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# Perceived Partner Responsiveness Predicts Better Sleep Quality Through Lower Anxiety

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## Abstract

The present study investigated whether perceived partner responsiveness—the extent to which individuals feel cared for, understood, and validated by their partner—predicted subjective sleep problems and objective (actigraph-based) sleep efficiency through lower anxiety and depression symptoms. A life span sample of 698 married or cohabiting adults (35–86 years old) completed measures of perceived partner responsiveness and subjective sleep problems. A subset of the sample ($N = 219$) completed a weeklong sleep study where actigraph-based measures of sleep efficiency were obtained. Perceived partner responsiveness predicted lower self-reported global sleep problems through lower anxiety and depression and greater actigraph-assessed sleep efficiency through lower anxiety. All indirect associations held after controlling for emotional support provision to the partner, agreeableness, and demographic and health covariates known to affect sleep quality. These findings are among the first to demonstrate how perceived partner responsiveness, a core aspect of romantic relationships, is linked to sleep behavior.

## Keywords

perceived partner responsiveness, sleep, marriage, well-being, anxiety

Sleep is a critical health behavior reducing the risk for morbidity and mortality (e.g., Dew et al., 2003; Reid et al., 2006). Given the well-established link between social relationships and health (e.g., Holt-Lunstad, Smith, & Layton, 2010), research has increasingly focused on the role of close relationships in sleep. Although both sleep quality (Dew et al., 2003) and total sleep duration (Shen, Wu, & Zhang, 2016) have been linked to health outcomes, social relationships or lack thereof have typically been found to be linked with sleep quality—for instance, subjective evaluations of how well individuals sleep or how much daytime dysfunction they experience, or objective assessments of sleep efficiency (the ratio of time spent sleeping to the time spent in bed)—rather than total duration (Bordeleau, Bernier, & Carrier, 2012; Cacioppo et al., 2002). These findings suggest that social relationships are associated with reduced nonrestorative sleep, which is defined as sleep that is interrupted with frequent awakenings and not refreshing, despite normal duration (Hawkley, Preacher, & Cacioppo, 2010). Restorative sleep depends on perceived absence of threat in the environment and downregulation of arousal. Persistent high arousal—a marker of anxiety—disrupts sleep by increasing nightly awakenings and resulting in poorer daytime functioning. Social relationships are thought to counteract this process, as they are a potent source of safety and protection, and they downregulate perceptions of threat (Eisenberger et al., 2011) and physiological arousal (Slatcher, Selcuk, & Ong, 2015).

Given that adult sleep is typically a shared activity between romantic partners (National Sleep Foundation, 2013) and romantic relationships have a unique capacity to influence the quality of human health and well-being (Loving & Slatcher, 2013), the role of marital and cohabiting relationships in sleep quality has received increased research attention (Troxel, 2010). Although studies have established that individuals' sleep quality is closely linked to how happy (or unhappy) they are in their relationship, the psychological processes through which relationships affect sleep are still not well understood (Troxel, 2010). Growing work, primarily led by social psychologists, aiming at explaining the psychological pathways by which long-term romantic relationships are linked to physical health demonstrates that relationship processes (e.g.,

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responsiveness, support provision) predict psychological symptoms (e.g., anxiety, depression) and well-being (e.g., life satisfaction), which in turn predict physical health (for reviews, see Slatcher, 2010; Slatcher & Selcuk, in press). In the few studies taking this approach (e.g., the links between self-disclosure to one's partner and sleep quality; Kane, Slatcher, Reynolds, Repetti, & Robles, 2014), the small sample sizes limited the ability to detect between-person differences and sleep quality was measured only with self-reports. However, a multimethod approach to measuring sleep is important because self-reported sleep quality is at best weakly correlated with objective measures such as actigraphy (Grandner, Kripke, Yoon, & Youngstedt, 2006), suggesting that the two types of measures tap different aspects of sleep quality. Whereas self-reports typically measure subjective (dis)satisfaction about sleep quality, actigraphy provides indices of objective sleep disruptions during a night's interval. The two measures are also differentially related to health and well-being (e.g., Lemola, Ledermann, & Friedman, 2013; Liu et al., 2013). It may be the case that romantic relationships may be associated with one type of sleep measure but not the other, or they may predict both subjective and objective sleep quality but through different psychological mechanisms.

