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The Prevalence of Daytime Napping and Its Relationship to Nighttime Sleep

June J. Pilcher, PhD; Kristin R. Michalowski; Renee D. Carrigan

Many healthy adults report daytime napping. Surprisingly few studies, however, have examined spontaneous napping behavior, especially very short naps, in healthy adults. The authors examined the prevalence of power naps (lasting less than 20 minutes) and longer naps (20 minutes or more) and their effects on nighttime sleep in a group of healthy young and middle-aged adults. The young and middle-aged adults reported very similar sleep and napping patterns, with approximately 74% of the participants in both groups reporting they had napped during a 7-day sleep-log period. Almost half of the participants reported that the average nap lasted less than 20 minutes. A multivariant analysis of variance (MANOVA) found no significant differences between the no-nap and the power-nap or long-nap groups in sleep quantity or quality for either age group. The current data suggested that power napping occurs frequently in healthy adults and that spontaneous napping does not negatively affect nighttime sleep.

Index Terms: *napping, power nap, self-report data, sleep*

Napping has been shown to be an effective means of countering sleepiness. A number of studies have investigated the use of naps as a countermeasure to sleepiness resulting from shift work[1-3] and prolonged wakefulness.[4-6] Naps have also been shown to be beneficial in counteracting sleepiness in operational settings where workers must be alert to maintain normal machinery operation.[7-10] However, the effects of daytime naps on nighttime sleep, which may affect the next day's sleepiness levels, have not been thoroughly investigated.

Research findings have indicated that healthy adults who do not have a sleep debt brought about by shift work or sustained sleep deprivation regularly report daytime napping. In an earlier summary of the napping literature, Dinges[11] concluded that about 75% of the adults surveyed reported napping and that nap duration across many studies ranged from about 30 to 90 minutes. In a more recent summary, Dinges[12] concluded that the duration of self-reported naps is consistently about 73 minutes and that very short naps do not occur or are not reported in most surveys and sleep logs.

The incident rate of very short naps (frequently termed *power naps*) in modern society may be on the rise. Power naps, typically defined as sleep episodes of less than 20 minutes, have been discussed as a potential countermeasure to fatigue and sleepiness.[13-15] However, although researchers and the lay public are discussing the potential benefits of power napping, few studies have examined the occurrence of different types of naps in healthy adults or considered how daytime napping is related to nighttime sleep.

We conducted this study to assess the frequency of spontaneous napping in healthy young and middle-aged adults and to examine whether napping affects sleep quantity or sleep quality. The young adults were college students, a group expected to experience voluntary restricted sleep[16] whose flexible schedules could permit more daytime nap-

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ping.[12] The current study addresses three specific questions concerning spontaneous napping behavior in modern society:

1. How often do power naps and long naps occur in young and middle-aged adults?
2. Do power naps or long naps differentially influence sleep quantity or sleep quality?
3. Do power naps or long naps influence sleep differently across the two age groups?

METHOD

Participants

Two groups of volunteers provided self-reported data on their sleep habits. The first group consisted of 79 middle-aged adults (55 women, 24 men, age $M = 54.8 \pm 10.6$ y). The middle-aged adults responded to advertisements in a local newspaper or were the parents of undergraduate students at the university where we conducted the study. The second group consisted of 87 young adults (62 women, 25 men, age $M = 18.9 \pm 1.1$ y). We recruited the young adults through introductory-level psychology courses and gave them extra credit for their participation in the study. We excluded from the study shift workers and persons who reported sleeping at times other than nighttime. All of the participants were healthy during the experimental period and had not been hospitalized in the previous 3 months. None of the participants reported that they had been diagnosed with a sleep disorder or regularly used sleeping aids.

Procedures

The study design was approved by the Bradley University Committee on the Use of Human Participants in Research. Before the onset of the experimental period, the participants attended an initial informational meeting at which we explained the sleep log. At the meeting, each participant had an opportunity to review the log and to ask questions. At the same time, the participants received instruction sheets with step-by-step directions regarding the completion of the sleep log. During the initial meeting, we also gathered information about each participant, including age and gender, and participants signed informed-consent documents.

