SLEEP and SLEEP DISORDERS

Subjective Daytime Sleepiness and Related Predictors in Finnish Schoolchildren

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The study objective was to find out the predictors which explain subjective daytime sleepiness (SDS) in schoolchildren. The questionnaire study included data on the child's sleeping habits, sleep disorders, daytime sleepiness, progress at school and TV/video watching. The corresponding parental data was also gathered. Bivariate cross-tabulations and multivariate log-linear modelling were used as statistical methods. The participants were 518 schoolchildren (9 to 17 years), 398 mothers and 345 fathers. SDS was reported in 21% of the children. The children with SDS slept less on weekdays and went to bed later on Saturday nights, reported a long sleep latency and more dreaming, night waking, insomnia, sleeptalking and video watching than the children without SDS. Their parents had more sleep disturbances than the parents of the alert children. This study shows that SDS in schoolchildren can be caused by poor sleeping habits and frequent sleep disorders, but that parental sleep problems may also have effect on the symptom. (Sleep and Hypnosis 2000;4:139-146)

Key words: *sleeping habits, sleep disorders, video watching*

INTRODUCTION

Daytime sleepiness in children and adolescents has negative consequences on schoolchildren's daily life and functioning (1-3). Thus it is important to evaluate the prevalence of daytime sleepiness and to find out its predictors. The prevalence of excessive daytime sleepiness in children and adolescents has varied between 0 and 35% in epidemiological studies (4-10). An increase of daytime sleepiness has been shown to occur during puberty (11). A longitudinal study about sleep requirement through puberty (12) has shown that excessive sleep requirement does not seem to be a constant phenomenon.

The most common predictor found for daytime sleepiness is short sleeping time on weekdays combined with an irregular sleep-wake schedule during the week (2,9,13,14). Poor sleep quality has also been connected with daytime sleepiness (7,9,15,16). In epidemiological studies among young adults the symptom has been connected to use of hypnotics and psychoactive substances (9,14) and snoring (9). Tiredness has also been associated with depression (17).

The aim of the present study was to analyse the associations between schoolchildren's subjective feeling of daytime sleepiness (SDS) and their sleeping habits and disorders, the effect of their parents' sleeping habits and sleep disorders, and the impact of the social situation of the family by a multivariate statistical method.

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METHODS

Participants and Questionnaire

A questionnaire study of sleep habits and disorders in schoolchildren and their families was conducted in spring 1988 in Tampere, Finland. Two schools (a primary school and a secondary school) were chosen for the study by the school authorities on the basis of their social representativeness. The school administrators also evaluated the ethical validity of the study protocol.

The study questionnaire consisted of two forms: one for the child and one for the parents. The questionnaire was given to 582 children (age range 9.4 to 17.1 years) and their parents. The children were asked to report wake-up and bedtimes on weekdays and at weekends, sleep latency, TV and video watching time, dreaming, sleep disorders, daytime sleepiness and progress at school. On the parental form the parents answered the same questions reporting their child. In addition, their form included questions on social background, parental sleeping habits, sleep disorders and daytime sleepiness. Further details of the material, methods and epidemiological data have been presented in our previous study (18).

Data Management

Daytime sleepiness (DS), estimated on the basis of the child's own answer, was studied with the question 'Are you sleepy in daytime?'. The four answer categories were offered 'always/often/sometimes/never'. Answers 'always' or 'often' were classified as subjective daytime sleepiness (SDS). The validity of the question was confirmed by comparing it to the same question answered by the parents (18). More detailed questions about DS were also asked (wake-up difficulties, daily sleep urge, napping, sleeping in lessons, sleeping while watching TV, sleeping in the car). Factor analysis was carried out in order to evaluate the relationship between subjective feeling and the objective phenomena of sleepiness.

The variables which were used in the analysis of SDS were children's age, sex, bedtimes, wake-up and total sleeping times on weekdays and at weekends, TV and video watching, various sleep phenomena and disorders and progress at school. Of parental answers data on social background, living and sleeping conditions of the family, parental sleeping habits, sleep phenomena and disorders, and parental diseases and medication were included in the analyses.

