



# The sleep and sex survey: Relationships between sexual function and sleep

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## ABSTRACT

**Objective:** Distress and dysfunction in sleep and sex are both very common, and have been found to be separately related to anxiety, depression, and stress. Even so, and despite evidence linking obstructive sleep apnea and erectile dysfunction, the connections between sleep and sex are largely understudied.

**Method:** A large ( $N = 703$ ) survey of people in the United States between 18 and 65 years old was conducted using Mechanical Turk, an on-line crowd-sourcing platform. Approximately 30% of participants were Black, Hispanic, Asian, or Native American, 8% identified as lesbian, gay or bisexual, and the sampling structure ensured an even gender distribution in each of 5 age strata. The Pittsburgh Sleep Quality Index (PSQI), Insomnia Severity Index (ISI), International Index of Erectile Function (IIEF), and Female Sexual Function Index (FSFI) assessed sleep and sexual dysfunction; the Perceived Stress Scale (PSS), Patient Health Questionnaire (PHQ-9), and General Anxiety Disorder scale (GAD-7) measured stress, depression, and anxiety to measure variance.

**Results:** We found a significant connection between insomnia severity and sexual function. The relationship remained significant after accounting for the shared variability associated with depressive and anxious symptoms, and perceived stress.

**Conclusion:** Given this relationship, clinicians observing dysfunction in one area should routinely assess for dysfunction in the other. Further research will be required to determine (a) if treatment of one has an effect on the other, and (b) if this connection is related to a common psychopathological factor and/or is a conditioned association related to the commonly shared context of bed.

## 1. Introduction

Sexual dysfunction is experienced by approximately 10–50% of men and 25–60% of women [1], and there is evidence that sexual dysfunction is tied to a number of other factors, both as cause and effect [2, 3]. This is similar to sleep difficulties, which have been convincingly associated with a wide variety of functional limitations and morbidities [4]. Chronic insomnia, for example, is linked to the development of both medical (e.g., hypertension) and psychiatric (e.g., depression) conditions as well as to overall function and life satisfaction [5, 6]. It is thus surprising that sleep disturbance is a relatively unexplored factor that may be either (or both) a risk factor for, and/or a sequelae of, sexual dysfunction and dissatisfaction, despite the call for further work in this area [7]. With the exception of the relationship between erectile dysfunction and obstructive sleep apnea (OSA) see, for example, [8–10], however, sleep disturbance is not typically enumerated as a contributing factor for, or consequence of, sexual dysfunction. The most

detailed sex and sleep review, published a decade ago, focused on abnormal sexual behaviors that occur *during* sleep [11]. The most comprehensive surveys and reviews of sexual behavior and function give little mention of sleep disturbance as a factor contributing to sexual dysfunction [3, 12, 13].

There are a number of reasons to suspect that a rather strong relationship between sleep and sexual function might exist. First, and most speculatively, the majority of sleep and sexual behavior occurs at night and often in the same location, making the potential for problems in one domain to become behaviorally associated with and interfere with the other domain likely. Second, there is the possibility of a shared third variable linking sleep and sex. Chief among these potential third variables is stress. Perceived stress and stress vulnerability are frequent precursors of poor sleep and subsequent chronic insomnia [14]. Stress is also known to adversely contribute to sexual function [15, 16]. In addition, the presence of a sleep disturbance may itself serve as an additional stressor that precipitates sexual dysfunction (or sexual

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problems may be a stressor that contributes to the development of, for example, insomnia). Mood disturbance is another potential shared path between sex and sleep problems, as strong literatures link both depression and anxiety to both sleep and sexual problems e.g., [17, 18]. Third, there are some empirical data for specific sleep-sex relationships. Among men, there is consistent evidence that obstructive sleep apnea is associated with erectile dysfunction [9, 19, 20]. In addition, even among men without sleep apnea, other sleep disorders such as insomnia have been observed to prospectively contribute to ED at least in one large, longitudinal cohort study [21]. Among women, a consistent finding, from cross-sectional data, has been the co-occurrence of sleep disturbance and sexual dysfunction during and after the menopause transition e.g., [22]. It is not without reason, therefore to expect a larger extant literature supporting a variety of sleep-sex associations than that which exists to date.

In addition to the relatively small literature in this area, one shortcoming of that literature is that even well designed epidemiologic or cohort studies emanating from the sleep field tend to have poor (or no) measures of sexual function. Even studies (both experimental and observational) designed to assess sleep and sexual function may focus on one component of sleep (e.g., sleep quality) to the exclusion of others (e.g., presence and severity of insomnia). This study sought to assess a variety of relationships between sleep and sex while striking a balance between having a full battery of validated scales of sleep, sex, mood and stress and having a large, representative sample.

Consistent with the literature reviewed above, we hypothesized that: (H<sub>1</sub>) Problems with sleep would be significantly correlated with problems with sex, and both issues would be significantly correlated with depressive and anxious symptoms, with lower function in one domain being related to lower function in the others. Further, we hypothesized that (H<sub>2</sub>) the correlation between negative sleep and sexuality outcomes would persist after accounting for the shared influence of symptoms of stress, anxiety and depression. Finally, we hypothesized that (H<sub>3</sub>) in hierarchical linear regression models predicting sleep function with anxiety and depression, the addition of sexual function as a predictor variable would significantly increase the variability accounted for by the model.

