**Smartphone use at bedtime:**

**The influence of sleep-smartphone hygiene, trait anxiety, and fear of missing out (FOMO) on sleep quality**

**Abstract 300words**

*Background*: To examine the relationship between smartphone usage habits in the sleeping environment (i.e., sleep-smartphone hygiene) and sleep quality among students and to examine whether this relationship can be explained through psychological mechanisms. *Participants:* Israeli college students (*N* = 467).

*Methods:* Six questionnaires were administered: Sleep-Smartphone Hygiene Questionnaire (SSHQ, developed for the current study), Social Media Engagement Questionnaire (SMEQ), Fear of Missing Out Scale (FoMOs), Trait Anxiety Inventory (STAI-T), Pittsburgh Sleep Quality Index (PSQI), demographic questionnaire.

*Results:* Positive Pearson correlations were found between sleep-smartphone hygiene, trait anxiety, FOMO and sleep quality. A significant regression model was found indicating that sleep quality can be predicted by sleep-smartphone hygiene, trait anxiety, and FOMO, which together explained 20% of the variance in sleep quality. In light of the findings, a moderation model was tested: trait anxiety was found to be a moderating variable in the relationship between sleep-smartphone hygiene and sleep quality.

*Conclusions:* trait anxiety was found to moderate the relationship between smartphone use in the sleeping environment (sleep-smartphone hygiene) and sleep quality.

Keywords: Smartphone, sleep hygiene, fear of missing out (FOMO), trait anxiety, sleep quality

**Smartphone use at bedtime and sleep quality:**

**The influence of sleep-smartphone hygiene, trait anxiety, and fear of missing out (FOMO) on sleep quality among college students**

The use of mobile information and communication technologies (ICTs) such as smartphones has increased rapidly in recent years (Papaconstantinou, Bartfay, & Bartfay, 2017). In one study, it was suggested that phone companies shipped a total of 347.4 million smartphones worldwide in the first quarter of 2017 alone (International Data Corporation, 2017). Smartphones are popular devices, capable of processing more information than all other technology; they include many features, such as games, access to the Internet and social networks, messaging, videos, multimedia, and navigation, in addition to their communication function (Demirci, Akgönül, & Akpinar, 2015). The booming use of smartphones and the fact that these phones encompass many features have raised the issue of the smartphone’s effect on the health of the users (Wolniewicz, Tiamiyu, Weeks, & Elhai, 2018). A number of adverse health outcomes associated with high users have been identified, such as obesity and decreased physical activity (Kenney & Gortmaker, 2016), reduced user well-being, as reflected in increased anxiety and depression (Banjanin, Banjanin, Dimitrijevic, & Pantic, 2015; Selvaganapathy, Rajappan, & Dee, 2017), and sleep quality (Kenney & Gortmaker, 2016; Papaconstantinou et al., 2017).

The current study focuses on the relationship between general smartphone use and its use at bedtime on sleep quality among college students. Studies have reported distinctions between high smartphone users and low smartphone users in sleep quality, as reflected in sleep disturbance and daytime dysfunction (Demirci et al., 2015) and in sleep onset latency and bedtime (Scott & Woods, 2018). All of the cited studies reported poorer sleep quality among students (adolescents and young adults) who are high-intensity smartphone users.

College students are known to have poor sleep and inconsistent sleep schedules, with nearly 60% complaining of poor sleep quality and close to 70% reporting sleep problems (Kloss et al., 2016). Insufficient sleep time among college students has been documented to occur in epidemic proportions (Peltzer & Pengpid, 2015), having a substantial impact on their physical and emotional well-being (Eliasson & Christopher, 2017). It has been demonstrated that insufficient sleep and irregular sleep schedules of college students are due in part to social and academic stress, work hours, freedom from parental supervision, and extensive consumption of tobacco, alcohol, and drugs (Cohen, Ben Abu, & Haimov, 2018; Eliasson & Christopher, 2017). All of these lead to an increase in behaviors that impair sleep quality and can be designated by the concept of *poor sleep hygiene*. Sleep hygiene is defined as a collection of behaviors and environmental variables related to the promotion of good sleep (Mastin, Bryson, & Corwyn, 2006; Suen, Tam, & Hon, 2010), such as modifiable environmental (e.g., conducive sleeping environment), scheduling (e.g., consistent sleep-wake schedule), sleep practices (e.g., predictable bedtime routine), and physiological (e.g., reduced caffeine consumption) (Martin et al., 2018; Mindell, Meltzer, Carskadon, & Chervin, 2008).

