Sleep Habits of Children and the Identification of Pathologically Sleepy Children

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ABSTRACT: Sleep disorders and daytime sleepiness have been investigated only minimally in children. The sleep habits of 218 children, ages 10-13 years, were surveyed by a sleep habits questionnaire (SHQ). Our results demonstrate that total night time sleep on school nights begins to fall in early adolescence, whereas it remains relatively stable on non-school nights. Daytime sleepiness is not a common problem in this age group, in contrast to a college age population. We conclude that in adolescence chronic sleep deficits begin to occur which cumulatively affect later functioning. The potential use of the SHQ for depicting pathological sleepiness is also discussed.

Polysomnographic recording in a sleep disorders clinic is now an accepted part of a comprehensive medical evaluation of disturbed sleep. Sleep studies have added considerably to our clinical understanding of such disorders as narcolepsy [1], the sleep apnea syndrome [2], drug dependency insomnia [3], and dyssomnias such as sleepwalking, sleeptalking, and pavor nocturnus [4]. In all of these efforts, relatively little attention has been directed toward the sleep and waking behaviors of children.

Daytime sleepiness and its effects on wakeful functioning are only now beginning to be examined. An emerging principle in sleep disorders is that the amount of nighttime sleep is not necessarily the best

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measure of pathology. For example, there is abundant evidence that many sleep parameters of seriously disabled insomniacs overlap those of a non-complaining population [5]. From a practical point of view, the important variable appears to be daytime functioning, and in particular the "sleepiness-alertness" dimension.

Sleepiness is followed by sleep only in a conducive situation. Clearly, it is possible to be sleepy all day without a single episode of sleep. Yet microsleep episodes, repetitive interruptions of wakefulness by momentary lapses into sleep, have been observed in adults with excessive sleepiness, suggesting that sleepiness is a physiological state existing in individuals who appear fully awake [6]. Thus, prolonged nighttime sleep associated with daytime alertness and efficiency might well be preferred to less sleep at night and daytime drowsiness.

Studies of *acute* sleep loss suggest that motivational factors can overcome sleepiness on a short-term basis enabling individuals to continue adequate function. It remains to be determined, however, if *chronic* sleep loss or disruption has similar or more adverse consequences.

The limits of tolerable daytime sleepiness are not well understood. In narcolepsy and the sleep apnea syndrome, the most extreme and chronic cases of pathological sleepiness, significant deficits in memory and learning have been observed; and some severely affected individuals develop an automatic behavior syndrome [7, 8].

Two clinical studies in children document the damaging effects of excessive daytime sleepiness on learning and school performance [9, 10]. In the latter study, 30% of adult narcoleptic patients retrospectively described childhood histories of excessive daytime sleepiness associated with learning problems and hyperactive behavior. Many had been treated with psychoactive medications which provided symptomatic improvement despite the missed diagnosis [10].

The "sleepy" child has been ignored by physicians, attracting medical attention only after daytime sleepiness has seriously impaired education. What constitutes "normal" amounts of sleep in the developing child? Greenberg and Kinsey (unpublished data) sampled an entire junior high school. Eighteen percent complained of falling asleep in school despite 7-10 hours of sleep at night. Twelve percent slept more than 10 hours a night. In a questionnaire study of 500 college students, 23% complained of excessive daytime sleepiness in the absence of significant nighttime sleep reduction or disturbance (Dement, personal communication). No studies of excessive sleepiness in younger children and its relationship to school and behavior problems exists.

The present study reports the results of a survey of nighttime sleep and daytime sleepiness in a sample of pre- and early-adolescent school children.

Method

A sleep habits questionnaire (SHQ), in use with adults and college students, was modified for ease of completion by children. It contains 68 multiple-choice and yes-no items that cover such diverse areas as bed- and waking times on weekdays and weekends; incidence and frequency of nocturnal arousals; incidence and frequency of naps; estimated time to fall asleep; sleepiness and sleep attacks during the day; episodic sleep disturbances; waking energy levels; attentiveness; and school performance. (A copy of the SHQ is available upon request.) The SHQ was pre-tested on a small sample of 5th and 6th graders to insure its comprehensibility and ease of completion within 15-25 minutes.

A letter requesting permission to participate in the study was given to 620 Palo Alto 5th and 6th graders who were instructed to show the letter to their parents; 218 returned parent-signed authorizations (36%). The questionnaire was then administered in the classroom by a research assistant who was available to answer questions. Four 5th grade classes, four 6th grade classes, and six 7th grade classes participated. Questionnaires were answered anonymously.

The responses to individual items were analyzed using Pearson product-moment correlation, student's t-test, and chi-square tests as appropriate. The .05 rejection region (two-tailed) was adopted in all statistical tests.

