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*J Health Psychol* 2010 15: 147

DOI: 10.1177/1359105309346342

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# Maladaptive Sleep Hygiene Practices in Good Sleepers and Patients with Insomnia

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ACKNOWLEDGEMENTS. This research was partially supported by the National Science Council of Taiwan (Grant no. NSC94-2413-H-004-004).

COMPETING INTERESTS: None declared.

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*Journal of Health Psychology*  
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Los Angeles, London, New Delhi,  
Singapore and Washington DC  
www.sagepublications.com  
Vol 15(1) 147–155  
DOI: 10.1177/1359105309346342

## Abstract

Previous studies examining the associations between sleep hygiene practices and insomnia have produced inconsistent results. This study further investigates this issue by examining different domains of sleep hygiene separately. One hundred and six insomnia patients and 89 good sleepers participated in the study. Their sleep hygiene, sleep quality and insomnia severity were assessed with subjective rating scales. Among good sleepers, almost all domains of sleep hygiene correlated significantly with their sleep ratings. However, in insomnia patients, only the arousal-related behavior correlated with sleep ratings. The findings suggest that strategies in prevention and treatment of sleep disturbance may be different accordingly.

## Keywords

- *arousal*
- *eating and drinking behaviors*
- *insomnia*
- *sleep environment*
- *sleep hygiene*
- *sleep quality*
- *sleep schedule*

## Introduction

Sleep hygiene refers to the general rules of behavioral practices and environmental factors that are consistent with good quality sleep. When defined broadly, it includes guidelines for general health practices (e.g., diet, exercise, substance use), environmental factors (e.g., light, temperature, noise), as well as sleep-related behavioral practices (e.g., regularity of sleep schedule, pre-sleep activities, efforts to try to sleep). It is usually assumed that maladaptive sleep hygiene practices can interfere with sleep and may cause sleep disturbances. The International Classification of Sleep Disorders even includes the diagnostic category 'inadequate sleep hygiene', which is designated for the sleep disruption associated with poor sleep hygiene practices (American Academy of Sleep Medicine (AASM), 2005). In addition, poor sleep-related habits leading to conditioned arousal in bed is considered to be one of the major etiological factors of psychophysiological insomnia (AASM, 2005; Bootzin, 1972). However, the contributing role of poor sleep hygiene practices in insomnia has not been well established empirically.

One approach to understanding the association between poor sleep hygiene and insomnia is to examine the treatment effects of sleep hygiene education. Sleep hygiene education is one of the most widely used strategies in dealing with sleep difficulties. It is commonly included as a component of cognitive-behavioral therapy (CBT) for insomnia (Morin, 1993). Clinical treatment usually starts with an examination of the patient's daily life activities and sleep-wake habits to identify a set of practices that are not consistent with good sleep hygiene. Patients are then educated about the possible impacts of these practices followed by a plan to change these behaviors. If, then, better sleep follows the patient's reduction of poor sleep hygiene practices, the practices can be assumed to be a contributing factor to the individual's insomnia. Several studies have investigated the treatment effects of sleep hygiene education. Although CBT or multi-component therapy including sleep hygiene education were consistently found to have a moderate to large effect size for the treatment of insomnia, there is insufficient evidence to support that sleep hygiene alone was an effective treatment (Lacks & Morin, 1992; Morin et al., 2006; Morin, Culbert, & Schwartz, 1994; Morin et al., 1999; Murtagh & Greenwood, 1995). These results suggest that sleep hygiene may not be a major contributing factor for insomnia.

On the other hand, studies assessing the correlations between poor sleep hygiene practices and sleep quality have yielded some positive results. Surveys of college students reported significant correlations of sleep hygiene practices with subjective sleep quality (Brown, Buboltz, & Soper, 2002) as well as with daytime sleepiness (Mastin, Bryson, & Corwyn, 2006). When examining the individual items of sleep hygiene practices, a study further reported that variable sleep length, noise disturbance, going to bed thirsty and worrying about the ability to fall asleep at bedtime were found to predict overall sleep quality (Brown et al., 2002). These results suggest that sleep hygiene is associated with sleep quality in normal young adults. Nonetheless, these studies were conducted with college-based populations, who are less susceptible to the development of insomnia. One should not assume that the associations are the same in community-based populations. Also, to our knowledge, no study has reported similar correlations in patients with insomnia. This issue requires further exploration.