Poor sleep hygiene practices, including increased technology use (i.e., computer, smartphone, MP3 player, tablet), have been identified as increasing the risk for sleep problems in college students (Martin et al., 2018; Rogers & Barber, 2019). In the current study, we refer to technology use in the sleep environment (including during sleep time) as *sleep-smartphone hygiene (SSH)*. This concept refers to behavioral habits of using smartphones at bedtime and includes various uses by students on a smartphone prior to bedtime (e.g., sleeping with the smartphone next to the bed, smartphone use in bed before going to sleep), in the middle of the night (e.g., checking the smartphone during the night and responding to stimuli from applications such as email, Facebook, or Instagram), or in the early morning (e.g., using a smartphone as an alarm clock, checking one’s smartphone upon waking up).

The current study’s main hypothesis is that there will be a relationship between SSH and sleep quality. This hypothesis is based on findings from previous studies demonstrating that the presence of smartphones in the bedroom (specifically at bedtime) affects sleep (Adams et al., 2017; Papaconstantinou et al., 2017; Scott & Woods, 2018).

Recently, Rogers and Barber (2019) examined the effect of educational intervention to address sleep-disruptive technology use and sleep hygiene, but did not find any direct effects. These findings raised questions about the mechanisms behind the links between SSH and sleep quality. The current study was designed to address this gap by exploring the moderate effect of psychological factors on this relationship.

The research literature has identified two possible psychological factors that may have a moderate effect on the association between SSH and sleep quality: *trait anxiety* and *fear of missing out (FOMO)*. Trait anxiety is the tendency to experience negative emotions such as fears, worries, and anxieties in many situations. It is expressed in repeated fears and reports of body symptoms. Trait anxiety can be considered at two levels: at the perceptual level, which includes the tendency to attend closely to threatening stimuli; and at the cognitive level, which includes the tendency to interpret the stimuli in a threatening manner (Woods, 2016). Trait anxiety has been found related to poor sleep (Rosen, Carrier, Miller, Rokkum, Ruiz, 2015).

Fear of missing out (FOMO) is a general state of anxiety at missing out on rewarding experiences, a fear that often drives social media engagement (Przybylski, Murayama, DeHaan, & Gladwell, 2013). Individuals report feelings of disconnectedness and missing out in the absence of access to online communication, preferring to keep their phones within reach at night (Vorderer, Krömer, & Schneider, 2016). This desire to be continually connected and concerned about missing out when offline may make it difficult for highly invested users to disengage from social media at bedtime (Woods & Scott 2016).

In light of this literature, the current study proposes a theoretical moderate model, asserting that psychological factors (i.e., anxiety and FOMO) moderate between the behavioral habits of using smartphones in the sleeping environment (SSH) and sleep quality.

**Trait anxiety**

**Sleep quality (PSQI total)**

**Behavioral habits of using smartphones in the sleeping environment (SSH)**

**Fear of missing out (FOMO)**

*Figure 1*. Proposed moderate model for the association between sleep-smartphone hygiene and sleep quality.

The following study hypotheses were posited:

1. Students will report poor behavioral habit of using smartphone in the sleeping environment (SSH).

2. Poor behavioral habits of using smartphone in the sleeping environment (SSH) will be related to poor sleep quality. Psychological factors (anxiety and FOMO) will moderate this relationship.

**Method**

***Participants***

Participants were 467 college students from Israel (316 women, 141 men; aged 19-30 years; *M*age = 25, *SD*age = 2.69). The participants were recruited through social networks and on campus; they completed online anonymous questionnaires using Google Forms.

***Instruments***

*Demographic questionnaire*: Participants were requested to provide information regarding their age and gender.