Results

The SHQ was completed by 120 females and 98 males. The ages of the children ranged from 10 to 13 years ($\overline{X} = 11.7 \pm 1.0$). There were 35 completed questionnaires from 10-year-olds, 58 from 11-year-olds, 78 from 12-year-olds, and 47 from 13-year-olds. None of the children complained of excessive daytime sleepiness or impaired school functioning.

Bedtimes were significantly correlated with age on both school and non-school nights ($r = .38$). On the average, the bedtimes of 10-year-old girls was 9:30 p.m., increasing to 10 p.m. by age 13; in 10-year-old boys, bedtime was 9:00 p.m., and increased to 10:30 p.m. by age 13. In both boys and girls, a significant difference existed between school and non-school night bedtimes. On the average, non-school bedtimes were 65 minutes later than school night bedtimes.

The reasons children gave for going to bed differed between school and non-school nights and according to age. Forty percent said bedtime on school nights was set by their parents, whereas only 15% gave this response for non-school nights. Likewise, 45% said they went to bed because they felt sleepy on non-school nights, compared to about

30% on school nights. Older children tended to report that school night bedtimes were set by their parents significantly less often than for younger children ($\chi^2 = 12.69$). The age of the child was unrelated to whether he or she reported "sleepiness" as the reason for going to bed on school and non-school nights. On school and non-school nights, boys with older siblings tended to go to bed later than first-born boys. In contrast, birth order was not significantly correlated with bedtime for girls.

Wake-up times on school days were significantly earlier than on non-school days in boys and girls. In addition, on school days, older girls tended to arise earlier than younger girls ($r = .31$), whereas boys arose at the same time at all ages. About 60% of the children were awakened by an alarm or parent on school days, compared to only about 3% on non-school days. Older children were awakened by an alarm or by parents more frequently than were younger children who seemed more likely to awaken spontaneously ($\chi^2 = 22.11$). On non-school days, both boys and girls slept later than on school days. On non-school mornings, wake-up times were significantly correlated with age; younger children tended to rise earlier than older children. In addition, 70% of the children reported that they awakened spontaneously on non-school mornings, while only 30% did so on school mornings. Of the latter group, the younger ages predominated.

On the basis of the replies given about bedtimes and wake-up times, total sleep times were computed for each child. Older children tended to sleep less on school nights than younger children, while the non-school night sleep times tended to diminish less across the age groups. Figure 1 illustrates these findings. The age-related reduction in total sleep time on school days reflects later bedtimes; and, in the girls, it also reflects an earlier school day waking time.

Nighttime awakenings and the time estimated to fall asleep (sleep-onset latency time) were not significantly different between school and non-school nights. Nearly 50% of the children reported no nighttime awakenings; 35% claimed they usually awakened once during the night. Only 11 children (3 girls and 8 boys) reported waking up three or more times during the night. Approximately 65% reported that they fell asleep in less than 30 minutes. Fewer than 20% reported taking 30 minutes or longer to fall asleep, and the remainder reported "no idea." No sex or age differences were noted.

To determine whether the SHQ could be utilized to recognize pathologically sleepy children, 12 "critical" items were selected. These items were related to sleep-onset latency time, presence of daytime naps, sleeping through alarms and lateness to school, sleep "attacks"

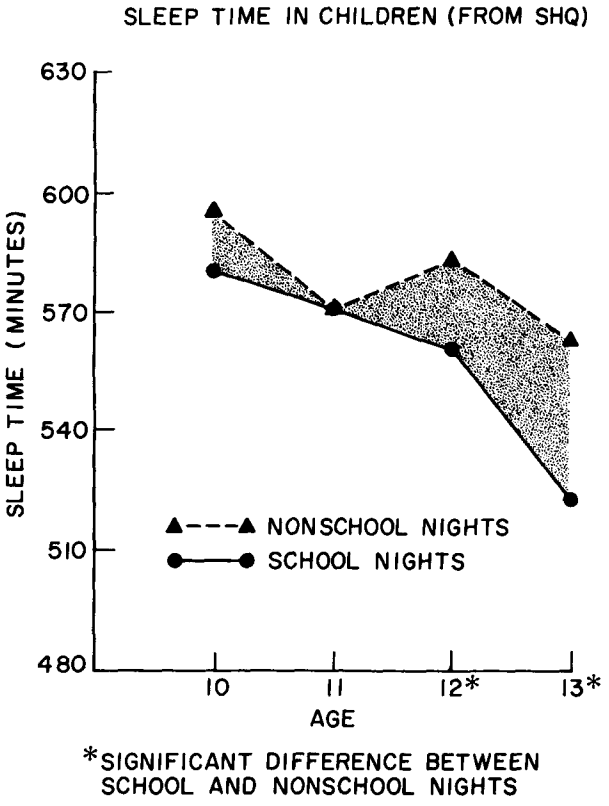

FIGURE 1. The length of a night's sleep in minutes is plotted for school nights and non-school nights across ages. By 12 years of age significant differences exist between school and non-school nights. This is accounted for largely by later bedtimes (and earlier wake-up times for girls) on school nights at the older ages.

during school time, snoring, daytime energy levels, and impaired daytime functioning. The responses were scored so that a "sleepiness score," ranging from 0 to 22, was derived for each child. The majority of children scored rarely; only 5 children (2.4%) scored above 6. These children might be considered candidates for further in-depth evaluation; however, since the questionnaires were distributed anonymously, we were unable to pursue them further.