Several studies have compared sleep hygiene practices between insomniacs and good sleepers to address the role of sleep hygiene in insomnia. It was rationalized that insomnia patients should practice more maladaptive sleep hygiene if it is an important factor of insomnia. However, the results were inconsistent. An early survey using the Sleep Hygiene Awareness and Practice Scale found that although insomnia patients did not have less sleep hygiene knowledge than did good sleepers, they engaged in more unhealthy habits than those of good sleepers (Lacks & Rotert, 1986). A recent study using the same scale with relatively smaller sample size has reported similar results, with poorer sleep hygiene practices in both primary insomnia patients and those with insomnia associated with mental disorder (Kohn & Espie, 2005). Another study compared insomnia patients with non-insomnia controls on selected aspects of sleep hygiene practices, including pre-sleep smoking habits, alcohol use, caffeine use, napping, time in bed, and 'sleeping in' on non-working days. The results also showed that insomniacs engaged in more maladaptive sleep hygiene practices, including cigarette smoking, alcohol use, napping and sleeping in on weekends. Logistic regression demonstrated that alcohol use, smoking and sleeping in on weekends could be the predictors for insomnia (Jefferson et al., 2005). However, negative results were also reported in several recent studies. A study using semi-structured

interviews for similar aspects of maladaptive sleep hygiene practices reported no significant differences between insomniacs and normal controls in these behaviors (Harvey, 2000). Furthermore, in the elderly population, individuals with sleep complaints did not report more maladaptive sleep hygiene practices than individuals with no sleep complaints, except for the frequency of napping (McCrae et al., 2006).

In summary, poor sleep hygiene practices have been considered to be a contributing factor to insomnia. Previous studies have showed an association between sleep hygiene practices and sleep quality in the population of young adults without insomnia. However, this relationship in patients with insomnia remains unclear. Reduction of maladaptive sleep practices through sleep hygiene education may be beneficial for the sleep in insomnia patients, but the effect is limited when it is given as a single therapeutic strategy. The role of sleep hygiene practices in contributing to insomnia still need to be clarified. One possible reason for the inconsistent results may be because of the multifaceted nature of sleep hygiene. In previous studies, sleep hygiene practices were treated as a general construct with a derived total score (e.g., Blake & Gomez, 1998). Considering the broad aspects of sleep hygiene and the various behaviors that may interfere with sleep, sleep hygiene may not be represented with a single construct. An individual who frequently practices one aspect of maladaptive sleep may not necessarily practice the others. A patient who typically does not follow a regular sleep schedule, for example, would not necessarily be more prone to planning the next day before bedtime or to drinking excessive amount of caffeinated drinks. Therefore, different domains of sleep hygiene should be evaluated separately.

The goal of the present study is to examine the associations between sleep quality and different areas of sleep hygiene practices in both insomnia patients and normal sleepers. The results are expected to further clarify the importance of maladaptive sleep hygiene in chronic insomnia by comparing the findings in individuals with no sleep complaints and patients with long-term insomnia. Furthermore, specific domains of sleep hygiene could be identified as targets in the prevention and treatment of insomnia.

## Methods

Eighty-nine good sleepers (44 men and 45 women, age  $40.34 \pm 12.28$  years, range, 20 to 65 years) and

106 insomniacs (46 men and 60 women, age  $40.72 \pm 11.68$  years, range, 17 to 63 years) participated in the study. Insomnia patients were recruited from the sleep clinic of a general hospital and were diagnosed by a psychiatrist/sleep specialist based on the DSM-IV criteria of primary insomnia through clinical interview (American Psychiatric Association, 1994). The inclusive criteria were: (1) predominant complaint of difficulty initiating or maintaining sleep, and/or nonrestorative sleep for at least 1 month; (2) the sleep disturbance (or associated daytime fatigue) causes clinically significant distress or impairment in social, occupational, or other important areas of functioning; (3) the sleep disturbance does not occur exclusively during the course of another mental disorder; and (4) the sleep disturbance is judged not to be the result of a medical condition, another sleep disorder, and/or substance use. One hundred and twenty-seven patients were referred as potential participants. Twenty-one of them were excluded because of reported symptoms of sleep disorders other than insomnia on the Pittsburgh Sleep Quality Index (PSQI) (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989), including 'cannot breathe comfortably', 'snore loudly', and 'had bad dreams'.

