p=0.008$ , mean 16.3608, SD 1.34037) than the individuals who scored below 5. Also, these subjects reported a worse quality of life, and the difference in QLES-Q score between the two groups achieved statistical significance for the physical activities ( $p<0.0001$ ), feelings ( $p<0.0001$ ), school ( $p<0.01$ ) and general activities ( $P<0.0001$ ) QLES Q domains. Moreover, subjects with poor sleep quality were more likely to have failed at least a class ( $p<0.035$ ) during the current school year.

TABLE 2 – Summary of answers that the study subjects gave to each of the PSQI items.

PSQI item		Normal Sleep Quality N=208 PSQI<=5	Poor Sleep Quality N=194, PSQI>5	
When have you usually gone to bed?	between 7:30 pm and 10:00 pm	13.5%	6.7%	
	between 10:01 pm and 11:00 pm	55.8%	40.3%	
	between 11:01 pm and 00:00 am	28.8%	44.8%	
	between 00:01 am and 1:00 am	1.4%	5.2%	
	between 1:01 am and 2:00 am	0.5%	2.5%	
	after 2:01 am	0.0%	0.5%	
How long (in minutes) has it taken you to fall asleep each night?	mean	10.8	26.1	
When have you usually gotten up in the morning?	before 6:00 am	0.0%	2.5%	
	between 6:00 am and 7:00 am	52.8%	87.7%	
	between 7:01 am and 8:00 am	46.7%	9.8%	
	between 8:01 am and 9:00 am	0.5%	0.0%	
	after 9:01 am	0.0%	0.0%	
How many hours of actual sleep do you get at night? (This may be different than the number of hours you spend in bed)	mean	7.7	6.8	
During the past month, how often have you had trouble sleeping because you...	Cannot get to sleep within 30 minutes	3 or more times a week	1.0%	24.0%
		once or twice a week	6.8%	25.5%
		less than once a week	34.5%	30.7%
		not during the past month	57.8%	19.8%
	Wake up in the middle of the night or early morning	3 or more times a week	5.8%	20.7%
		once or twice a week	14%	28.5%
		less than once a week	29%	23.3%
		not during the past month	51.2%	27.5%
	Have to get up to use the bathroom	3 or more times a week	5.3%	8.3%
		once or twice a week	7.7%	12.4%
		less than once a week	24.2%	28.0%
		not during the past month	62.8%	51.3%
	Cannot breathe comfortably	3 or more times a week	1.9%	6.2%
		once or twice a week	1.9%	10.4%
		less than once a week	8.2%	10.4%
		not during the past month	87.9%	73.1%
	Cough or snore loudly	3 or more times a week	1.5%	6.3%
		once or twice a week	3.9%	6.3%
		less than once a week	12.6%	14.1%
		not during the past month	82.0%	73.3%
	Feel too cold	3 or more times a week	1.9%	2.6%
		once or twice a week	8.2%	13.5%
		less than once a week	31.9%	33.2%
		not during the past month	58.0%	50.8%
	Feel too hot	3 or more times a week	3.4%	13.5%
		once or twice a week	19.3%	36.8%
		less than once a week	34.3%	29.5%
		not during the past month	43.0%	20.2%
		3 or more times a week	2.4%	8.3%
		once or twice a week	0.0%	0.0%

		once or twice a week	11.2%	21.8%
		less than once a week	32.5%	35.8%
		not during the past month	53.9%	34.2%
		3 or more times a week	1.0%	4.7%
		once or twice a week	6.8%	16.6%
		less than once a week	19.4%	31.1%
		not during the past month	72.8%	47.7%
		3 or more times a week	2.3%	13.8%
		once or twice a week	7.0%	23.6%
		less than once a week	16.4%	27.6%
		not during the past month	74.2%	35.0%
	During the past month, how would you rate your sleep quality overall?	Very good	49.8%	5.7%
		Fairly good	49.3%	63.7%
		Fairly bad	1.0%	28.5%
		Very bad	0.0%	2.1%
	During the past month, how often have you taken medicine (prescribed or over the counter) to help you sleep	3 or more times a week	0.0%	3.6%
		once or twice a week	0.5%	6.2%
		less than once a week	2.4%	6.7%
		not during the past month	97.1%	83.4%
	During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?	3 or more times a week	1.0%	6.7%
		once or twice a week	3.4%	15.0%
		less than once a week	18.8%	29.0%
		not during the past month	76.8%	49.2%
	During the past month, how much of a problem has it been for you to keep up enthusiasm to get things done?	3 or more times a week	0.5%	5.8%
		once or twice a week	6.8%	24.1%
		less than once a week	31.1%	45.0%
		not during the past month	61.7%	25.1%