*Sleep-Smartphone Hygiene Questionnaire (SSHQ):* This questionnaire contains 10 Likert-type scale items, ranging from 1 (never) to 5 (always), based on elaboration of two items from the Sleep Hygiene Index (Mastin, Bryson, & Corwyn, 2006). The items examine the habits associated with smartphone use in the sleeping environment prior to bedtime, in the middle of the night, or in the early morning (e.g., "I sleep with my smartphone in the bedroom", "I scroll on my smartphone while I'm in bed before I fall asleep", "I check my smartphone during the night"). Scores across these items were averaged to create a sleep-smartphone hygiene score for each participant, with a high score indicating behavioral habits that impair sleep hygiene. Reliability of the questionnaire for the current sample was acceptable (Cronbach’s alpha = .71).

*The Fear of Missing Out Scale* (FoMOs; Przybylski et al., 2013) comprises 10 items (e.g., “I get anxious when I don't know what my friends are up to”) presented on a 5-point Likert-type scale, ranging from 1 (*not at all true of me*) to 5 (*extremely true of me*). Item scores were averaged to give an overall score of 1–5. Cronbach’s alpha reliability coefficient for the current sample was .85.

*The State-Trait Anxiety Inventory* (STAI; Spielberger, 1983): The STAI-T is a 20-item inventory measuring trait anxiety as a psychological construct involving self-perception in addition to measuring higher-order factors of negative emotional experience and sub-factors of depression and anxiety. Each item is scored from 1 to 4 points, with potential scores for the STAI-T ranging from 20 to 80. Cronbach’s alpha reliability coefficient for the present sample was .93.

*Pittsburgh Sleep Quality Index* (PSQI; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989): The PSQI is a self-administered questionnaire assessing sleep quality and disturbance over the last one-month interval. The PSQI comprises 19 items divided into seven subscales: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. Each of the seven subscales is weighted equally on a 4-point scale of 0 to 3 (0 = no difficulty, 3 = severe difficulty). The subscales are then summed to yield a global PSQI score, ranging from 0 to 21, with higher scores indicating worse sleep quality; a global PSQI score ≥ 5 is consistent with poor sleep quality. For the current study, we used only the global PSQI score.

***Procedure***

After obtaining consent for the research from the college's Committee of Ethics, participants recruited through social networks and on campus completed online anonymous questionnaires using Google Forms.

***Data analysis***

Assumptions regarding normal distribution were verified. Means, standard deviations, and Pearson’s correlations between study variables were examined. Differences between male and female students were tested via student’s *t*-test. The hypothesized model was tested by moderation analysis using SPSS 24 (IBM, Chicago, IL, USA) with the PROCESS macro Model 2 (Hayes, 2013). The independent variable was SSHQ, the dependent variable was sleep quality (PSQI), and the potential moderators were trait anxiety and FOMO. Moderation occurs if the interaction between the independent variable and the potential moderator is statistically significant.

**RESULTS**

Means, standard deviations, and ranges for each measure are presented in [Table 1](https://www.sciencedirect.com/science/article/pii/S0140197118301441" \l "tbl1).

TABLE 1: Means (Standard Deviations) and Ranges for Study Variables

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Variable | Mean (*SD*) | Min | Max | Skewness | Kurtosis |
| Smartphone-sleep hygiene (SSHQ) | 3.82 (0.60) | 1.8 | 5.0 | -0.52 | 0.06 |
| Social media engagement (SMEQ) | 23.16(7.80) | 5 | 35 | -0.13 | -0.85 |
| Fear of missing out (FoMOs) | 2.59 (0.70) | 1.0 | 4.9 | 0.29 | -0.13 |
| Trait anxiety (STAI-T) | 39.75 (11.80) | 20 | 77 | 0.63 | -0.8 |
| Sleep quality (PSQI) | 5.21 (2.80) | 1 | 17 | 0.84 | 0.91 |

***Student Sleep-Smartphone Hygiene***

The first hypothesis claimed that students will report on the poor behavioral habit of using smartphone in the sleeping environment (SSH). Table 2 presents the frequency (percent) of the responses in each question.