*Perceived partner responsiveness* (i.e., the extent to which individuals perceive their partner as caring, understanding, and appreciative; Reis, 2007) may be one important process by which romantic relationships affect sleep quality. In this study, we investigated the associations between perceived partner responsiveness and sleep quality in a large sample using both self-report measures of sleep problems and an objective actigraph-based measure of sleep efficiency. The large sample size provided us with sufficient statistical power to investigate the potential psychological mechanisms through which partner responsiveness is associated with sleep. Specifically, we tested two potential mediators of the link between perceived partner responsiveness and sleep quality—anxiety and depressed affect two classes of psychological symptoms that are among the most common predictors of sleep disturbances (Koffel & Watson, 2009)—hypothesizing that perceived partner responsiveness would positively predict sleep quality through lower anxiety and depressive symptoms.

## Perceived Partner Responsiveness and Well-Being

Perceived partner responsiveness has been identified as a key process that influences the extent to which romantic relationships are satisfying and intimate. It focuses on partners' positive responses to each other in contrast to negative responses or indifference (Reis, 2007). When one perceives her or his partner as caring, understanding, and appreciative, one is more likely to self-disclose and also to react responsively to the partner's disclosures. When this process is enacted reciprocally and mutually, it reinforces the development and maintenance of intimacy in the relationship (Reis & Patrick, 1996).

Of particular relevance to the present study, a central function of perceived partner responsiveness involves downregulating anxiety and arousal and instilling a sense of security and quiescence (Selcuk, Zayas, & Hazan, 2010). When individuals encounter threats and stressors, the primary coping strategy for most adults is to turn to their partners for safety and protection (Mikulincer & Shaver, 2007). *Responsive* partner support during these times alleviates distress and downregulates anxious arousal. Indeed, when individuals were faced with an anxiety-provoking experience in the laboratory (e.g., talking about a stressful problem or anticipating giving a public speech), their partner's responsive support alleviated both self-reported (Collins & Feeney, 2000) and observer-rated (Simpson, Rholes, & Nelligan, 1992) anxiety. Repeated responsive interactions with partners translate over time to a long-term decline in anxiety, both psychologically and physiologically (e.g., endocrine functioning; Feeney & Collins, 2015). For instance, a recent daily experience study (Slatcher et al., 2015) demonstrated that high partner responsiveness predicts a steeper decline in diurnal cortisol a decade later, suggesting that the effect of responsiveness goes beyond the immediate stressful context and may potentially be associated with lower chronic levels of anxiety over the long term. This finding is important in the present context also given that prior work has linked steeper diurnal cortisol slopes to lower anxious arousal (Doane et al., 2013), which would be expected to predict higher quality sleep.

Responsiveness (or lack thereof) is also thought to be one key process that explains how social relationships affect depression across the life span (Bowlby, 1980). More specifically, relationships are argued to reduce an individual's risk for depression to the extent that a partner's support (a) effectively meets the demands of the stressful life situations and (b) does not undermine the individual's sense of autonomy (Ibarra-Rovillard & Kuiper, 2011). Those who are perceived as responsive are more likely to engage in support behaviors that are appropriately contingent on the demands of the situation (Collins, Guichard, Ford, & Feeney, 2006) and, moreover, their support also enhances the partner's autonomy, self-efficacy, and independent goal pursuit (Feeney, 2007). Thus, it is not surprising that perceived partner responsiveness is a strong predictor of lower symptoms of depression in daily life (Fekete, Stephens, Mickelson, & Druley, 2007; Khan et al., 2009).

Prior studies have illuminated consistent associations between anxiety, depression, and sleep quality as well (Alvaro, Roberts, & Harris, 2013; Koffel & Watson, 2009; Magee & Carmin, 2010; Revenson, Marín-Chollom, Rundle, Wisnivesky, & Neugut, 2016). Increasing research indicates that disruptions in nighttime sleep is associated with indicators of physiological hyperarousal such as increased metabolic rates, heart rate variability, and cortisol output (for a review, see Stepanski & Rybarczyk, 2006). Watson and colleagues (1995) referred to these indicators as anxious arousal, and in extensive work with both clinical and nonclinical samples of adults from different age-groups, they showed that these symptoms are specific to anxiety (and not to depression). In a similar vein, they found that loss of interest and low positive affect, which are collectively referred to as anhedonic depression, are specific to depression (and not anxiety; Watson et al., 1995). Focusing on these nonoverlapping aspects of anxiety and depression is important to identify specifically through which symptoms partner responsiveness would be linked to different aspects of sleep quality.