The variables concerning sleep phenomena and disorders had four answer categories (always/often/sometimes/never). They were dichotomised as follows: 1) those who answered 'always' or 'often' were classed as having the symptom and 2) those who answered 'sometimes' or 'never' were deemed not to have the symptom. The dividing points of the remaining questions answered by the child are presented in Table 1. Parental variables were categorised according to analogous principles. Marital status was dichotomised to 1) marriage or common law marriage, 2) divorced, widowed or single. Education was dichotomised to 1) college and academic, 2) basic and vocational. Social class was divided into 16 subgroups (19) which were combined into five main categories (entrepreneurs, upper and lower employees, workers, others).

Statistical Management

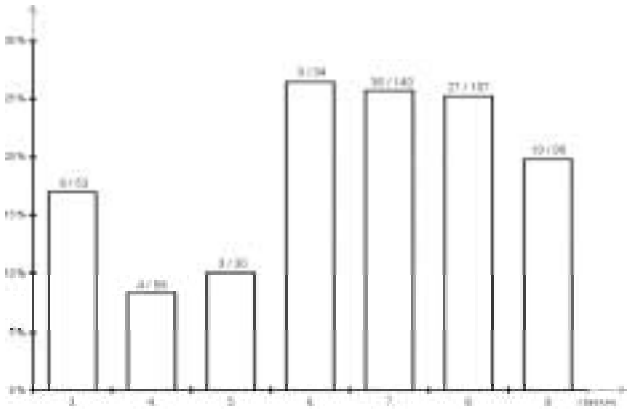
The scheme of statistical management of the data is presented in Figure 1 (the numbers in the boxes refer to the variables in Table 2). At first bivariate analysis (cross-tabulations) was done in order to include all possibly significant variables related to SDS in the multivariate analysis. Here we used a very liberal limit $p<0.09$. Log linear modelling was used as a multivariate technique. Because this technique takes into account only cases with complete data the modelling was made in two settings: 1) children's data only and 2) data of both children and their parents. The modelling consists of successive analyses in which only three variables at a time were tested against SDS because the sample size of the present study was not large enough to use more. In order to include the variables of different aspects in each analysis the following selection process was used.

Table 1. The dividing points of the non-four-category answers of the child.

QUESTION	DIVIDING POINT
Bedtime*	
on weekdays	10 p.m.
on Fridays	11.30 p.m.
on Saturdays	12 p.m.
Wake-up time*	
on weekdays	7 a.m.
on Saturdays	9.30 a.m.
on Sundays	9.30 a.m.
Sleeping time*	
on weekdays	8.5 hrs
on Friday nights	10 hrs
on Saturday nights	10 hrs
Sleep latency	< 30min
TV/video watching	* 2hrs per day
Average grade*	7.9 (range 4.0-10.0)
Grade* in	
mathematics	8 (range 4-10)
Finnish	8 (range 4-10)
Age**	13 years

*dividing point was chosen based on median of the data
**dividing point was chosen based on mean of the data

Figure 1. Scheme of statistical management of the data



At first the significant variables (n = 19, see results) in the bivariate analysis were arranged into conceptually related blocks (Figure 1). Three variables (child's age, grade in mathematics and video watching time) did not fit in any of these blocks and were used in the analyses as individual variables in parallel with the blocks. The blocks (the number of variables in each block is in parenthesis) were child's sleeping habits (6), child's sleep disorders (5), parents' sleep disorders (3), and parents' social background (2).

The selection of the three variables included in the successive analyses was made by using variables from different blocks or individual variables so that each variable was tested against SDS in these analyses. In the analyses of the children's data only the variables of the child's sleeping habit block and sleep disorder block, video watching time, grade in mathematics and age were used. In the analyses of both the children's and their parents' data the variables of parental sleep disorder block and social background block were added to the analyses. The variables with p-value less than 0.05 were included in the multivariate model, and studied in greater detail by standardised and Freeman-Tukey deviates.

If several variables in the block were significant in the multivariate analyses a new variable was formed by combining all the significant variables in the block. This was done to reduce the number of variables included in the analysis without loss of essential information. However, if the variables in the block were strongly correlated with each other only the most significant ones were included in the new variable. E.g. bedtime on schooldays correlated with sleeping time on schooldays so strongly that one of the two variables could be left out without any effect on the results. The significance of the new variable was then tested.

