The Connections among Worry, Sleep Hygiene, and Sleep Quality

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Acknowledgments

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Abstract

Sleep disturbances commonly plague undergraduate students (Buboltz et al., 2001). In fact, being an undergraduate student is a risk factor for developing a sleep disturbance (Medic et al., 2017). Understanding the impact of worry on the relationship between sleep hygiene and sleep disturbances could inform strategies for improving sleep quality in undergraduate populations. Given the fact that sleep issues affect health and academic performance negatively (Buboltz et al., 2001), improving sleep patterns may boost academic performance, physical health, and mental health. This study investigated relationships between sleep hygiene and worry in an undergraduate sample by using a longitudinal design. Participants were 81 undergraduate students recruited from the Sona research pool at the University of Arkansas. To evaluate worry, the PSWQ (Penn State Worry Questionnaire) was administered. The SHI (Sleep Hygiene Index) was administered to evaluate sleep hygiene. The PSQI (Pittsburgh Sleep Quality Index) was administered to evaluate sleep quality. A repeated-measures ANCOVA revealed that time is not a main effect between worry and sleep hygiene or sleep hygiene and sleep disturbances. There were associations between worry and sleep hygiene, as well as sleep hygiene and subjective and sleep quality, but it was not dependent on time. Previous studies have found associations between sleep and worry, so further exploring these variables are necessary to understand the relationship they have with time.

Keywords: worry, sleep, sleep hygiene, sleep quality
The Connections among Worry, Sleep Hygiene, and Sleep Quality

About three quarters of undergraduate students experience sleep disturbances (Buboltz al., 2001). Sleep disturbances can be characterized by an inability to fall asleep or stay asleep (insomnia), poor sleep quality, waking up repeatedly during the night, and insufficient hours of sleep. Daytime sleepiness can be a consequence of sleep disturbances as well (Hatcher et al., 2021). Additionally, sleep disturbances may lead to lack of focus in an academic setting, poorer performance in classes, lower life satisfaction, and mood disturbances (Buboltz et al., 2001). There can be specific environmental factors leading to sleep disturbances, such as thirst before bed, outside noise, and inconsistent sleep schedules (Brown et al., 2010). Some other risk factors for sleep disturbances are excessive caffeine and alcohol use, being a college student, underexposure to daytime light, and stressful life circumstances (Medic et al., 2017). Sleep disturbances have been associated with health problems such as hypertension, weight-issues, all-cause mortality in men, colorectal cancer, and increased severity of gastrointestinal issues and other underlying medical conditions (Medic et al., 2017). Thus, there is a need to further understand factors associated with sleep disturbances.

Worry is a factor that impacts sleep (Marques et al., 2016). The American Psychological Association (2022) defines worry as “a state of mental distress or agitation due to concern about an impending or anticipated event, threat, or danger.” Worry can be normal, but it can become excessive and create issues seen in anxiety disorders such as health problems or impaired social function. Worry can be used as a coping mechanism for unpleasant or unknown events or a playing field for what-ifs. As a reaction to uncertainty, it is a hallmark characteristic of anxiety disorders (Wells, 1993). Worry is linked to sleep disturbances (Pillai & Drake, 2015). The cognitive model of insomnia (Harvey, 2022) explains the link between worry and its interference
with sleep by proposing worry about sleeping well and the effects of lack of sleep. Physiological arousal related to worry interferes with sleep, resulting in deficits of sleep and daytime functioning (Harvey, 2002). Understanding how worry can impact sleep and, in turn, daily function is essential to understanding more about sleep disturbances.

Sleep hygiene is another factor that can impact sleep quality or cause sleep disturbances. (Brown et al., 2010). The American Psychological Association (2022) defines sleep hygiene as routines that can help promote good quality sleep. Recommendations for good sleep hygiene can include factors such as nightly routines, electronic use in bed, daytime activity, diet before bed, and consistency of bedtimes (CDC, 2016). In the treatment method of Cognitive Behavioral Therapy for Insomnia (CBTI), stimulus control is extremely important. Stimulus control in this situation refers to learning to associate the bed and bedroom with sleep or sex only instead of other behaviors, such as work or electronic use. Proper sleep hygiene practices are encouraged in CBTI. Along with stimulus control, establishing a routine around waking and resting to regulate circadian rhythms is a factor involved with having productive sleep, as well as avoiding napping during the day and going to bed only when sleepy (Stanford Medicine, 2017).