TABLE 2: Frequency (percent) of the Responses to the Sleep-Smartphone Hygiene Questionnaire\*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Never | Rarely | Sometimes | Often | Always |
| 1 | Sleeps with the smartphone in the bedroom |  | 1.7 | 1.5 | 1.3 | 4.8 | **90.7** |
| 2 | Sleeps with the smartphone next to the bed |  | 7.6 | 6.1 | 8.1 | 14.1 | **63.6** |
| 3 | Leaves the smartphone on overnight |  | 1.3 | 1.7 | 2.6 | 5.4 | **88.9** |
| 4 | Switches the smartphone to silent mode at night |  | 23.6 | 11.3 | 15 | 9.5 | **40.6** |
| 5 | Scrolls up on the smartphone when in bed before going to sleep |  | 3.5 | 8.5 | 14.8 | 23 | **50.0** |
| 6 | Scrolls up on the smartphone when in bed after turning off the lights (after having already planned to sleep) |  | 10.2 | 14.5 | 18 | 24.5 | **32.8** |
| 7 | Checks smartphone during the night |  | 20.8 | **23.0** | 21.5 | 18.7 | 16.1 |
| 8 | Responds to one of the following applications: email / Facebook / Instagram during the night |  | **34.5** | 26.9 | 21.5 | 8.2 | 8.9 |
| 9 | Uses smartphone as an alarm clock |  | 9.0 | 1.7 | 1.7 | 4.3 | **91.3** |
| 10 | Checks smartphone first upon waking up |  | 2.2 | 4.8 | 16.7 | 29.5 | **46.9** |

*Note*. \*The mode response for each of the items appears in bold.

As Table 2 indicates, the students reported poor sleep-smartphone hygiene. Most of the students (90.7%) reported sleeping with the smartphone in the bedroom, with 88.9% leaving the smartphone turned on during the night, 50% scrolling the smartphone at bed before falling asleep, and 32.8% scrolling it after turning off the lights. While 43.8% of the students 'never used' or 'rarely used' the smartphone during the night, 34.8% reported that they 'often' or 'always' check the smartphone during the night. In addition, 76.4% reported checking the smartphone the first thing they do when they wake up.

***The moderate model:***

No statistically significant gender difference was found in sleep quality, as reflected in the total score of the PSQI tested, *t*(459) = 0.6, ns. Therefore, all subjects were treated as a single group.

TABLE 3: PearsonCorrelations between Study Variables

|  |  |  |  |
| --- | --- | --- | --- |
|  | Sleep-Smartphone hygiene (SSHQ) | Fear of missing out (FOMO) | Trait Anxiety (STAI-T) |
| Fear of missing out (FoMOs) | 0.15\*\* |  |  |
| Trait anxiety (STAI-T) | 0.14\*\* | 0.51\*\* |  |
| Sleep quality (PSQI) | 0.17\*\* | 0.18\*\* | 0.43\*\* |

***Note.* \*\**p* < .01** after Bonferoni adjustment.

Pearson correlations between the study variables were consistent with expected associations, based on the proposed model with SSHQ, FOMO, and trait anxiety positively correlated with sleep quality.

Multiple regression test was conducted to predict sleep quality (PSQI), based on the Sleep–Smartphone Hygiene Questionnaire (SSHQ), trait anxiety (STAI-T), and FOMO. Table 4 presents the main findings.

TABLE 4: Simultaneous Regression for Sleep Quality as a Function of Sleep–Smartphone Hygiene, Trait Anxiety, and FOMO

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Predictive Variable | Β | *t* | R2 | *F*(3,457) |
| Trait anxiety | 0.408 | 8.53\*\*\* | 0.20 | 29.59\*\*\* |
| FOMO | 0.024 | 0.50 |
| Sleep – Smartphone Hygiene (SHSQ) | 0.108 | 2.52\*\* |

***Note****.* \*\**p* < .005, \*\*\* *p* < .001.

As indicated in Table 4, the regression model was significant, *F*(4, 456) = 29.59, *p* < .001. That is, sleep quality (PSQI) can be predicted by trait anxiety, FOMO and sleep–smartphone hygiene (SHSQ). The three variables explained 20% of the variance in sleep quality (PSQI). Table 4 also reveals that trait anxiety offered the highest unique contribution (β = 0.45, *p* < .001), followed by sleep–smartphone hygiene (SSHQ; β = 0.12, *p* < .005). The contribution of FOMO to predict sleep quality (PSQI) was not found to be significant (β = -0.01, β = 0.06, ns).