## The Present Research

The present study aimed to further extend our conceptual understanding of how partner responsiveness is linked to health and well-being by investigating the role of perceived partner responsiveness in sleep. Importantly, we tested the associations of perceived partner responsiveness with both self-report measures of sleep problems and an objective actigraph-based assessment of sleep efficiency—that is, the ratio of total sleep time to the total time spent in bed. Based on prior theorizing and empirical work on social relationships and sleep (Bordeleau et al., 2012; Cacioppo et al., 2002; Hawkley et al., 2010), we prioritized testing the links between partner responsiveness and sleep quality, although we included sleep duration in analyses as well.

Moreover, we investigated the potential mechanisms by which perceived partner responsiveness was linked to sleep. Specifically, we chose anxiety and depression, given their well-established links to both perceived partner responsiveness (Selcuk et al., 2010; Slatcher et al., 2015) and sleep quality (Alvaro et al., 2013; Koffel & Watson, 2009; Revenson et al., 2016). Given the theoretical function of partner responsiveness in downregulating arousal and anxiety (Selcuk et al., 2010) and prior empirical work documenting that perceived partner responsiveness predicts lower depression and anxiety (e.g., Fekete et al., 2007; Simpson et al., 1992), we expected that perceived partner responsiveness would be meaningfully linked to sleep quality via its associations with those two symptomologies, a hypothesis hitherto unexplored in the relationships and health literatures. Previous research indicated that individuals project their own support provision to their partner, that is, individuals who provide more support to their partner are more likely to perceive their partner as responsive (Lemay, Clark, & Feeney, 2007). Moreover, individuals who perceive their partner as responsive may be more agreeable people in general. Thus, following prior work on partner responsiveness (Slatcher et al., 2015), we controlled for emotional support provision to the partner and agreeableness in the analyses. In addition, our analysis controlled for demographic factors (age, gender, race, and education) and physical health factors (perceived health, health symptoms, and body mass index [BMI]) known to affect sleep quality (Mezick, Wing, & McCaffery, 2014; Ong et al., 2013).

## Method

### Sample and Procedure

The data for the present study came from the National Survey of Midlife Development in the United States II (MIDUS II), a study on health and aging conducted in 2004–2006 ($N = 4{,}963$; age range = 32–84). The MIDUS II survey consisted of a phone interview and a self-administered questionnaire (Ryff et al., 2007). Upon completion of MIDUS II, a subset of respondents ($N = 1{,}255$) participated in the Biomarkers Study (Dienberg Love, Seeman, Weinstein, & Ryff, 2010), which included sleep assessments. Mean time lag between the MIDUS II self-administered questionnaire and the Biomarkers Study was 25 months ($SD = 14$ months). The current sample consisted of 698 married or cohabiting adults (mean age = 57 years, range = 35–86 years) who completed the perceived partner responsiveness measure, all covariates, and at least one of the sleep measures (self-reported global quality or objective sleep efficiency) and reported still being together with their partner over the course of data collection (i.e., between the MIDUS II phone interview and the Biomarkers Study). Of these participants, 50% were female and 50% male; 94% were White and 6% were from other racial backgrounds; 24% graduated from high school or less and 76% had some college education or more. In the final sample, 479 participants completed only the self-reported global sleep quality measure, 16 completed only the objective sleep efficiency measure, and 203 completed both measures. Thus, analyses testing the associations of perceived partner responsiveness with global sleep quality and objective sleep efficiency were based on 682 and 219 adults, respectively. Participants who had data for objective sleep efficiency were slightly younger ($M = 56.22$, $SD = 10.86$ vs. $M = 58.03$, $SD = 11.28$, $p = .048$, $d = .16$, 95% CI [0.02, 3.59]) and scored slightly lower on anxiety ($M = 20.84$, $SD = 4.20$ vs. $M = 21.54$, $SD = 4.41$, $p = .047$, $d = .16$, 95% CI [0.01, 1.40]). The two groups, however, did not differ on other variables of interest including perceived partner responsiveness, global sleep quality, depression, or any of the covariates ($ps > .071$).

### Measures

*Perceived partner responsiveness.* Following prior work (Selcuk, Gunaydin, Ong, & Almeida, 2016; Selcuk & Ong, 2013; Slatcher et al., 2015), perceived partner responsiveness was measured with 3 items in the MIDUS II self-administered questionnaire. Participants indicated the extent to which their partner or spouse cares about them, understands the way they feel about things, and appreciates them (1 = *a lot* to 4 = *not at all*, $\alpha = .82$). Responses were reverse scored, so that higher scores reflected greater partner responsiveness.