## 2. Methods

### 2.1. Sample

Respondents ( $N = 703$ ) were recruited from Amazon's Mechanical Turk. See Table 1 for overview of demographics. Mechanical Turk (MTurk) was used as a sample source because of its demonstrated ability to achieve comparatively national representation from a variety of age and socioeconomic groups. Prior work has demonstrated that MTurk produces data at least as reliable as other survey techniques see, for example, [23–25] and that MTurk more closely approximates a random distribution than traditional, geographically-limited studies [23]. Participants for this study were recruited by gender in five age groupings (18–25, 26–35, 36–45, 46–55, and 56–65 years old, one age group each for men and women) to ensure an approximately even age and gender distribution and were paid \$6.00 upon completion of the survey.

Consistent with best survey practices, four instructional manipulation check questions were asked of participants [26]. These questions, inserted in the midst of other measures, ask participants to respond to the question with a specific answer – e.g., “Select ‘very strongly disagree.’”. These questions are intended to identify participants who are not sufficiently attending to the survey instrument. Of the 703 participants who answered basic demographic questions, 95.5% answered all four questions correctly. Those participants ( $N = 31$ ) who missed one or more questions were excluded from the sample, as were participants who identified as transgender ( $N = 5$ ), and those who identified as either asexual ( $N = 5$ ), or an orientation that was not captured by the

**Table 1**  
Demographics.

	Female ( $N = 319$ )	Male ( $N = 337$ )	All participants ( $N = 656$ )
	M ± N (%)	M ± SD N (%)	M ± SD N (%)
Age	40.4 ± 12.5	41.1 ± 12.9	40.8 ± 12.7
Sexual Orientation			
Heterosexual	294 (92%)	313 (93%)	607 (92%)
Bisexual	10 (3%)	8 (2%)	18 (3%)
Homosexual	15 (5%)	16 (5%)	31 (5%)
Ethnicity			
White/Caucasian	218 (69%)	243 (72%)	461 (71%)
Asian	50 (16%)	57 (17%)	107 (16%)
Black/African American	33 (10%)	17 (5%)	50 (8%)
Hispanic/Latino/Latina	15 (5%)	17 (5%)	32 (5%)
American Indian/Alaska Native	0 (0%)	2 (1%)	2 (0.3%)
Native Hawaiian/Pacific Islander	0 (0%)	0 (0%)	0 (0%)

No statistically significant differences were found for these variables by gender.

Kinsey scale ( $N = 6$ ). The remaining respondents ( $N = 656$ ) were used for all analyses.

The gender split was nearly even, with 48.6% ( $N = 319$ ) participants identifying as women and the remaining 51.4% ( $N = 337$ ) as men. The average age of participants was 40.8 years old ( $SD = 12.7$ ). The majority of participants identified as heterosexual (92.5%,  $N = 607$ ), while others identified as bisexual 2.7% ( $N = 18$ ), or gay or lesbian 4.7% ( $N = 31$ ). The majority of respondents identified as White or Caucasian (70.7%,  $N = 461$ ), with 16.4% ( $N = 107$ ) of participants identifying as Asian, 7.7% ( $N = 50$ ) as Black or African American, and 0.3% ( $N = 2$ ) as American Indian or Native Alaskan. No statistically significant or meaningful difference between men and women was found for age, orientation, or ethnicity.

## 3. Materials

The primary outcome of interest was sleep dysfunction, as measured by the Pittsburgh Sleep Quality Index (PSQI) and the Insomnia Severity Index (ISI). The Pittsburgh Sleep Quality Index PSQI; [27] is a 19-item scale intended to capture a range of sleep problems. It produces seven component scores: sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, use of sleep medication, and daytime dysfunction. The PSQI has demonstrated strong reliability and validity in identifying clinically important sleep dysfunction in a variety of clinical and non-clinical settings e.g., [28]. Scale reliability for the PSQI is complex to evaluate, with most subscales having too few items to meaningfully calculate a Cronbach's alpha for brief discussion, see [29]. The observed alpha for the eight-item sleep disturbance scale in this sample was an adequate .81, and the correlations between the seven subscale scores and the full scale ranged in absolute value from .51 to .72, consistent with the subscales addressing relatively independent domains of sleep function.

The Insomnia Severity Index ISI; [30] is a seven-item scale for insomnia that has been widely used as a measure of insomnia intensity and distress with both clinical and non-clinical samples, and has demonstrated reliability and validity in both identifying sleep issues and tracking treatment response and other changes see, for example, [31]. Scores range from zero to 28, with higher scores indicating greater insomnia severity. The observed Cronbach's alpha for this sample was strong;  $\alpha = .93$ .

Sexual function was measured by the Female Sexual Function Index FSFI; [32] and the International Index of Erectile Function IIEF; [33].

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