In light of the above results, a model including SSH as an independent variable and sleep quality (PSQI) as a dependent variable was tested, with psychological factors (trait anxiety and FOMO) as moderators. This model was significant (F(5, 455)=24.92, p<.001 and explained 21.5% of the variance. The effect of SSH on sleep quality was found to be positive and significant conditional on the mean anxiety [mean centered anxiety= 0 ] (b=0.6587, se=.2070, p<.002). The effect of anxiety on sleep was positive and significant condition on mean SSH (b=0.1076, se=.0120, p<.001). Trait anxiety was a statistically significant moderator of the relationship between SSH and sleep (F(1, 455)=5.24, p<.02) and the interaction between SSH and trait anxiety explained 0.9% of the variance in sleep quality. At low levels of trait anxiety (-1 SD) the relationship between sleep and SSH was positive but insignificant. At median and high levels of trait anxiety the relationship between sleep and SSH were positive and significant (figure 2).

There was no statistically significant effect of FOMO on sleep [conditioned on mean anxiety ] (t(455)=-1.21, p>.23 ) and was not a moderator of SSH on sleep quality (F(1, 455)=1.72, p>.19).

**DISCUSSION**

The purpose of this study was to examine the relationship between behavioral habits of using smartphones in the sleeping environment (SSH) and sleep quality among college students and to examine whether psychological factors moderate this association. The research hypotheses were partially confirmed. The results revealed that behavioral habits of using smartphones in the sleeping environment (SSH) were associated with sleep quality, this association was moderate by trait anxiety but not by FOMO.

***Behavioral habits of sleep-smartphone-hygiene in the sleeping environment***

Sleep-smartphone hygiene comprises behavior such as using the smartphone before bedtime, during the night, and in early morning at waking (Chehri et al., 2017; Suen, Tam, & Hon, 2010)

The first hypothesis of the study suggests that students will report poor sleep-smartphone hygiene. This hypothesis was supported by the current findings. In all measures, students reported performing behavioral habits that impair sleep-smartphone hygiene. Most of the students reported sleeping with their smartphones in the bedroom, in proximity to their bed, and report scrolling through it until the moment they fall asleep. Most participants also reported that the first thing they do when they wake up is to check their smartphone. Smartphone use during the night was reported in lower percentages.

These findings are consistent with other studies examining student's behavioral habits of using smartphones in the sleeping environment (Fobian, Avis, & Schwebel, 2016; Jennifer Falbe et al., 2015; Li, Lepp, & Barkley, 2015; Rogers & Barber, 2019). For example, in one study examining student athletes (Monma et al., 2018), 70.2% reported scrolling through their smartphone after turning off the lights. The findings of this and other cited studies illustrate that student's behavioral habits of using smartphones in their sleeping environment are characterized by poor sleep-smartphone hygiene.

***The moderate model: psychological factors (trait anxiety and FOMO) as moderators between behavioral habits of using smartphones in the sleeping environment (sleep-smartphone hygiene) and sleep quality***

Based on the literature, two psychological factors have been identified as moderating variables in the associations between sleep-smartphone hygiene and sleep quality. The findings supported the assumptions of the model, showing that the moderating model explained 21.5% of the variance of sleep quality. A positive relationship was found between sleep-smartphone hygiene and sleep quality that was significantly conditioned by anxiety but not by fomo. The interaction between sleep-smartphone hygiene and trait anxiety explained 0.9% of the variance in sleep quality. At median and high levels of trait anxiety the relationship between sleep and SSH were positive and significant.

However, in contrast to our hypothesis, FOMO was not significant, possibly FOMO characterizes more adolescents, rather than adult students, the current study population. We propose to extend this study to the adolescent population.