*Anxiety and depression symptoms.* Anxiety and depression were assessed in the Biomarker Study using the Anxious Arousal subscale of the Mood and Symptom Questionnaire (MASQ; Watson et al., 1995), measuring specific anxiety symptoms (somatic tension and hyperarousal) that are critical for sleep quality (Stepanski & Rybarczyk, 2006), and the Anhedonic Depression subscale measuring specific depression symptoms (low positive affect and loss of interest). Prior work showed that these subscales are less correlated with each other ($r = .369$, $p < .001$ in the current sample) and show higher discriminant validity compared to other measures of anxiety and depression while maintaining convergent validity, in both clinical and nonclinical samples (Watson et al., 1995). Participants indicated how much they experienced each symptom during the past week (1 = *not at all* to 5 = *extremely*). The Anxious Arousal subscale consisted of 17 items (e.g., "heart was racing or pounding") and the Anhedonic Depression subscale consisted of 22 items (e.g., "felt nothing was very enjoyable"). Anxiety and depression scores were computed by summing across all items for participants who had no missing value (for participants who had a missing value for only 1 item, mean substitution was used for the item), $\alpha = .73$ for anxiety and .93 for depression.

*Sleep outcomes.* All sleep assessments were obtained in the Biomarker Study. Global sleep quality was measured with the widely used Pittsburgh Sleep Quality Index (PSQI; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). The PSQI includes subjective assessments of seven sleep components: sleep quality (overall assessment of sleep quality), sleep latency (time and difficulty to fall asleep at night), sleep duration (hours of sleep gotten at night), habitual sleep efficiency (the ratio of actual sleep to the time spent in bed), sleep disturbance (trouble staying asleep), use of sleeping medication, and daytime dysfunction (trouble staying awake during daytime). Each category receives a score between 0 and 3, with higher scores reflecting worse sleep quality. Although the components measure different aspects of sleep, the PSQI is typically analyzed using a global score, especially given that all components reflect an underlying subjective (dis)satisfaction with sleep (e.g., Grandner et al., 2006). Thus, in line with prior work using the PSQI, a global sleep problems index was computed by summing the seven sleep components for each participant with complete data ($\alpha = .69$; see Online Supplemental Material for supplemental analyses using the component scores separately).

Objective sleep outcomes were measured by collecting actigraphy data. Participants wore a Mini Mitter Actiwatch®-64 activity monitor on their nondominant wrist for 7 consecutive days and nights starting on a Tuesday morning at 7:00 a.m. and ending the next Tuesday morning. Using a built-in sensor, the monitor detects the number of movements made by the wearer. The start and end times of actigraphic records were determined using diary logs in which participants entered their bedtime and risetime. Activity counts within 30-s epochs were used to estimate sleep statistics. Whether participants were asleep or awake was estimated by comparing activity counts in each epoch and the epochs surrounding it to a predetermined threshold value. *Sleep duration* was computed by summing the epochs, in minutes, marked as sleep during a night's interval (the difference between the start and end times logged in the diary). *Sleep efficiency* was computed as the percentage ratio of total sleep time to the total time spent in bed. Sleep efficiency may suffer due to two reasons: difficulty to fall asleep or difficulty to stay asleep. Therefore, sleep onset (a measure of difficulty falling asleep) and wake after sleep onset (a measure of difficulty staying asleep) were also included in the analyses to figure out which aspects of sleep efficiency were linked with partner responsiveness. *Sleep onset* corresponded to the time required, in minutes, for the onset of sleep after attempting to get to sleep. Finally, *wake after sleep onset* corresponded to the total time of awakenings during the night's interval after falling asleep.

## Covariates

*Demographic covariates.* Demographic covariates included age at completion of the Biomarker study, and gender (0 = *male*, 1 = *female*), race (0 = *White*, 1 = *Non-White*), and education (1 = *no school/some grade school* to 12 = *doctoral degree*) assessed at MIDUS II.

*Physical health covariates.* We controlled for three physical health predictors of sleep quality: perceived physical health, health symptoms, and BMI. Perceived physical health was measured in the MIDUS II phone interview via a single item asking participants to evaluate their physical health (1 = *excellent* to 5 = *poor*). Participants also completed a health symptoms checklist (e.g., "ever had heart disease?" "ever had cancer?") in the Biomarker Study. The total number of health symptoms ever experienced was included in the analyses. Finally, the BMI was computed by dividing weight in kilograms by height squared in meters. These measurements were obtained by clinical staff during a physical exam as part of the Biomarker Study.

*Relationship covariates.* Emotional support provision to the partner was measured by a single item asking how many hours per month participants give emotional support to their partner (e.g., comforting, lending a listening ear, giving advice; Rossi, 2001). Given the open-ended nature of the item, there were some outliers with very high values on this variable. Responses higher than 2.5 standard deviations of the mean were recoded to the highest value below 2.5 standard deviations to reduce the influence of the outliers on the results.