Ninety seven adults who reported normal sleep were recruited from community-based populations by matching the gender, age, and education with the insomnia participants. They were screened with the PSQI for possible sleep disorders. Individuals with a PSQI total score over 5 and/or who reported frequent symptoms of insomnia or other sleep disorders were excluded. Other exclusion criteria were a current or past history of major psychiatric or medical conditions. Eight potential participants were excluded because of reported symptoms of sleep disorders. A package of questionnaires, including questions regarding demographic information, the PSQI, the Sleep Hygiene Practice Scale (SHPS), and the Insomnia Severity Index (ISI) were administered individually to all participants who passed the screening.

The study procedures were conducted following the ethical principles of psychologists of the Taiwanese Psychological Association.

## Instruments

### SHPS

The SHPS is a 30-item self-rating scale that is designed to assess the practice of daily living activities

Table 1. Items of the SHPS

## Domain 1: Arousal-related Behaviors

- Doing sleep-irrelevant activities in bed (e.g., watching TV, reading).
- Worry about not being able to fall asleep in bed.
- Unpleasant conversation prior to sleep.
- Not enough time to relax prior to sleep.
- Falling asleep with TV or music on.
- Pondering about unresolved matters while lying in bed.
- Check the time in the middle of night.
- Worry about night-time sleep during the day.
- Vigorous exercise during the two hours prior to sleep.

## Domain 2: Sleep Scheduling and Timing

- Bedtime not consistent daily.
- Get out of bed at inconsistent times.
- Stay in bed after waking up in the morning.
- Sleep in on weekends.
- Napping or resting in bed for over one hour during the day.
- Lack of exposure to outdoor light during the day.
- Lack of regular exercise.

## Domain 3: Eating/Drinking Behaviors

- Going to bed hungry
- Drinking caffeinated drinks (e.g., coffee, tea, coca-cola) within the four hours prior to bedtime.
- Drinking alcohol within the two hours prior to bedtime.
- Consuming stimulating substances (e.g., nicotine) during the two hours prior to bedtime.
- Drinking a lot during the hour prior to sleep.
- Eating too much food during the hour prior to sleep.

## Domain 4: Sleep Environment

- Sleep environment is either too noisy or too quiet.
- Sleep environment is either too bright or too dark.
- Sleep environment is either too humid or too dry.
- Feeling too hot or too cold during sleep.
- Poor ventilation of bedroom.
- Uncomfortable bedding and/or pillow.
- Too many sleep-unrelated items in bedroom.
- Sleep is interrupted by bed partner.

and sleep habits that may have negative impacts on sleep (Lin, Cheng, Yang, & Hsu, 2007). The items were modified from published instruments to measure adult sleep hygiene practices (Blake & Gomez, 1998; Lacks & Rotert, 1986; Mastin et al., 2006) and general sleep hygiene guidelines of various sources (e.g., National Sleep Foundation, n.d.; Taiwan Society of Sleep Medicine, n.d.). The SHPS adopts a multi-factorial structure to measure sleep hygiene. Sleep hygiene, by definition, includes environmental factors and behavioral practices that may have impacts on sleep (Hauri, 1991). The behavioral practices could further be divided into behaviors that facilitate sleep regulation and behaviors that promote awakening or arousal. In addition, poor eating and drinking habits could not be classified into any of the above

categories. Therefore, the collected items of maladaptive sleep hygiene practices were classified into the following four domains by two specialists in sleep medicine: (1) sleep schedule and timing (interfering with homeostatic and/or circadian process of sleep); (2) arousal-related behaviors (enhancing arousal through promotion of anxiety and/or conditioned arousal with sleep-related cues); (3) poor eating/drinking habits prior to sleep; and (4) poor sleep environment (see Table 1 for the items within each of the domains). Items from different sources that describe the same or similar behavioral practices were integrated into a single item. The participants were instructed to rate how frequently they engaged in the behavioral practices on a six-point Likert scale, from 1 = *never* to 6 = *always*. The scores for the