Previous research has found evidence that sleep quality can be affected by both sleep hygiene practices and individual worry. It has been found that worry impacts sleep quality negatively by causing sleep disturbances, such as insomnia (Harvey, 2002). There is some evidence that improving the quality of sleep will in turn improve mental health. In a 2021 study, sleep improvements were made by CBTI (which involves facets of sleep hygiene) and found to be significant for depression, anxiety, and stress (Scott et al., 2021).

Although previous studies have linked worry and sleep hygiene to sleep disturbances, studies have yet to identify what role worry has in sleep hygiene practices. The proposed study
sought to determine the temporal association between sleep hygiene and worry. I hypothesized that worry would be negatively associated with later sleep hygiene and that sleep hygiene would be negatively associated with later worry. I also hypothesized that poor sleep hygiene would have a negative association with later subjective sleep quality.

**Method**

**Participants**

Participants \((n=81)\) were undergraduate students recruited from the online Sona research pool at the University of Arkansas. Students received course credit in a psychology course for their participation. There were 67 participants identifying as female (82.7%) and 14 identifying as male (17.3%). The mean age was 19, ranging from 18 to 29 with a \(SD=1.60\). 68 participants identified their race to be Caucasian/White, 16 as Spanish/Hispanic/Latinx, 5 as Asian, 4 as Other, 3 as Black/African American, and 2 as American Indian/Alaska Native.

**Measures**

The PSWQ (Penn State Worry Questionnaire) was administered to assess worry. It is a self-report questionnaire with 16 items on a 1–5-point scale ranging from 1=not at all typical of me to 5=very typical of me. An example statement is item 7, “I am always worrying about something.” The PSWQ is scored by reverse-scoring the negatively worded items (numbers 1, 3, 8, 10, and 11), then summing the score of each item. Higher scores indicate more worry. Internal consistency has been found to be high (\(\alpha=0.93\)) among undergraduate students (Meyer et al., 1990). Internal consistency was excellent at time 1, \(\alpha=0.95\), and time 2, \(\alpha=0.95\).

The SHI (Sleep Hygiene Index) was administered to assess general sleep hygiene habits. It is a self-report questionnaire with 13 items on a 0-4-point scale ranging from 0=never and
4=always. An example statement is item 12, “I do important work before bedtime (for example: pay bills, schedule, or study).” The SHI was scored by summing the items together. Higher scores indicate more maladaptive sleep hygiene practices. Internal consistency has been found to be acceptable-poor ($\alpha = 0.66$) and a moderate-high test-retest reliability of ($r=0.71$) among undergraduate students (Mastin et al., 2006). Internal consistency was acceptable at time 1, $\alpha=0.73$, and time 2, $\alpha=0.77$.

The PSQI (Pittsburgh Sleep Quality Index) was administered to assess sleep quality. It is a self-report questionnaire to report sleep quality over one month interval. An example statement is item 9, “During the past month, how would you rate your sleep quality overall?” Typically, it has a high degree of internal consistency ($\alpha =0.83$) (Buysse et al., 1989). Only item 9, assessing overall sleep quality, was used in the present study. The PSQI was modified from one month to two weeks to fit the study timeframe.

**Procedure**

Participants were provided a link to complete the measures online, which served as the first time point (T1). Two weeks later participants were asked to complete the measures again online survey, which served as the second time point (T2). At each distribution, informed consent was given, and demographics were collected before questionnaires. At the end of time 2, participants were entered to receive a $25 gift card.

**Statistical Plan**

Zero-order correlations were examined. To test the hypotheses while accounting for the stability of the dependent variables over time, repeated-measures ANCOVA models were used. This study had three hypotheses. I hypothesized that worry would have a positive association
with later poor sleep hygiene. To test this, I used a repeated-measures ANCOVA with Time (T1, T2) as the repeated-measures and sleep hygiene as the dependent variable. Time 1 worry was entered as a covariate. The second hypothesis was that poor sleep hygiene would have a positive association with later worry. To test this, I used a repeated-measures ANCOVA with Time (T1, T2) as the repeated-measures and worry (PSWQ total score) as the dependent variable. The covariate variable was time 1 poor sleep hygiene (SHI total score). My third hypothesis was that poor sleep hygiene and worry would have negative associations with later subjective sleep quality. To test this, I used a repeated-measures ANCOVA with Time (T1, T2) as the repeated-measures and sleep quality (PSQI item 9) as the dependent variable. The covariate variable was time 1 SHI. A post-hoc question was raised to determine if the association of sleep quality found in hypothesis three was significant when controlling for worry, and this was tested by running the model again with time 1 worry added as a covariate.