All participants completed a 7-day sleep log, beginning on a Wednesday afternoon and ending the following Wednesday morning. The participants also completed the Pittsburgh Sleep Quality Index (PSQI), an average sleep quality survey, between 4 PM and 6 PM on the Wednesday afternoon following their completion of the sleep-log. We chose the late afternoon time to avoid the circadian dip that occurs in the early afternoon and the peak that occurs in the early evening. Approximately half of the middle-aged adults and all of the young adults completed the surveys in a classroom setting at the university. The remaining middle-aged adults filled out the surveys in a nondistracting environment at home and mailed the completed surveys to us. We compared the data for the middle-aged adults who completed the surveys in a classroom setting with those from individuals who completed the surveys at home. The two data sets were not statistically different; therefore we collapsed the data from the middle-aged adults to create one data set for comparison to the young adults.

Surveys

The sleep log we used in the current study was modeled after a log used by Hawkins and Shaw[17] in a previous investigation. It assessed sleep quantity, sleep quality, and napping time for each 24-hour period. Self-reported estimates of sleep quantity have been shown to be highly correlated with physiological measures of sleep;[18,19] as such, they provide meaningful data about sleep habits. We assessed sleep quantity with two questions asking for (a) the total amount of time spent in bed with the intention of sleeping (time in bed: TIB) and (b) an estimated time asleep. The participants rated sleep quality for the previous night each morning on a scale from 1 (*awful*) to 7 (*great*). In addition, each participant recorded the amount of time that he or she napped during the previous 24-hour period. The sleep log also included questions about daily caffeine consumption (one drink = 8 oz cup of coffee or one 12-oz can of a caffeinated beverage) and alcohol intake (one drink = one 12-oz can of beer or one mixed drink).

The participants completed the sleep log each morning immediately after awakening. For analysis, we averaged the TIB, time asleep, daily sleep quality, and napping time across the 7-day sleep-log period. We also averaged the daily amount of caffeine and alcohol intake reported across the week.

The participants completed the PSQI as an additional measure of average sleep quality. The PSQI has been shown to have strong internal validity and temporal stability.[20] The PSQI asked participants to respond to 19 self-assessment questions regarding sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction that the subjects answered about their sleep during the week. We calculated the overall score according to the directions given by Buysse and colleagues.[20]

Data Analyses

We completed all data analyses on SAS (SAS Institute, Cary, NC). The first major step in analysis involved divid-

ing each age group (middle-aged and young participants) into three groups on the basis of their napping behavior: no nap, power nap, or long nap. The no-nap group consisted of those individuals who did not report any napping in their sleep surveys. The power-nap group consisted of the participants whose average nap length across the 7-day sleep log period was less than 20 minutes, the long-nap group were those participants who reported an average nap length across the 7-day sleep log period of 20 minutes or more. We used average napping length rather than the actual number of naps as part of our experimental design.

The second major step in our analysis was to determine whether sleep quantity or sleep quality varied across the three nap groups within each age group. We completed a multivariant analysis of variance (MANOVA) for each age group for each sleep quantity and sleep quality measure, using the nap group as the factor. Because we found no main effects, we did not complete post hoc analyses.

RESULTS

The young adults and the middle-aged adults reported similar sleep habits (Table 1). The middle-aged adults reported that they spent slightly less time in bed and time asleep than the young adults did, but they reported slightly better sleep quality than the young adults did on both the daily sleep logs and the PSQI. In addition, the two groups reported similar levels of caffeine and alcohol intake. The middle-aged participants reported that they drank an average of 2.27 caffeine drinks (SD = 1.8) and 0.33 alcohol-containing drinks (SD = 0.62) during each 24-hour period. The young participants reported consuming an average of 1.78 caffeine drinks (SD = 1.5) and 0.98 alcohol-containing drinks (SD = 1.4) in each 24-hour period.

TABLE 1
Means and Standard Deviations of Sleep Quantity and Quality Measures

	Middle-aged adults		Young adults	
Variable	*M*	*SD*	*M*	*SD*
Time in bed (h)	7.39	0.83	7.70	1.02
Time asleep (h)	6.69	0.85	7.06	1.11
Sleep quality†	5.31	0.92	4.99	0.97
PSQI	5.17	2.90	6.00	2.63

Note. PSQI = Pittsburgh Sleep Quality Index; higher numbers indicate poorer sleep quality. †Higher numbers indicate better sleep quality.

Average reported nap times were also very similar between the two age groups (see top portion of Table 2). Furthermore, the number of young and middle-aged adults in each napping category was very similar (eg, almost half of the young and middle-aged participants reported average nap times of less than 20 minutes). As such, we classified 46% of the young adults and 46% of the middle-aged adults as part of the power-nap group. In contrast, the no-nap group consisted of 24% of the young adults and 28% of the middle-aged adults. The long-nap group consisted of 29.8% of the young adults and 25.3% of the middle-aged adults. Average nap duration within each nap group was also very similar across the two age groups, with the power-nap groups reporting substantially less napping time than the long-nap groups.