No statistically significant gender difference was found between subjects who scored above and below the threshold for poor sleep quality. Similarly, no statistically significant differences were found based on the area of living (urban, suburban, rural).

## Conclusions

Our study showed that almost half of the adolescents who participated in the research endorsed the criteria for poor sleep quality. This worrisome finding is consistent with the data from other studies. For instance, Megdal and Schernhammer [10] conducted a cross-sectional survey of 131 students grades 9–12 from a private high school in the United States and found that 69% of girls and 58% of boys in this sample were poor sleepers. Hansen [21] evaluated a sample of 60 American high school students, and observed that adolescents lost as much as 120 minutes of sleep per night during the week after the start of school while weekend sleep time was significantly longer (30 minutes). Wolfson and Carskadon [9] classified 3,120 high school students in two subgroups: group A (adequate sleep habit group) and group B (less than adequate sleep habit group). Group A students reported a total sleep time longer than 8 hours and 15 minutes with less than 60 minutes weekend delay whereas group B students reported a total sleep time shorter than 6 hours and 45 minutes and large weekend bedtime delay (>120 minutes). Interestingly, students of group A achieved better grades at school than students of group B and the latter described themselves as struggling or failing school and reported more daytime sleepiness, more daytime fatigue, tendency of falling asleep at school and attention problems. This finding is consistent with other studies [14, 22, 23, 24] and with the findings of the present study about the relationship between poor sleep and worse school grades. In fact, we found that subjects who score above the PSQI threshold for poor sleep were more likely to have failed at least a class in the current school year. This result is not surprising. In fact, various surveys have indicated that sleep deprivation impairs significantly memory and learning. For example, Derhing [25] reported that good-quality sleepers have better short-term memory than poor-quality sleepers and that good-quality sleepers have higher test scores in the morning, while poor-quality sleepers have higher test scores in the evening. Also, one single night of sleep deprivation has proven enough to impair memory. Of interest, we also found a significant relationship between poor sleep and a worse quality of life, which achieved statistical significance for the physical activities, feelings, school and general activities QLES Q domains. The latter domain is considered the most important QLESQ domain in that it analyzes the core features of all the other domains and represents a broad indicator of quality of life across all domains.

Among the limitations of this study we would like to acknowledge the fact that study subjects were recruited from only 2 high schools in the Siena municipality and therefore the results may not be generalizable to all Italian adolescents. Also, we would like to acknowledge the lack of a diagnostic assessment to establish the role of disorders such as depression or anxiety as mediators or moderators of the relationship between poor sleep quality and worse school grades and quality of life. Another limitation of this study is that the PSQI and QLES Q were developed to assess sleep quality in adults and it is not clear how reliably they can be used to assess sleep

quality in adolescents. At the time when the study was conducted, we were unfortunately unaware of the existence of an Italian version of the QLESQ. Also, we are unable to establish a direction of causality, i.e. if poor sleep quality determines poorer quality of life/worse school grades or vice-versa and to evaluate the possible contribute of other variables, such as obesity, physical activity, sedentary behavior, psychologic trauma, comorbid psychiatric or medical illnesses. Despite the many and important limitations above, we think that our study can still add to the existing literature. For instance, it can contribute to raising the attention on the high prevalence of poor sleep quality among adolescents, stimulate new research on the relationship among sleep quality, quality of life and school achievements, and call for the development of strategies to improve sleep in adolescents.

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