The model was tested by deleting variables, regrouping them and evaluating whether the fit of the model changed significantly. The goodness-of-fit of the model was measured using likelihood ratio chi-square. In this case high p-value indicates a satisfactory fit. When interpreting the results odds ratio (OR) with 95% confidence interval was used. The variables from the multivariate analysis which were significantly related to SDS are called predictors.

The computation was carried out using BMDP Statistical Software (versions 1988 and 1990) on a SUN/UNIX mainframe.

RESULTS

In this study 518 out of the 582 children (89%), 398 of the 582 mothers (68%) and 345 of the 582 fathers (59%) returned the questionnaire. SDS was detected in 107 (21%) children. The results from each school grade are presented in Figure 2. In factor analysis the question of daytime sleepiness correlated strongly with daily sleep urge, napping, wake-up difficulties and sleeping in the car.

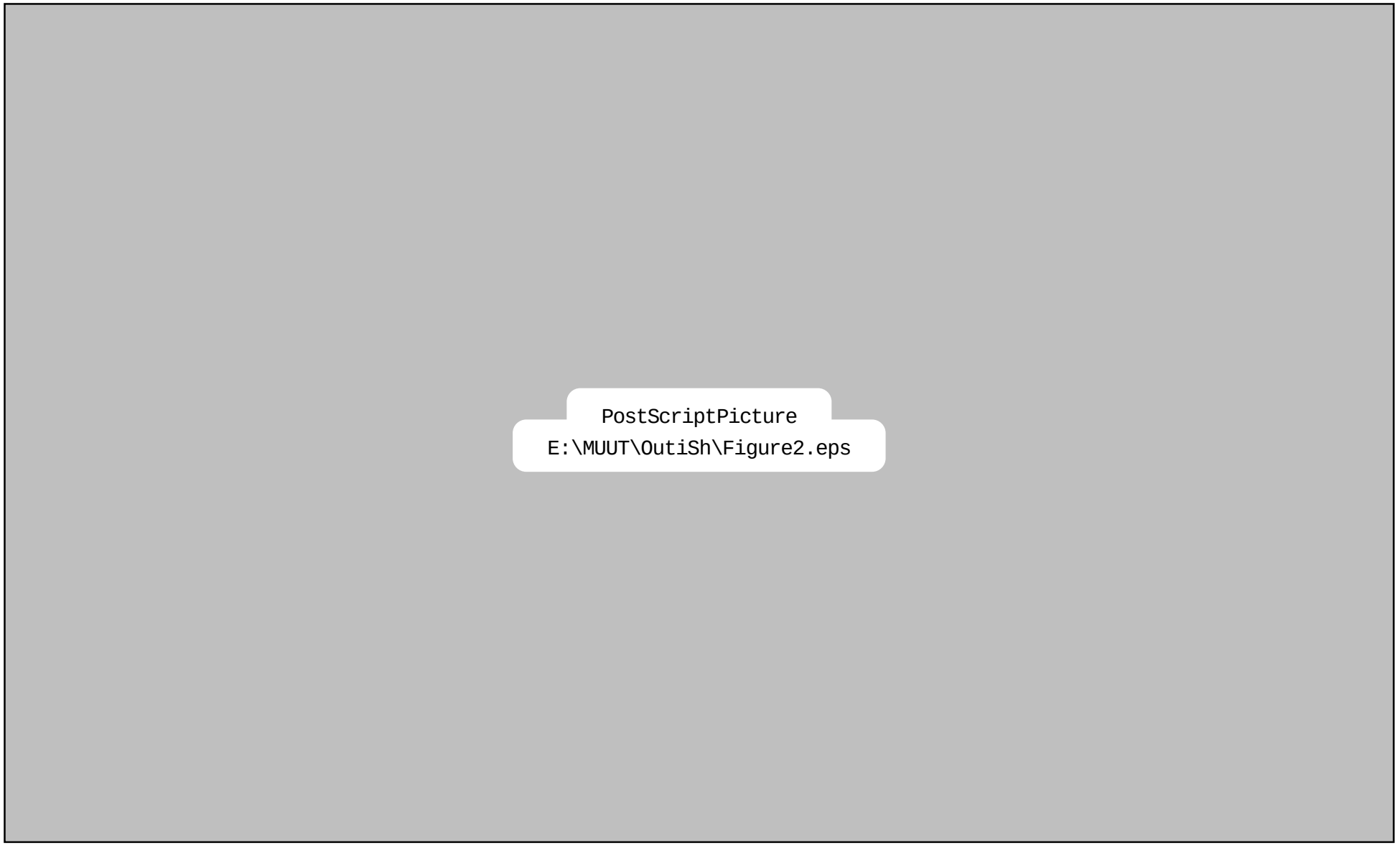
The variables which were related to SDS in bivariate analysis are presented in Table 2. These variables were used in the multivariate analyses. When the children's data were studied by multivariate analyses the following variables were significant: bedtimes on schooldays, Fridays and Saturdays, wake-up times on Saturdays and Sundays and