items were summed up to generate four subscale scores. Chronbach's  $\alpha$  coefficients were .70 and .58 for arousal-related behaviors, .67 and .65 for sleep-environment, .72 and .70 for eating/drinking habits, and .82 and .74 for sleep scheduling in good sleepers and insomniacs, respectively. Considering the broad aspects of sleep hygiene practices and the variation of behaviors that an individual may engage in, the coefficients are within acceptable ranges. To verify the factorial structure, an exploratory factor analyses were conducted first. Scree test and parallel analysis suggested three to six underlying factors. Factor analyses conducted with all possible factor numbers (three to six) showed that four-factor structure is the most appropriate for both groups according to their interpretability of factor patterns (Sharma, 1996). Confirmatory factor analysis with the four underlying factors suggested the possibility of minor factors. Confirmatory factor analysis based on two randomly formed parcels for each factor were conducted following the procedures suggested by Bandalos and Finney (2001). Results show acceptable fit for both good sleepers ( $\chi^2 = 24.57$ , NNFI = .95, CFI = .98, RMSEA = .083, SRMR = .043) and insomnia patients ( $\chi^2 = 17.95$ , NNFI = .96, CFI = .98, RMSEA = .047, SRMR = .048).

**PSQI**

The PSQI, developed by Buysse and colleagues, contains 19 items that are designed to measure different aspects of sleep quality and sleep disturbances during a one-month period (Buysse et al., 1989). A global sleep quality score, ranging from 0 to 21, can be derived with the higher score indicating poorer sleep quality. The PSQI global score was shown to have good internal consistency (Chronbach's  $\alpha = .83$ ) and test-retest reliability ( $r = .85$ ). A cut-off score of 5 was found to correctly identify 88.5 percent of patients with sleep disturbances.

**ISI**

The ISI, developed by Morin, is a seven-item Likert-type self-rating scale designed to assess the subjective perception of the severity of insomnia (Morin, 1993). The scale contains items that measure the symptoms and associated features and impacts of insomnia, including difficulty falling asleep, difficulty maintaining sleep, early morning awakening, satisfaction with sleep, concerns about insomnia and functional impacts of insomnia. The total score could be used to differentiate patients with and without insomnia, and

to categorize patients to different levels of insomnia severity. The scale was found to have adequate internal consistency (Cronbach's  $\alpha = .74$ ) (Bastien, Vallieres, & Morin, 2001). It was also shown to have small to moderate correlation with polysomnographic indices of sleep quality ( $r = 0.32-0.55$ ).

**Data analysis**

All 195 participants completed the SHPS. Among them, 10 and 21 participants had missed some items on the PSQI and the ISI, respectively. Their data were not included for the analyses of the scales with missing data, but were included for the rest of the analyses. Student's *t*-tests were conducted to compare the scores on the PSQI, the ISI, and the SHPS obtained from insomnia patients and normal sleepers. Pearson correlations were then conducted to assess the associations of poor sleep hygiene practices with sleep quality and severity of insomnia in both groups of participants. The Pearson correlations between control and insomnia groups were then compared after Fisher's transformation with associated significance tests (Howell, 2007).

**Results**

Table 2 shows the demographic data as well as the PSQI and ISI scores in both groups of participants. Sex distribution and age range were comparable between the two groups. As expected, the PSQI and ISI scores were both higher in insomnia participants than in good sleepers ( $t = 21.64$ , d.f. = 136,  $p < .001$ ;  $t = 21.48$ , d.f. = 173,  $p < .001$ , respectively).