As all sleep-smartphone hygiene measures have demonstrated behaviors characterized by intense use of smartphones in the sleeping environment, it is reasonable to assume that these behavioral habits alone do not explain the impairment of sleep quality. The finding that psychological factor (anxiety) are found to moderate this relationship is important. The presence of the smartphone in the bedroom does not necessarily affect sleep quality, but sleep quality will be impaired for those individuals afflicted with trait anxiety who leave their smartphones close to their bed. These findings are in line with other studies showing that trait anxiety (Demirci et al., 2015; Woods, 2016) is related to intense use of smartphones in the sleeping environment and to various measures of sleep (Scott & Woods, 2018).

The association between sleep-smartphone hygiene and sleep quality is important for those seeking effective practices for coping with the impairment of sleep quality among students. Recommendations for behavioral change, as suggested in programs, encourage sleep hygiene (Whipps, Byra, Gerow, & Hill Guseman, 2018) alone are insufficient. Simply removing the smartphone from the bedroom will not necessarily improve sleep quality. Recommendations should also address intra-personal aspects, such as trait anxiety. Accordingly, the recommendations should be incorporated into behavior that encourages a hygienic sleep environment (including removing the smartphone from the bedroom) and techniques shown to reduce anxiety, such as CBT (Suh, Cho, & Zhang, 2018) or mindfulness (Lau, Leung, Wing, & Lee, 2018; Scott & Woods, 2018).

**Limitations**

The current study had several limitations. First, the results of the study were based on self-report questionnaires, and showed that students obtained poor quality sleep (the PSQI average score was 5.21). Previous studies have already discussed the gap between subjective reporting of sleep quality and its objective measurement (Cohen et al., 2018). In a follow-up study, the Sleep Quality and the Smartphone Usage Index should be examined using objective measurements (actigraphy). Second, the study was conducted on Israeli students; due to the characteristics of life in Israel, most undergraduate students are older than their counterparts in the United States or Europe. In the context of smartphone use, age plays a significant role, and therefore, this issue should be examined at younger ages such as adolescents and children.

Despite these limitations, the findings have important implications for understanding the impact of smartphone use on sleep quality and the ability to present an evidence-based intervention program.

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**Figure and Table Captions:**

*Figure 1*. Proposed mediation model for the association between sleep-smartphone hygiene and sleep quality.

TABLE 1: Means (Standard Deviations) and Ranges for Study Variables

TABLE 2: Frequency (percent) of the Responses to the Sleep-Smartphone Hygiene Questionnaire\*

TABLE 3: PearsonCorrelations between Study Variables

TABLE 4: Simultaneous Regression for Sleep Quality as a Function of Sleep–Smartphone Hygiene, Social Media Engagement, Trait Anxiety, and FOMO

Highlights:

* Students are characterized by behavioral habit of low "Sleep-smartphone hygiene"
* "Sleep-smartphone hygiene" associate with sleep quality.
* The link between Sleep-smartphone hygiene" with sleep quality is mediated by gpsychological factors: Trait anxity and FOMO.
* Intervention programs should address to behavioral and psychological aspects of smartphone use.

**עד כאן**

**Full model: (using mean centering)**

Run MATRIX procedure:

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* PROCESS Procedure for SPSS Version 3.1 \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

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Documentation available in Hayes (2018). www.guilford.com/p/hayes3

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Model : 2

Y : psqiscor

X : meansshi

W : sumstpi

Z : meanfomo

Sample

Size: 461

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

OUTCOME VARIABLE:

psqiscor

Model Summary

R R-sq MSE F df1 df2 p

.4637 .2150 6.6602 24.9225 5.0000 455.0000 .0000

Model

coeff se t p LLCI ULCI

constant 5.1949 .1220 42.5808 .0000 4.9551 5.4346

meansshi .6587 .2070 3.1818 .0016 .2519 1.0655

sumstpi .1076 .0120 8.9975 .0000 .0841 .1311

SSHI\*STPI .0495 .0216 2.2891 .0225 .0070 .0920

meanfomo -.2349 .1946 -1.2067 .2282 -.6173 .1476

SSHI\*FOMO -.4218 .3218 -1.3108 .1906 -1.0543 .2106

The effect of SSHI on sleep was positive and significant condition on mean anxiety [mean centered anxiety= 0 ] (b=0.6587, se=.2070, p<.002). The effect of anxiety on sleep was positive and significant condition on mean SSHI (b=0.1076, se=.0120, p<.001). Trait anxiety was a moderator of the relationship between SSHI and sleep. There was no significant effect of FOMO on sleep condition on mean anxiety [mean centered anxiety= 0 ]