Table 2. The variables related to SDS in bivariate analysis (the numbers in the parentheses refer to Figure 1).

VARIABLE	p-value	VARIABLE	p-value
Child's age	0.01 (1)	Child's sleep latency	0.03 (10)
grade in mathematics	0.09 (2)	night waking	0.001 (11)
video watching time	0.02 (3)	insomnia	0.0001 (12)
bedtime		sleeptalking	0.0009 (13)
on schooldays	0.001 (4)	dreaming	0.01 (14)
on Fridays	0.005 (5)		
on Saturdays	0.002 (6)	Mother's sleep quality	0.06 (15)
wake-up time		Father's	
on Saturdays	0.0002 (7)	sleep urge	0.001 (16)
on Sundays	0.006 (8)	insomnia	0.04 (17)
sleeping time		social class*	0.008 (18)
on schooldays	0.004 (9)	educational level	0.04 (19)

*entrepreneurs versus the others

Figure 2. Percentage of DS in various classes at school. The number of sleepy children in each class vs. the total number of children in the class are indicated at the top of the columns.



sleeping time on schooldays in the block of sleeping habits; sleep latency, night waking, insomnia, sleeptalking and dreaming in the block of sleep disorders; and child's age and video watching time.

Because in the block of sleeping habits each variable was correlated strongly with SDS and also with each other variable the two most significant variables in the multivariate analysis (sleeping time on schooldays and bedtime on Saturdays) were combined to create a new variable which would be used in the following analyses. The reduction did not change the significance of the sleeping habit block. The predictor was divided into three levels as shown in Table 3. The variable was called sleeping habit predictor, which describes the general regularity of the sleep pattern during the week.

In the block of child's sleep disorders all variables were significant and not correlated. Thus a predictor called the sleep disorder predictor was formed including all five variables (sleep latency, night waking, insomnia, sleeptalking and dreaming). The predictor was divided into three levels: 1) no disorder, 2) one disorder 3) two or more disorders. Both the sleeping habit variable and the sleep disorder variable were tested in multivariate analysis with SDS and were found to be significant.

The time spent watching videos and age were also significantly associated with SDS. In addition, age was strongly associated with both sleeping habit variable and video watching and was interpreted to have an effect on SDS through these living habits. Thus age was left out of the final model.

The significant variables created in the two blocks and time spent watching videos came out as predictors for final model 1. The fit of model 1 was p=0.44. Cross-tabulations between SDS and the predictors are presented in Table 3. The model shows that the children with SDS had poorer sleeping habits: sleeping time <8.5 hours on schooldays and /or bedtime >24 hours on Saturdays. They also had more sleep disorders: long sleep latency, night waking, insomnia, sleeptalking and dreaming. The children with SDS spent more time watching videos. Furthermore, sleeping habit predictor and video watching predictor were significantly associated so that those with poorer sleeping habits also watched more videos. The number of children in the final model was 397.

In the multivariate analyses using both children's and parental data, the significant variables were child's sleep latency, night waking, insomnia, sleeptalking and dreaming in the block of child's sleep disorders, mother's sleep quality, father's sleep urge and insomnia in the block of parental sleep disorders, and father's social class in the block of social background (the dichotomy between entrepreneurs vs. the other classes was used because occurrence of SDS in the entrepreneur class differed significantly from its occurrence in the other classes).

The child's sleep disorder variable, created previously from the significant sleep disorders, was also used in this modelling. A new variable was formed out of the three significant parental sleep disorders. It was dichotomised as follows: 1) no

Table 3. Model 1 (children's data only): SDS and sleeping time predictor, sleep disorder predictor and video watching time predictor in cross-tabulation with odds ratio (OR) and 95% confidence interval (CI).