The sleep quantity and quality data for the young adults are shown in Figure 1. As can be seen, we found no consistent trends between the no-nap and power-nap or long-nap groups. The one-factor MANOVA revealed no significant differences across the napping groups for any of the sleep quantity or sleep quality measures for the young adults.

The amount of time in bed, time asleep, and sleep quality ratings for the middle-aged adults is shown in Figure 2 for each napping group. Although we found a small trend toward less time reported asleep and poorer sleep quality in the power-nap and long-nap groups than in the no-nap group, we found no significant differences for any sleep quantity or quality measure across the three napping groups for the middle-aged adults.

COMMENT

The findings from our current study indicate that young adults and middle-aged adults reported very similar sleeping and napping behaviors. Both groups reported comparable estimates of sleep duration and sleep quality. In addi-

TABLE 2
Descriptive Data for Naps

	Middle-age adults			Young adults		
Napping group	*n*	*M*†	*SD*	*n*	*M*†	*SD*
Average napping	79	15.55	21.74	87	17.71	21.61
No-nap group	22	0	0	21	0	0
Power-nap group	37	7.66	5.72	40	9.39	5.44
Long-nap group	20	47.25	20.50	26	44.81	20.56

†Mean nap duration in minutes.

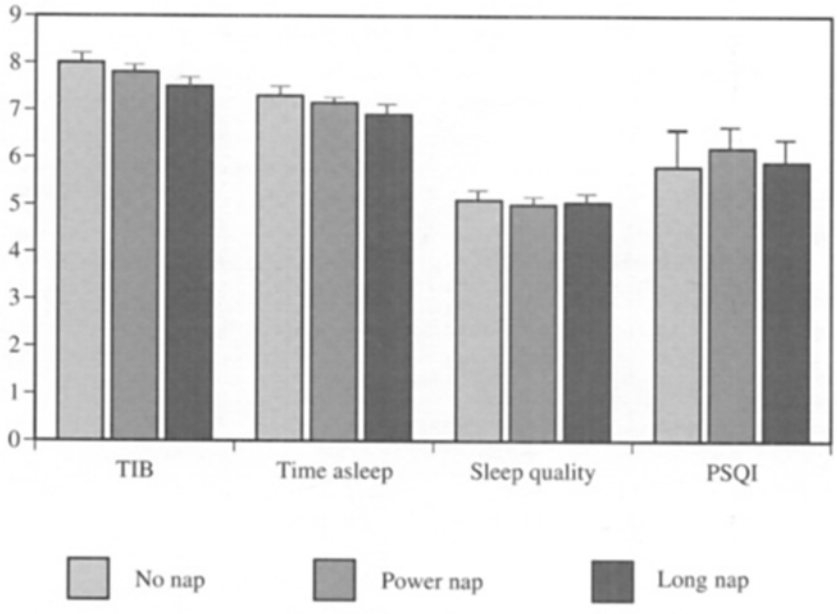

Figure 1. Sleep quantity and quality measures for the young adults. TIB = Time in bed. PSQI = Pittsburgh Sleep Quality Index. TIB and time asleep are reported in hours. Higher numbers on the sleep quality scale indicate better sleep quality; higher numbers on the PSQI indicate poorer sleep quality.

tion, both groups of adults reported very similar napping patterns and naps that were almost equivalent in average duration; the numbers of participants in the different napping groups were also almost equal. Furthermore, none of the measures of sleep quantity or sleep quality were related to the length of naps in either age group.

It is interesting to note that the current study reports a number of people taking naps similar to that reported by Dinges in a 1992 review.[12] He concluded that about 75% of healthy adults report napping behavior. In the current sample, 76% of the young adults and 72% of the middle-aged adults reported taking at least one nap during the 7-day sleep log period. However, the duration of the average nap reported in the current study was substantially different from that reported by Dinges. After reviewing several studies on napping, Dinges concluded that the average nap duration was about 73 minutes and those short naps (which lasted less than 15 minutes) either did not occur or were not reported.

In contrast, the current data indicated average nap duration of 17.71 minutes in young adults and 15.55 minutes in middle-aged adults. This difference is partially due to the number of participants in the current study who reported power naps that lasted less than 20 minutes. However, it is important to note that even among the long-nap group, the length of the average nap for the two age groups did not approach the 73-minute average that Dinges reported in his review.