Table 2. Demographic data, the PSQI global score, and the ISI score for both insomnia patients and good sleepers

	<i>Insomniac</i>	<i>Good sleeper</i>
N	89	106
Gender (%)		
Male	43.4	49.4
Female	56.6	50.6
Age (year)		
M $\pm$ SD	40.72 $\pm$ 11.68	40.34 $\pm$ 12.28
Range	17 to 63	20 to 65
PSQI score (M $\pm$ SD)	13.46 $\pm$ 3.73	3.79 $\pm$ 1.95
ISI score (M $\pm$ SD)	17.75 $\pm$ 5.03	4.11 $\pm$ 3.53

Table 3. Comparisons of scores on the SHPS between insomnia patients and good sleepers

SHPS scores	Insomniac		Good sleeper		t-value	p	Glass's Δ
	M	SD	M	SD			
Sleep schedule	22.64	5.43	21.17	5.79	1.83	.069	.253
Arousal-related behavior	28.61	6.55	19.39	4.92	11.21	<.001	1.874
Drinking/eating	11.55	4.28	12.29	4.29	-1.21	.228	-.172
Sleep environment	18.92	6.24	17.33	5.62	1.87	.064	.283

Table 3 shows the means and SDs of the ratings on the SHPS. Student's *t*-test results showed a significant difference between the two groups on the SHPS subscales of Arousal-related Behaviors with a large effect size ( $t = 11.21, df = 190, p < .001, \text{Glass's } \Delta = 1.87$ ). The other three subscales showed no significant differences between the two groups.

Table 4 shows Pearson correlation coefficients between the scores on SHPS with ISI and PSQI total scores. For good sleepers, all the SHPS scores correlated significantly with the ISI score; all SHPS scores but the Eating/Drinking Behaviors correlated significantly with the PSQI global score. For insomnia patients, only the subscore in the Arousal-related Behavior domain correlated significantly with the ISI and the PSQI scores. The differences of the Pearson correlations between control and insomnia groups after Fisher's transformation are also presented in Table 4. The correlations of all the SHPS scores with the ISI score were significantly larger for good sleepers than insomnia patients. The correlations between the SHPS scores and the PSQI scores were significantly larger for good sleepers only in the

Arousal-related Behavior and Sleep Environment domains. In addition, because one item in the SHPS ('feeling too hot or too cold during sleep') overlaps with two items in the PSQI ('feel too cold' and 'feel to hot'), Pearson correlations were conducted after removing these three items. The results did not generate remarkable changes and are presented in Table 4.

### Discussion

The present study aims to examine the relationships of different domains of sleep hygiene with sleep quality and severity of insomnia. It is intriguing to find that the associations are more evident for good sleepers than for insomniacs. Moderate to high correlations are found between all the domains of sleep hygiene and sleep disruption in good sleepers. This result is consistent with previous studies in college students (Brown et al., 2002; Mastin et al., 2006) and further demonstrate a similar association in a community-based adult population. In insomnia patients, however, the only area of sleep hygiene

Table 4. Pearson correlation coefficients between the scores on the SHPS and the scores on the ISI and the PSQI. Because two items in the PSQI overlap with one item in the SHPS, correlation coefficients after removing these items are presented in the parentheses

SHPS subscale	ISI			PSQI		
	Insomniacs	Control	Difference <sup>a</sup>	Insomniacs	Control	Difference <sup>a</sup>
Sleep schedule	.007	.377**	.390**	.176 (.112)	.318** (.311)**	.151
Arousal-related behavior	.326**	.610**	.372**	.248* (.221)*	.533*** (.540)***	.340*
Drinking/eating habits	-.092	.323**	.427**	-.035 (-.073)	.117 (.125)	.153
Sleep environment	-.022	.511**	.587***	-.038 (-.023)	.321** (.312)**	.371**

\* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ ; <sup>a</sup>: difference of Pearson correlation after Fisher's transformation

correlated with insomnia severity and sleep quality is arousal-related behaviors. When comparing the ratings between insomnia patients and good sleepers in different domains of maladaptive sleep hygiene practices, arousal-related behavior again shows the only significant difference. No differences between the two groups, however, are found in sleep scheduling, drinking/eating habits and sleep environment.