PREDICTORS		SUBJECTIVE DAYTIME SLEEPINESS					
		SDS+ n (%)	SDS* n (%)	total n		OR	95% CI
VIDEO WATCHING TIME	<2hrs/day	50 (60)	230 (73)	280		1.88	1.14-3.12
	>2hrs/day	34 (40)	83 (27)	117			
	total	84 (100)	313 (100)	397			
SLEEPING* HABIT 0.725-2.35	level 1	21 (25)	143 (46)	164	1 vs. 2	2.27	1.25-4.11
	level 2	36 (43)	108 (34)	144	2 vs. 3	1.31	
	level 3	27 (32)	62 (20)	89	1 vs. 3	2.97	1.56-5.64
	total	84 (100)	313 (100)	397			
SLEEP DISORDER	none	12 (14)	88 (28)	100	none vs. one	1.64	0.82-3.30
	one	39 (46)	174 (56)	213	one vs. more	2.89	1.65-5.05
	two / more	33 (40)	51 (16)	84	none vs. two or more	4.75	2.25-10.0
	total	84 (100)	313 (100)	397			

*1 = sleeping time > 8.5 hrs on weekdays and bedtime <24hrs on Saturday nights

2 = sleeping time < 8.5 hrs on weekdays or bedtime >24hrs on Saturday nights

3 = sleeping time < 8.5 hrs on weekdays and bedtime >24hrs on Saturday nights

disorder, 2) one or more disorders. Both the child's sleep disorder variable and the parental sleep disorder variable were tested in multivariate analysis with SDS and were found to be significant.

The significant variables created in the two blocks and father's social class came out as predictors for the final model 2. The fit of model 2 was p=0.896. Cross-tabulations between SDS and the significant predictors are presented in Table 4. The model shows that the children with SDS had parents with more sleep disorders. Their mothers had poorer sleep quality and fathers had more sleep urge and insomnia. Their fathers were also more likely to be entrepreneurs. The children had more sleep disorders themselves, such as long sleep latency, night waking, insomnia, sleeptalking and dreaming. The number of children in the final model was 312.

DISCUSSION

In the present study the prevalence of SDS was 15% in preadolescents and 23% in adolescents. The aim of this study was to evaluate the subjective feeling of daytime sleepiness and to exclude the possibly more objective findings (daily sleep urge, napping, wake-up difficulties, sleeping in the car, sleeping while watching TV, sleeping in lessons). However, a clear correlation was found between daytime sleepiness and the first four of these parameters.

Reliable comparison between studies of the prevalence of daytime sleepiness (DS) and the factors related to it is not easy because the definition of daytime sleepiness (DS) is a considerable problem. Another problem in the evaluation of DS is the question selected to describe the symptom. In some studies the question 'Are you sleepy/tired during daytime' has been used (6,18). Some studies differentiate between morning, afternoon and evening tiredness (16), while others report morning tiredness only (20). Expressions 'tired most of the time' and 'sleepiness independent of meals' have also been used (7,15). The need for more sleep has been inquired by some researchers (8,10,12). The question 'Are you sleepier than your friends' has been used (5,21). Sleepiness has also been analysed by a scoring system (4) when more objective aspects of sleepiness are taken into account. The comparison between various studies is also difficult because of differences in the age groups.

The effect of seasonal variation on mood and alertness has been studied. In epidemiological studies concerning depression and affective disorders in adults the results are contradictory (22-24). The peak of depressive symptoms has been discovered in spring and summer (22), the peaks in prescribing antidepressants in summer and winter (23), and there has been no difference in depressive symptoms between cold and warm climate (24). Seasonal affective disorders (winter and summer depression), even in children, are encountered in clinical practice and light therapy has been used for them (25,26). Our questionnaire study took place in May, when the nights in Finland are short. On the other hand, May is at the end of the school year when pupils are more likely to be tired. In fact, in the Finnish study by Partinen (27) young draftees estimated their daytime sleepiness to be most common in spring.