It is difficult to say why the current participants reported short naps when participants in earlier self-report-based studies did not. One possibility is the design of the studies. Most of the studies reviewed by Dinges used one-time surveys instead of daily logs. It is possible that participants would be less likely to remember short naps when asked once about their sleeping habits, especially when filling out a relatively long survey form. Our use of a daily log may have allowed the participants to assess their daytime sleep habits more accurately. Another possibility is that daytime napping behaviors may have changed in recent years. For the most part, the studies that Dinges reviewed were completed before the mid-1980s. It is possible that in today's society people are aware of the potential benefits of power naps and recognize their very short sleep episodes as naps. Unfortunately, this question cannot be answered definitely from the data in the current study, although our findings do clearly indicate that, in modern society, power naps occur in both young and middle-aged healthy adults.

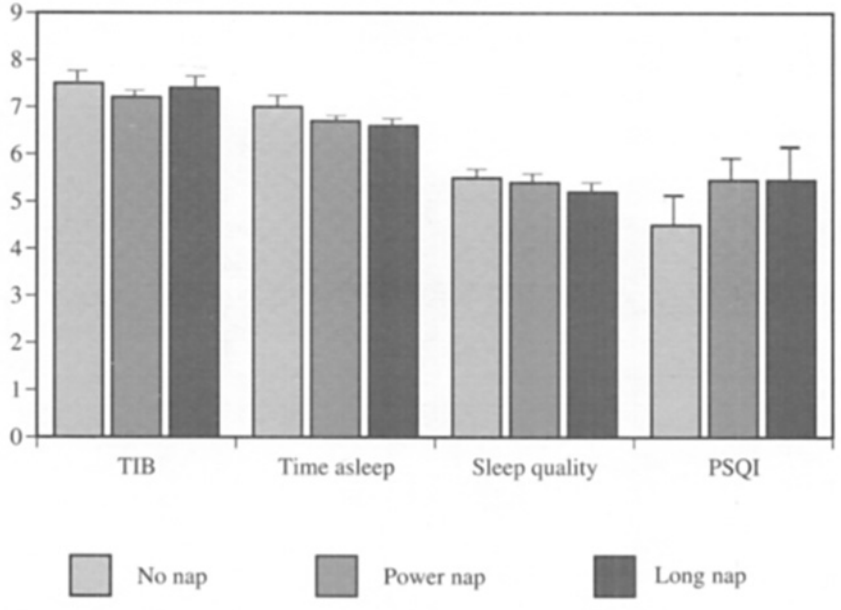

Figure 2. Sleep quantity and sleep quality measures for the middle-aged adults. TIB = Time in bed. PSQI = Pittsburgh Sleep Quality Index. TIB and time asleep are reported in hours. Higher numbers on the sleep quality scale indicate better sleep quality. Higher numbers on the PSQI indicate poorer sleep quality.

A concern that frequently arises in discussing daytime napping is the effect naps may have on the next night's sleep. This is a particular concern for older people who may experience sleep difficulties at night and try to compensate for their sleep loss by napping during the day.[21-25] Although the current data cannot directly address concerns in the elderly who experience sleep difficulties, it is important to note that neither sleep quantity nor sleep quality differed significantly between the participants who reported napping and the participants who did not report napping during a 7-day period. This was true across a wide range of ages in healthy adults and in several measures of sleep quantity and sleep quality.

Because the current results are based on self-reported data, we must be cautious when drawing inferences. However, self-reports are the primary means that we have for assessing napping in our day-to-day life. In addition, the current data indicate that self-reported data may be a reliable means of gathering this information because the reports by the two different age groups we surveyed were very similar. This would indicate that when naps occur, they could be reliably recorded in a self-report log. Furthermore, other aspects of napping behavior may also affect the relationship between napping and the following night's sleep. For example, the number of naps may have an effect on sleep quantity. Future studies could be designed to address this issue; in addition, future studies are needed to document the occurrence of power naps and their potential benefits in more detail.

In summary, this study is a first step in documenting the prevalence of daytime napping in our society and assessing how daytime napping may affect nighttime sleep. Perhaps one of the most interesting findings was the somewhat unexpected prevalence of power naps that were reported by both young men and women and middle-aged adults. However, the current data suggest that napping, regardless of length, does not have a negative affect on sleep quantity or sleep quality in either young or middle-aged adults.

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NOTE

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