Agreeableness was measured by asking participants the extent to which each of five adjectives (helpful, warm, caring, softhearted, sympathetic) described them (1 = *a lot* to 4 = *not at all*; Rossi, 2001). Responses were reverse coded, so that higher scores indicated greater agreeableness ($\alpha = .81$).

# Results

Table 1 provides the correlations among variables of interest. As in prior work (Grandner et al., 2006), the PSQI global score showed weak correlations with the actigraph assessments (all $r$s < .24), suggesting that the two measures tap different aspects of sleep quality. Looking at the specific PSQI components that

**Table 1.** Descriptive Statistics and Correlations Among Variables.

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Partner responsiveness | – | | | | | | | | | | | | | | | |
| 2. Sleep problems (PSQI) | −.144*** | – | | | | | | | | | | | | | | |
| 3. Sleep efficiency (actigraph) | .015 | −.159* | – | | | | | | | | | | | | | |
| 4. WASO (actigraph) | −.118 | .242*** | −.608*** | – | | | | | | | | | | | | |
| 5. Sleep onset (actigraph) | .039 | .089 | −.728*** | .197** | – | | | | | | | | | | | |
| 6. Sleep duration (actigraph) | −.036 | −.068 | .549*** | .032 | −.358*** | – | | | | | | | | | | |
| 7. Anxiety | −.148*** | .359*** | −.186** | .294*** | .053 | −.008 | – | | | | | | | | | |
| 8. Depression | −.212*** | .401*** | −.070 | .054 | .042 | −.042 | .369*** | – | | | | | | | | |
| 9. Agreeableness | .110** | −.005 | .097 | −.026 | −.168* | −.035 | −.071 | −.212*** | – | | | | | | | |
| 10. Provision of emotional support | .142*** | .046 | .092 | −.041 | −.067 | .134* | .002 | −.045 | .106** | – | | | | | | |
| 11. Poor perceived health | −.049 | .256*** | −.195** | .218** | .153* | −.009 | .340*** | .346*** | −.044 | −.039 | – | | | | | |
| 12. Health symptoms | −.001 | .254*** | −.131 | .193** | .175** | .070 | .308*** | .164*** | .076* | .056 | .345*** | – | | | | |
| 13. BMI | −.069 | .062 | −.176** | .114 | .151* | −.147* | .104** | .092* | .014 | .048 | .240*** | .151*** | – | | | |
| 14. Age | .137*** | −.073 | −.138* | .150* | .086 | .002 | .021 | −.172*** | .086* | .069 | .022 | .355*** | .004 | – | | |
| 15. Education | −.028 | −.033 | .011 | −.071 | −.012 | −.077 | −.124*** | −.066 | −.094* | −.110** | −.119** | .006 | −.059 | −.059 | – | |
| 16. Race[a] | −.046 | .015 | .031 | .035 | −.035 | .068 | .038 | .067 | .031 | −.029 | .162*** | −.014 | .080* | −.108** | −.031 | – |
| 17. Gender[b] | −.151*** | .162*** | .313*** | −.126 | −.230*** | .316*** | .096* | .012 | .221*** | .101** | −.034 | .068 | −.100** | −.167*** | −.049 | .014 |
| *M* | 3.592 | 5.640 | 82.975 | 42.522 | 24.001 | 384.913 | 21.321 | 50.534 | 3.420 | 27.546 | 2.280 | 3.930 | 29.092 | 57.460 | 7.830 | – |
| *SD* | 0.538 | 3.357 | 7.887 | 18.391 | 20.921 | 62.514 | 4.356 | 12.338 | 0.496 | 38.758 | 0.909 | 2.807 | 5.565 | 11.174 | 2.449 | – |

*Note.* PSQI = Pittsburgh Sleep Quality Index; WASO = wake after sleep onset; BMI = body mass index. The sample size was 682 for estimates including the PSQI, 219 for estimates including actigraph assessments, and 698 for the remaining estimates.

[a]0 = *White*, 1 = *non-White*. [b]0 = *male*, 1 = *female*.

*$p < .05$. **$p < .01$. ***$p < .001$.