Test(s) of highest order unconditional interaction(s):

R2-chng F df1 df2 p

SSHI\*STPI .0090 5.2401 1.0000 455.0000 .0225

SSHI\*FOMO .0030 1.7181 1.0000 455.0000 .1906

**An additional 0.9% of the variance is explained by the interaction.**

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Focal predict: meansshi (X)

Mod var: sumstpi (W)

Mod var: meanfomo (Z)

Conditional effects of the focal predictor at values of the moderator(s):

sumstpi meanfomo Effect se t p LLCI ULCI

-11.8349 -.7275 .3796 .2914 1.3028 .1933 -.1930 .9523

-11.8349 .0000 .0728 .2976 .2445 .8070 -.5122 .6577

-11.8349 .7275 -.2341 .4493 -.5210 .6026 -1.1171 .6489

.0000 -.7275 .9656 .3254 2.9670 .0032 .3260 1.6051

.0000 .0000 .6587 .2070 3.1818 .0016 .2519 1.0655

.0000 .7275 .3518 .2991 1.1765 .2400 -.2359 .9395

11.8349 -.7275 1.5515 .5079 3.0549 .0024 .5534 2.5495

11.8349 .0000 1.2446 .3580 3.4767 .0006 .5411 1.9481

11.8349 .7275 .9378 .3286 2.8534 .0045 .2919 1.5836

At low levels of trait anxiety (-1 SD) the relationship between sleep and SSHI was positive but insignificant. At median and high levels of trait anxiety the relationship between sleep and SSHI were positive and significant.

Data for visualizing the conditional effect of the focal predictor:

Paste text below into a SPSS syntax window and execute to produce plot.

DATA LIST FREE/

meansshi sumstpi meanfomo psqiscor .

BEGIN DATA.

-.6010 -11.8349 -.7275 3.8644

.0000 -11.8349 -.7275 4.0926

.6010 -11.8349 -.7275 4.3207

-.6010 -11.8349 .0000 3.8780

.0000 -11.8349 .0000 3.9217

.6010 -11.8349 .0000 3.9654

-.6010 -11.8349 .7275 3.8916

.0000 -11.8349 .7275 3.7509

.6010 -11.8349 .7275 3.6102

-.6010 .0000 -.7275 4.7854

.0000 .0000 -.7275 5.3657

.6010 .0000 -.7275 5.9461

-.6010 .0000 .0000 4.7990

.0000 .0000 .0000 5.1949

.6010 .0000 .0000 5.5908

-.6010 .0000 .7275 4.8126

.0000 .0000 .7275 5.0240

.6010 .0000 .7275 5.2355

-.6010 11.8349 -.7275 5.7064

.0000 11.8349 -.7275 6.6389

.6010 11.8349 -.7275 7.5714

-.6010 11.8349 .0000 5.7200

.0000 11.8349 .0000 6.4681

.6010 11.8349 .0000 7.2161

-.6010 11.8349 .7275 5.7336

.0000 11.8349 .7275 6.2972

.6010 11.8349 .7275 6.8608

END DATA.

GRAPH/SCATTERPLOT=

meansshi WITH psqiscor BY sumstpi /PANEL ROWVAR= meanfomo .

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* ANALYSIS NOTES AND ERRORS \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Level of confidence for all confidence intervals in output:

95.0000

W values in conditional tables are the mean and +/- SD from the mean.

Z values in conditional tables are the mean and +/- SD from the mean.

NOTE: The following variables were mean centered prior to analysis:

sumstpi meanfomo meansshi

NOTE: Variables names longer than eight characters can produce incorrect output.

Shorter variable names are recommended.

------ END MATRIX -----