It was not surprising that children with SDS slept less on weekdays than their more alert peers. Their late bedtime on Saturday nights also indicates irregular sleeping habits at weekends. On the other hand, either short sleeping time on weeknights or late bedtime on Saturdays adds to the risk of SDS as much as having both habits. In the study by Billiard et al. (9)

Table 4. Model 2 (both children's and their parents' data): SDS and child's sleep disorder predictor, parental sleep disorder predictor and father's social class predictor in cross-tabulation with odds ratio (OR) and 95% confidence interval (CI).

PREDICTORS		SUBJECTIVE DAYTIME SLEEPINESS					
		SDS+ n (%)	SDS* n (%)	total n		OR	95% CI
CHILD'S SLEEP DISORDER	none	7 (13)	81 (31)	88	none vs. one	2.18	0.911-5.24
	one	27 (51)	143 (55)	170	one vs. more	2.88	1.44-5.75
	two or more	19 (36)	35 (14)	54	none vs. two or more	6.28	2.42-16.3
	total	53 (100)	259 (100)	312			
PARENTAL SLEEP DISORDER	none	41 (77)	232 (90)	273		2.51	1.18-5.36
	one or more	12 (23)	27 (10)	39			
	total	53 (100)	259 (100)	312			
FATHER'S SOCIAL CLASS	entrepreneurs	12 (23)	24 (9)	36		2.87	1.33-6.18
	others	41 (77)	235 (91)	276			
	total	53 (100)	259 (100)	312			

the irregular sleep/wake schedule was also more common in subjects with daytime sleep episodes than in subjects without them. The delayed sleep phase syndrome has also been found to be connected to irregular sleeping time (1), and some of our schoolchildren may also have the syndrome.

Of the many factors causing SDS, long sleep latency, insomnia and night waking are well known (7,9,15,16). In our study, we showed the association between SDS and dreaming and sleeptalking, which has been rarely reported (21). Insomniacs have also been reported to suffer from these phenomena (7,15,28) as well as DS (7,15). The possible connection between SDS and dreaming could be a psychological factor, e.g. depression or anxiety. In this study we did not separately ask about nightmares among children. Psychological factors were likewise not elicited in the present study and they will need more evaluation in future. Snoring was not associated with SDS in contrast to many reports on both adults and children (9,29,30).

According to our study SDS, older age, insufficient sleep and excessive time spent with videos were associated with each other. It seems that in older schoolchildren the lifestyle changes, they go to bed later and perhaps spend their time watching videos. The irregular sleeping habits of teenagers have also been detected in other studies (7,8,12,16,18,20). Video watching is not often mentioned in the literature in association with daytime sleepiness, although the effect of watching TV on sleep has been evaluated and contradictory results have been found (20,31). In the recent study by Mary Carskadon et al. (2) there is evidence of a possible biological effect of age on sleep rhythm and DS. According to this, biological development may be the primary cause of delayed sleep rhythm, and thus the lifestyle of adolescents would only be a secondary phenomenon.

SDS was almost as common in third grade pupils (9-10 years) as in the seventh, eighth and ninth grade (13-17 years), although previous studies have reported DS to be very rare among preadolescents (4,32). One possible explanation is that in Finland in the third grade the length of schooldays and the amount of homework increases.

The influence of parents' sleep problems on the SDS of their child is an interesting finding. Psychological stress in the family or genetic effect could explain the findings. In the study by Kahn et al. (28) poorly sleeping boys more often had poorly sleeping fathers than the controls. In a Finnish study (33) self-reported sleeping data from monozygotic and dizygotic sets of twins indicated a significant hereditary effect on sleep length and sleep quality.

Father's social class was a significant predictor. When comparing the entrepreneurs with the other classes, SDS was more common in the entrepreneur families. The explanation could be that the enterprise adds to stress in the family, which is expressed as sleep and alertness problems. In the study by Partinen and Rimpelä (5) DS is also reported most frequently among retired, unemployed and entrepreneurs.

In conclusion, SDS was a common symptom in our questionnaire study. Five main predictors were found 1. Shorter sleeping time on weekdays and late bedtime on Saturday nights, 2. sleep disorders of the children such as dreaming, a long sleep latency, night waking, insomnia and sleeptalking, and 3. video watching were more common in children with SDS. 4. Parental disorders such as fathers' daily sleep urge and insomnia and mothers' poor sleep quality, and 5. private enterprise of the father were also more common in the families of children with SDS.

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