The results have significant implications regarding the association of sleep hygiene with sleep quality in different populations. Our data suggests that sleep hygiene is one of the important determinants of sleep quality in normal sleepers. The more maladaptive sleep practices an individual employs, the more sleep disruptions he or she may experience. However, only arousal-related behavior is associated with sleep difficulties in chronic insomniacs. A plausible explanation of the findings is that patients with chronic insomnia may be different with regard to sleep hygiene even before they develop insomnia. For example, some of them may worry more about the negative consequences of poor sleep and therefore pay more attention to their sleep environment and sleep-related practices. Thus, most domains of sleep hygiene may not be associated with poor sleep. However, this worry-prone tendency may lead to more arousal-provoking behaviors that may interfere with sleep. Therefore, the more arousal-related behaviors an insomnia patient does, the more sleep disruption he/she may have. An alternative explanation is that as chronic insomnia develops, the patients start to watch and control some of the maladaptive sleep hygiene practices. Therefore, their sleep scheduling, eating and drinking habits, and sleep environment may become less influential. In contrast, some of the arousal-related behaviors, such as 'worry about not being able to fall asleep in bed', 'check the time in the middle of night', and 'worry about night-time sleep during the day', usually originate from the experience of poor sleep and may increase as a consequence of long-term sleep difficulties. These behaviors may further exacerbate the sleep problems. Harvey (2002) has proposed that some safety behaviors aimed at gaining more control over sleep and avoiding the consequences of poor sleep, such as checking the time and worrying about the ability to sleep, may indeed induce more arousal and form a vicious cycle that exacerbates or maintains the already disrupted sleep. This vicious cycle thus may strengthen the association between insomnia severity and arousal-related behaviors.

As suggested by the 3-P model of Spielman (1986), the factors that predispose an individual to develop insomnia could be different from those maintaining insomnia. It is very likely that poor sleep hygiene in general can predispose an individual to occasional sleep disruptions. However, as the sleep disruptions become more severe or chronic, arousal-related behaviors emerge as a consequence of poor sleep, continue to exist, or are even exacerbated, but the other behaviors may have been adjusted by the patients or become relatively less influential in comparison to the impact of arousal-related behaviors. These hypothetical explanations, however, cannot be tested with the cross-sectional design of the present study.

The findings on arousal-related behaviors in chronic insomniacs are also in line with the hyperarousal model of insomnia, which suggests that insomnia is caused by a general state of hyperarousal that may interrupt normal sleep processes. Hyperarousal may originate from both physiological and cognitive bases, or through a conditioning process that associates bedtime cues with arousal (Bonnet & Arand, 1997; Morin, 1993; Perlis, Giles, Mendelson, Bootzin, & Wyatt, 1997). It may be crucial for the treatment of chronic insomnia to address the arousal-related behaviors. Simply giving insomniacs sleep hygiene education on their daily life practices and sleep environment may not be enough to resolve their sleep problem. Previous studies have shown that sleep hygiene alone is not a sufficient treatment for insomnia (Lacks & Morin, 1992; Morin et al., 2006; Morin et al., 1994; Morin et al., 1999; Murtagh & Greenwood, 1995). Interventions aimed to reduce physiological or cognitive arousal (e.g., relaxation training, cognitive restructuring) and stimulus control instructions to reduce conditioned arousal with bedtime cues may be indicated to generate better results.

In light of the implications described above, the interpretation of the results should be cautious because correlation does not imply a causal relationship. As pointed out above, the results may suggest that poor sleep hygiene may precipitate sleep disturbance in non-insomniacs, and arousal-related behaviors may perpetuate the sleep problem into chronic insomnia. However, the causality cannot be assumed with a cross-sectional design. Future study with longitudinal design can further clarify this issue. In addition, there are some inconsistencies on the PSQI and the ISI in their association with the



SHPS. The subscore on eating and drinking behavior of the SHPS was found to correlate with the ISI score but not the PSQI score in the control population. As the ISI measures primarily the symptoms of insomnia and the PSQI covers a broader perspective of sleep quality and sleep disturbances, it is possible that the eating and drinking behaviors may have more influence on insomnia symptoms but not the other symptoms, and therefore showed higher correlation with the ISI than the PSQI. Future studies should be conducted to investigate the influence of specific sleep hygiene behaviors on sleep with an experimental or longitudinal design.

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