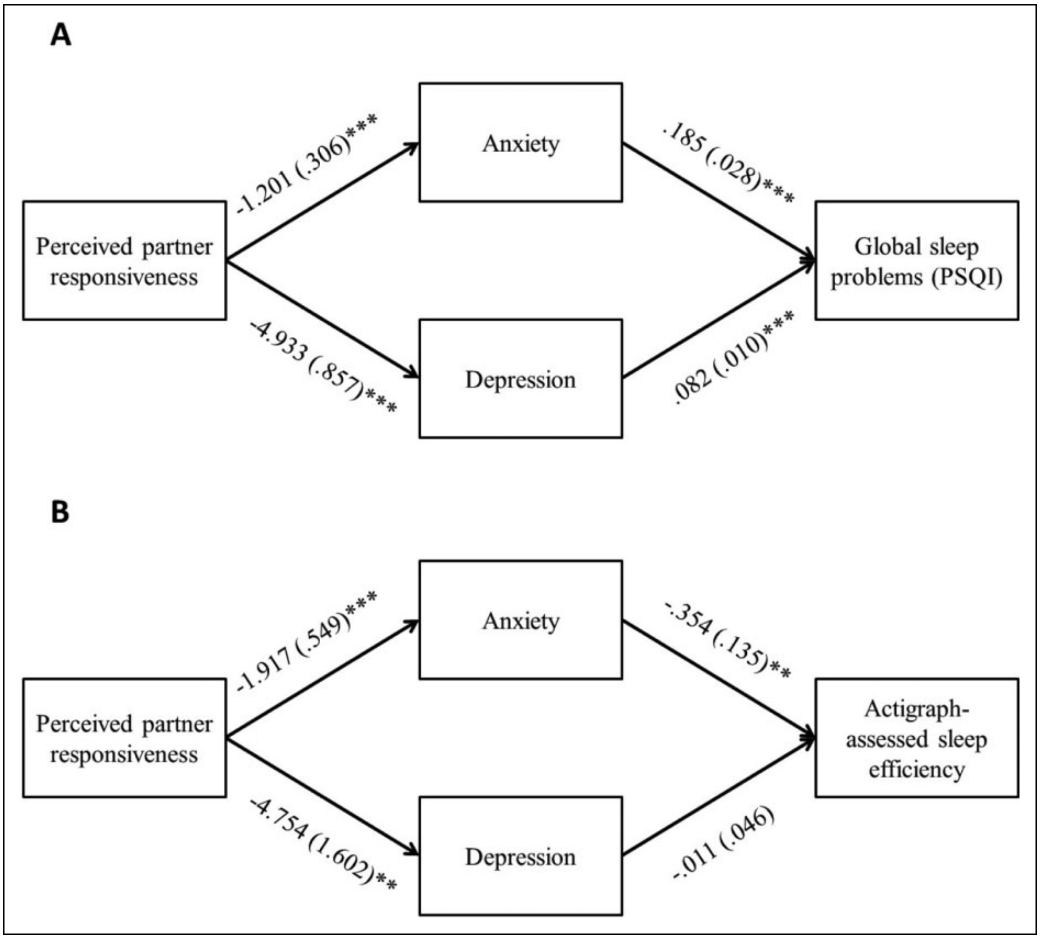


**Figure 1.** The indirect associations of perceived partner responsiveness with global sleep problems (Panel A) and actigraph-assessed sleep efficiency (Panel B) through anxiety and depression. Numbers outside the parentheses are unstandardized regression coefficients and numbers inside the parentheses are standard errors. The sample size was 682 in analyses predicting global sleep problems and 219 in analyses predicting sleep efficiency. PSQI = Pittsburgh Sleep Quality Index. $^{**}p < .01$. $^{***}p < .001$.

map onto the actigraph-based measures, PSQI sleep efficiency was unrelated to the actigraph sleep efficiency ($r = .104$, $p = .140$) and the PSQI sleep duration was moderately related to actigraph sleep duration ($r = .379$, $p < .001$; see Table S1 in Online Supplemental Materials for all pairs of correlations between the actigraphy indices and the PSQI components).

## *Perceived Partner Responsiveness and Self-Reported Sleep Problems*

Participants who perceived their partner as responsive reported lower sleep problems as measured by the global PSQI score ($B = -.901$, $SE = .237$, $p < .001$). Partner responsiveness also indirectly predicted lower global sleep problems through lower anxiety (indirect association [IA] = −.223, 95% CI: [−0.426, −0.081]) and depression (IA = −.406, 95% CI: [−0.620, −0.251]; Figure 1A; see Online Supplemental Materials for complete details on the data analytic approach for testing indirect associations). Once anxiety and depression were included in the model, the direct association between partner responsiveness and self-reported sleep problems was not significant (although the effect size was similar to that of the IA through anxiety, $B = -.272$, $SE = .218$, $p = .213$). The indirect associations between perceived partner responsiveness and global sleep problems held even when the analyses were repeated by controlling for emotional support provision to the partner, agreeableness, demographic factors, and physical health factors (IA = −.129, 95% CI [−0.297, −0.027] for anxiety and IA = −.280, 95% CI [−0.465, −0.143] for depression; see Table S2 in Online Supplemental Materials for all direct and indirect associations between partner responsiveness and the PSQI subcomponents).