**Results**

Zero-order correlations suggested moderate to high stability in the study variables, $r = .59 - .87$ (see Table 1). Worry was correlated positively with sleep hygiene across both time points. Time 1 sleep quality was positively correlated with T2 sleep hygiene, and there was a marginally significant, $p = .06$, positive correlation between T1 sleep hygiene and T2 sleep quality. Sleep quality was not correlated with worry at either time.
Table 1.

Means and correlations among study variables.

<table>
<thead>
<tr>
<th></th>
<th>T1 Worry</th>
<th>T1 Sleep Hygiene</th>
<th>T1 Sleep Quality</th>
<th>T2 Worry</th>
<th>T2 Sleep Hygiene</th>
<th>T2 Sleep Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 Worry</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1 Sleep Hygiene</td>
<td>.45**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1 Sleep Quality</td>
<td>.03</td>
<td>.34**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T2 Worry</td>
<td>.87**</td>
<td>.42**</td>
<td>.05</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T2 Sleep Hygiene</td>
<td>.34**</td>
<td>.81**</td>
<td>.41**</td>
<td>.37**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T2 Sleep Quality</td>
<td>.08</td>
<td>.21</td>
<td>.59**</td>
<td>.10</td>
<td>.10</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>56.93</td>
<td>75.78</td>
<td>2.22</td>
<td>56.32</td>
<td>74.53</td>
<td>2.23</td>
</tr>
<tr>
<td>SD</td>
<td>14.97</td>
<td>6.85</td>
<td>.59</td>
<td>14.92</td>
<td>7.39</td>
<td>.60</td>
</tr>
</tbody>
</table>

Note. *** p < .001, ** p < .01, * p < .05.

Hypothesis 1

A repeated-measures ANCOVA was used to test hypothesis 1, that worry at time 1 would be associated with poor sleep hygiene at time 2. There was no main effect of time, $F(1,79)=.17$, $p=.68$, nor was there an interaction between time and worry, $F(1,79)=1.20$, $p=.28$. There was a main effect of worry, $F(1,79) = 16.48$, $p < .001$.

Hypothesis 2

A repeated measures ANCOVA was used to test hypothesis 2, that poor sleep hygiene at time 1 would be associated with worry at time 2. There was no main effect of time, $F(1, 79) = .25$, $p=.62$, nor was there an interaction between time and poor sleep hygiene, $F(1, 79) = .32$, $p = .62$. There was a main effect of poor sleep hygiene, $F(1, 79)= 20.03$, $p < .001$.

Hypothesis 3

A repeated-measures ANCOVA was used to test hypothesis 3, that poor sleep hygiene at time 1 would be associated with sleep quality at time 2. There was no main effect of time $F(1,$...
WORRY AND SLEEP

Worry was associated with worse sleep hygiene at both time points, and it did not depend on time. Sleep hygiene was associated with worry at both time points, and it did not depend on time. Sleep hygiene, but not worry, was associated with sleep quality at both time points, and did not depend on time. This study found that worry did not depend on sleep quality in past 2 weeks, in contrast to previous studies. Clancy et al., in their meta-analysis of worry, rumination, and sleep, found a consistent association between worry and sleep (2020). Brown et al., found sleep hygiene to be related to sleep quality in their longitudinal study, and specific worries about falling asleep along with other sleep hygiene practices predicted poor sleep quality (2002). Marques et al., had similar findings in worry tendency to attribute to sleep loss due to worry (2016). This studied differed in observing worry more broadly. Understanding sleep hygiene factors and their relationship to sleep disturbances in undergraduate students in association to worry can help contribute to solutions for creating better sleep patterns. Further exploring causality, temporal relations, and the role of sleep hygiene could lead to improving sleep
patterns, which may boost academic performance, overall health, and other factors such as mental health in undergraduate students.

The conclusions of this study are limited by the study design and sample size. The effect between worry and sleep quality could be difficult to see in the small sample size of 81. It is possible that the study was under-powered to detect some effects, such as the association between T1 poor sleep hygiene and T2 sleep quality. Future studies would benefit from a larger sample size. Additionally, there was significant attrition between time 1 and time 2, resulting in a loss of ~100 participants’ data. Another limitation was due to an error in PSQI entry in the survey, only item 9 relating to subjective sleep quality could be used. The effect could be different if evaluated using all PSQI items.