In an unrelated study, 24 normal children in the same age range as the survey group were recorded polygraphically and asked to com-

plete the SHQ. None of these children was determined to have polygraphic abnormalities, and all of them scored in the lower range of "sleepiness" scores. In contrast, one child who was referred to the Sleep Disorders Clinic for evaluation of respiratory problems during sleep and who was subsequently diagnosed as having the sleep apnea syndrome [9] scored 8 on the sleepiness scale. Clearly, before such a test can be used clinically for screening potentially sleepy children, further studies need to be done.

Discussion

We have attempted to portray nighttime sleep patterns and daytime sleepiness behavior of a large population of normal 10- to 13-year-old children in Palo Alto. Our sample represents a largely middle- and upper-middle-class socioeconomic group, and it would be interesting to compare our results to samples with other demographic characteristics.

Our results, when compared to college students only 6-8 years older (of similar socioeconomic background), demonstrate a marked difference in the complaint of daytime sleepiness. A large number of university undergraduates complained of excessive daytime sleepiness and falling asleep in the classroom, and none of the children in our sample had similar complaints. Our results suggest that the period of middle-to-late adolescence may signal important changes in sleep patterning, sleepiness, and daytime functioning.

We have studied children in regular classrooms only, and have not surveyed children with pathological learning deficits, hyperactive behavior, significant psychopathology, or mental retardation. Our results neither refute nor support the contention that excessive sleepiness may be associated with these other problems. The SHQ needs to be administered to such populations.

Our speculation that adolescence is a fruitful age for the investigation of changes in sleep patterning including the onset of daytime sleepiness and pathological sleep disturbances is shared by several other authors who have described changes in sleep state organization during this developmental period. Studying nighttime sleep, Feinberg [11] described increases in the length of the first non-rapid eye movement (NREM) sleep and the amount of Stage 4 sleep from preadolescence to late adolescence. Similarly, Karacan et al. [12] demonstrated all night total sleep reduction during the four years of active puberty. Williams et al. [13] reported a slight increase in Stage 4 NREM sleep from preadolescence to midpuberty with a subsequent

decrease in young adulthood. The proportionate amount of time in rapid eye movement (REM) sleep remained constant during this age period. Ross et al. [14] described 2-5 hours more sleep per night in preadolescent males.

Marks and Monroe [15, 16] report that nighttime sleep characteristics of emotionally disturbed adolescents differ according to the psychopathological diagnosis. In a large national survey of 831 emotionally disturbed adolescents, 13% had been referred because of sleep difficulties. Another 20% were described as having significant sleep problems. These poor sleepers were characterized by anxiety, tension, depression, somatic concerns and multiple neurotic manifestations. In contrast, the emotionally disturbed good sleepers were more likely to be "pseudonormal" or psychopathic. The presence of a sleep disturbance in one-third of emotionally disturbed adolescents contrasts to the absence of such disturbances in our non-emotionally disturbed preadolescents.

Our survey has demonstrated that total sleep time on school nights begins to fall, by 1 hour, in early adolescence. Non-school night sleep, on the other hand, remains relatively stable over this age span. Thus, the school/non-school night discrepancy in total sleep time, small or nonexistent in younger children, is approximately 45-60 minutes in older children. Data in college students 6-10 years older show a similar school/non-school night discrepancy.

When the daytime portion of the diurnal cycle was explored, preadolescent children claimed never to nap and denied symptoms of excessive daytime sleepiness. In contrast, a significant percentage of college respondents reported excessive daytime sleepiness and regular naps.

These results from children suggest an interesting hypothesis about the genesis of daytime sleepiness in older adolescents. The reduction in total nighttime sleep in 12- to 13-year-olds, on school nights only, suggests that the "need" for sleep does not decrease with age. Rather, a reduction of sleep below optimal amounts may arise in response to school and other social pressures, which do increase with age. Thus, daytime sleepiness, by college age, may be the result of chronic sleep deficits dictated by social pressures.

More normative developmental studies need to be done with other age groups and with other socioeconomic classes. Further research also needs to be carried out to evaluate the effectiveness of the SHQ as a predictor of sleep pathology. If the scale is valid and reliable, it will be valuable for screening children with sleep problems who are inexplicably failing in school.

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