## *Perceived Partner Responsiveness and Actigraph-Assessed Sleep Efficiency*

Partner responsiveness was not directly associated with actigraph-assessed sleep efficiency or sleep duration (Table 1). However, partner responsiveness indirectly predicted greater objective sleep efficiency via lower anxiety (IA = .678, 95% CI [0.100, 2.014]) but not depression (IA = .052, 95% CI [−0.398, 0.504]; Figure 1B). Improved sleep efficiency could be due to faster sleep onset or lower wake after sleep onset. Our findings supported the latter possibility. Whereas perceived partner responsiveness indirectly predicted lower wake after sleep onset through lower anxiety (IA = −2.495, 95% CI [−5.650, −0.728]), it was not associated with sleep onset (IA = −.529, 95% CI [−03.052, 0.630]). The indirect associations between perceived partner responsiveness and objective sleep quality through anxiety held, even after adjusting for emotional support provision to the partner, agreeableness, demographic factors, and physical health covariates (IA = .566, 95% CI [0.013, 1.856] for sleep efficiency and IA = −1.796, 95% CI [−4.656, −0.140] for wake after sleep onset). After adjusting for covariates, partner responsiveness was not associated with actigraph-assessed sleep duration through anxiety (IA = 2.195, 95% CI [−.719, 10.389]) or depression (IA = 1.148, 95% CI [−1.113, 5.691]).

## Discussion

These findings are the first to demonstrate how perceived partner responsiveness is linked to subjective and objective sleep quality. Perceived partner responsiveness predicted lower global sleep problems through lower anxiety and depression. Importantly, perceived partner responsiveness was also associated with actigraph-assessed sleep efficiency through lower anxiety (but not depression). These indirect associations remained significant after we statistically controlled for emotional support provision to the partner, agreeableness, and demographic (age, gender, race, and education) and health covariates (perceived health, health symptoms, and BMI) that could have potentially accounted for the findings.

An important strength of the present study was using a combination of subjective (the PSQI) and objective (actigraph) sleep measures. Past work showed that the PSQI, the most widely used subjective sleep quality measure, and actigraph assessments are not substitutes for each other but rather measure distinct aspects of sleep quality (Grandner et al., 2006; Landry, Best, & Liu-Ambrose, 2015). The low correlations between the PSQI and actigraphy assessments (also replicated in the present work) have led researchers to suggest that both measures should be included in sleep studies whenever possible (Landry et al., 2015). Using the two measures in the same study enabled us to document the distinct pathways by which perceived partner responsiveness is associated with sleep.

We found a direct association between partner responsiveness and sleep only for the PSQI but not for the actigraph-assessed sleep quality. Indirect associations were much more pronounced across both subjective and objective sleep measures. The more consistent pattern with indirect (vs. direct) associations is in line with theoretical models explaining how romantic relationships are associated with physical health (Burman & Margolin; 1992; Kiecolt-Glaser & Newton, 2001; Slatcher, 2010; Slatcher & Selcuk, in press). These models suggest that romantic relationship processes are more likely to be linked to physical health through psychological mechanisms (e.g., psychological symptoms, well-being) rather than having a direct effect. The present findings are in line with this theorizing by showing that partner responsiveness is mainly linked to sleep through psychological symptoms—particularly anxious arousal but also anhedonic depression.

Although partner responsiveness predicted better actigraph-assessed sleep efficiency through lower anxiety, there was no such indirect association between partner responsiveness and actigraph-assessed sleep duration. A prior study on parental responsiveness and child sleep reached a similar conclusion, with parental responsiveness predicting parent reports of child sleep quality but not duration, although that study only focused on the direct links (Bordeleau et al., 2012). Taken together with the present findings, it seems that sleep duration is unrelated to responsiveness of partners or caregivers, but individuals with less responsive close others experience more disrupted sleep. This qualitative difference between individuals who have responsive versus unresponsive partners is important, as chronic disruptions—that is, inefficient sleep—predicts important physical health outcomes, including mortality (Dew et al., 2003).