In summary, my study found an association of worry with poor sleep hygiene and of poor sleep hygiene with sleep quality. But there was no evidence that these associations depended on time, which would have suggested a temporal association. The findings indicate that worry is associated with sleep hygiene, and sleep hygiene is associated with sleep quality. The results are most consistent with a model in which worry, poor sleep hygiene, and sleep quality are related without a clear temporal sequence that defines those relations.
Worry and Sleep

References


https://doi.org/10.1017/s1352465800015897
Appendix

Penn State Worry Questionnaire (PSWQ)

Instructions: Please indicate the extent to which each of the following statements has applied to you over the past two weeks.

Response scale:

1 = Not at all typical of me
2
3 = Somewhat typical of me
4
5 = Very typical of me

1. If I do not have enough time to do everything, I do not worry about it.
2. My worries overwhelm me.
3. I do not tend to worry about things.
4. Many situations make me worry.
5. I know I should not worry about things but I just cannot help it.
6. When I am under pressure I worry a lot.
7. I am always worrying about something.
8. I find it easy to dismiss worrisome thoughts.
9. As soon as I finish one task, I start to worry about everything I else I have to do.
10. I never worry about anything.
11. When there is nothing more I can do about a concern, I do not worry about it anymore.
12. I have been a worrier all my life.
13. I notice that I have been worrying about things.
Once I start worrying, I cannot stop.

I worry all the time.

I worry about projects until they are done.

**Pittsburgh Sleep Quality Index (PSQI)**

**Instructions:** The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. *Please answer all questions.*

1. During the past month, when have you usually gone to bed at night? (example: 8:00 PM)

2. During the past month, how long (in minutes) has it usually taken you to fall asleep each night? (example: 60)

3. During the past month, when have you usually gotten up in the morning? (example: 8:00 AM)

4. During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spend in bed.) (example: 8)

5. During the past month, how often have you had trouble sleeping because you…
   
   5a) Cannot get to sleep within 30 minutes
   
   5b) Wake up in the middle of the night or early morning
   
   5c) Have to get up to use the bathroom
   
   5d) Cannot breathe comfortably
   
   5e) Cough or snore loudly
   
   5f) Feel too cold
5g) Feel too hot
5h) Had bad dreams
5i) Have pain
5j) Other reason(s), please describe __________

6. During the past month, how would you rate your sleep quality overall?
   Very good
   Fairly good
   Fairly bad
   Very bad

7. During the past month, how often have you taken medicine to help you sleep (prescribed or “over the counter”)?
   Not during the past month
   Less than once a week
   Once or twice a week
   Three or more times a week

8. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?
   Not during the past month
   Less than once a week
   Once or twice a week
   Three or more times a week

9. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?
No problem at all

Only a very slight problem

Somewhat of a problem

A very big problem

10. Do you have a bed partner or roommate?

No bed partner or roommate

Partner/roommate in other room

Partner in same room, but not same bed

Partner in same bed

10, continued: If you have a roommate or bed partner, ask them how often in the past month you have had…

10a: Loud snoring

10b: Long pauses between breaths while asleep

10c: Legs twitching or jerking while you sleep

10d: Episodes of disorientation or confusion during sleep

10e: Other restlessness while you sleep, please describe: __________

**Sleep Hygiene Index (SHI)**

**Instructions:** Below you will find a list of statements. Please rate how true each statement is for you by circling the number next to it.

**Response Scale:**

0 = Never

1 = Rarely
2 = Sometimes
3 = Frequent
4 = Always

1. I take daytime naps lasting two or more hours.
2. I go to bed at different times from day today.
3. I get out of bed at different times from day to day.
4. I exercise to the point of sweating within one hour of going to bed.
5. I stay in bed longer than I should two or three times a week.
6. I use alcohol, tobacco, or caffeine within four hours of going to bed or after going to bed.
7. I do something that may wake me up before bedtime (for example: play video games, use the Internet, or clean).
8. I go to bed feeling stressed, angry, upset, or nervous.
9. I use my bed for things other than sleeping or sex (for example: watch television, read, eat, or study).
10. I sleep on an uncomfortable bed (for example: poor mattress or pillow, too much or not enough blankets).
11. I sleep in an uncomfortable bedroom (for example: too bright, too stuffy, too hot, too cold, or too noisy).
12. I do important work before bedtime (for example: pay bills, schedule, or study).
13. I think, plan, or worry when I am in bed.