Depression also mediated the partner responsiveness–sleep association but only for subjective sleep problems. This finding replicates prior work on the association between depression and the PSQI and extends a recent finding that depression mediates the association between quality of general social ties and the global PSQI score (Kent, Uchino, Cribbet, Bowen, & Smith, 2015). Given our finding that subjective evaluations of sleep quality do not reflect actual sleep efficiency, depressed individuals may be negatively biased in their perceptions of their psychological and physiological states, which may extend to sleep (Grandner et al., 2006). This is not to say that the PSQI assessments are irrelevant to sleep quality; on the contrary, subjective sleep quality does predict important health and well-being outcomes (Lemola et al., 2013; Martin et al., 2011). Rather, the present findings show the importance of using multiple measures to study the links between close relationships and sleep, as the nature of the associations and the mediating psychological mechanisms may be different across measures.

The present findings also dovetail with and extend past work investigating the role of romantic attachment orientations in sleep quality. Insecure (i.e., anxious or avoidant) attachment, which is thought to result from close others' failure to behave responsively, has been linked to poor self-reported sleep quality and sleep disturbances such as difficulty falling asleep and staying asleep (e.g., Adams & McWilliams, 2015; Carmichael & Reis, 2005; see also Adams, Stoops, & Skomro, 2014, for a review). There was a significant direct association between perceived partner responsiveness and subjective sleep quality in the present sample as well. In addition, the present study extended and complemented prior findings by documenting psychological mechanisms through which partner responsiveness is linked to both self-reported sleep problems and objectively assessed sleep efficiency.

Recent studies have shown that perceived partner responsiveness has relevance for health outcomes including all-cause mortality (Selcuk & Ong, 2013). There is increasing evidence that partner responsiveness predicts potential mechanisms, including affective reactivity to stressors, trait negative affect, depression, psychological well-being, and diurnal cortisol (Fekete et al., 2007; Selcuk et al., 2016; Selcuk, Zayas, Gunaydin, Hazan, & Kross, 2012; Slatcher et al., 2015), that may ultimately affect adult morbidity and mortality. By showing that perceived partner responsiveness predicts self-reported sleep problems through lower anxiety and depression, and objective sleep efficiency through lower anxiety, the present study extends the set of processes by which perceived partner responsiveness potentially affects physical health.

The findings also have implications for therapy and intervention design. The inherently interdependent nature of adult romantic relationships means that romantic partners, as well as perceptions of one's romantic partner, play a meaningful role in promoting better health and well-being. Our findings suggest that enhancing perceived partner responsiveness has the potential to increase the effectiveness of interventions designed to reduce sleep disturbances in particular and improve individual well-being in general.

Before concluding, we acknowledge some limitations of the present research. These data are correlational, meaning that we are unable to make claims about the causal direction of the associations between partner responsiveness, anxiety and depression, and sleep. For example, it is possible that partner responsiveness may be linked to anxiety, depression, and sleep simultaneously, or poor sleep could have affected scores on the MASQ as well as individuals' perceptions of their partner's responsiveness. The existing literature, however, makes a stronger theoretical case for individuals who experience higher partner responsiveness to have better sleep outcomes, rather than the other way around (cf. Carmichael & Reis, 2005; Selcuk et al., 2015; Troxel, Buysse, Hall, & Matthews, 2009). Moreover, the fact that partner responsiveness was assessed on average 25 months before both the mediating and outcome variables supports this possibility, although we should note that we were not able to model change in sleep behavior. Related to this point, it may be possible to observe stronger associations between partner responsiveness and sleep in a design with a smaller time interval between the measurements. For instance, future daily experience studies may investigate whether daily perceptions of responsiveness predicts sleep, especially on days participants experience stressors and exhibit greater anxiety.

A second limitation of the current study involves the diversity of the sample. The MIDUS sample is not racially diverse, limiting our ability to generalize our findings to non-White individuals. Furthermore, although the PSQI was administered at three different study sites (University of California Los Angeles, University of Wisconsin, and Georgetown University), the subset of participants who provided actigraph data of sleep quality completed the study at only one site (University of Wisconsin). Finally, participants were in their middle and late adulthood, leaving the question of whether the results would look similar for younger individuals open for future research. Regardless, the emergence of the partner responsiveness–sleep link through lower anxiety in analyses that included potentially meaningful covariates bolsters our confidence in the findings. Future studies would benefit from replicating these findings in a more heterogeneous sample.

In sum, the present study demonstrated the role of perceived partner responsiveness in subjective and objective assessments of sleep quality through lower anxiety and depression. Future research should further elucidate the mechanisms by which higher partner responsiveness exerts a salutary influence on health and well-being.

## Declaration of Conflicting Interests

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## Supplemental Material

The online data supplements are available at http://journals.sagepub.com/doi/suppl/10.1177/1948550616662128.

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