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Does Sleep Disturbance Among Parents of Infants
Predict Increased Depressive Symptoms?

Zachary Joseph Blackhurst

A thesis submitted to the faculty of
Brigham Young University
in partial fulfillment of the requirements for the degree of
Master of Science

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ABSTRACT

Does Sleep Disturbance Among Parents of Infants Predict Increased Depressive Symptoms?

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Research has shown that sleep disturbance (e.g., sleep latency, wakefulness after sleep onset [WASO]) negatively affects physical, emotional, and mental health. For many adults, the postpartum period is one that is particularly highlighted by sleep disturbance and fatigue. Postpartum mothers are also more vulnerable to psychiatric disorders such as depression. We sought to investigate whether the number of children and presence of an infant predicted clinically significant sleep disturbance, and subsequently, depressive symptoms, for both mothers and fathers. We found that having an infant was significantly associated with increased wife WASO, which in turn was associated with increased depressive symptoms for wives. Further, husband WASO was associated with decreased wife WASO which was similarly associated with decreased depressive symptoms for wives. Thus, by helping with nighttime care so that mothers can get more sleep fathers can greatly contribute to the physical and emotional health of mothers.

Keywords: sleep disturbance, parents, infants, depressive symptoms

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Does Sleep Disturbance Among Parents of Infants Predict Increased Depressive Symptoms?

The quantity and quality of sleep an individual gets can greatly impact virtually all aspects of life. Research has shown that poor sleep negatively affects physical, emotional, and mental health (Insana, Costello & Montgomery-Downs, 2011). Poor sleep can also compromise occupational pursuits and social functioning (Edinger et al., 2001), and is related to interpersonal and relationship satisfaction and functioning (Gordon & Chen, 2013; Gunn, Troxel, Hall, & Buysse, 2014; Troxel, Robles, Hall, & Buysse, 2007; Troxel, Buysse, Hall, & Matthews, 2009). Said concisely, chronic poor sleep is associated with diminished quality of life (Troxel, 2010).

These implications become particularly important when we consider the primary social context for most adults: marriage (Troxel, Robles, Hall, & Buysse, 2007). Though sleep is often thought about as an individual activity, most married adults do not sleep alone and therefore the quality of an individual's sleep impacts and is impacted by their bed partner. However, research is only beginning to investigate the dyadic nature of sleep and sleep disturbance, and their implications.

Sleep disturbance can take many forms and can occur at different points in the sleep cycle. Individuals may have a difficult time initiating sleep (sleep latency) or maintaining sleep (wakefulness after sleep onset; WASO). Others may find themselves waking early in the morning and struggling to fall back asleep. Still others may experience a combination of these sleep disturbances. If the sleep disturbance is persistent and causes significant distress or impairment it is considered to be insomnia (see Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition). Considering that 15-35% of adults experience frequent sleep disturbance, this is a relatively common phenomenon that can have significant personal, interpersonal, and societal implications (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989).

For many adults, the months following the birth of a child is a period that is particularly highlighted by sleep disturbance and fatigue; attending to an infant's needs day and night comes at the cost of parental sleep (Hunter, Rychnovsky, & Yount, 2009; Dørheim, Bjortvan, & Eberhard-Gran, 2014). There is some evidence that fathers experience postpartum sleep disturbance and fatigue (Montgomery-Downs, Stremmler, & Insana, 2013), though sleep disturbance and fatigue is especially present for mothers as they are more likely than fathers to be waking and caring for children during the night (Venn, Arber, Meadows, & Hislop, 2008).

Some research suggests mothers, especially experienced mothers, can adjust their sleep patterns to more quickly return to deep, restorative stages of sleep after being awakened (Lee, Zaffke, & McEnany, 2000). Still, evidence suggests that both new and experienced mothers experience significant sleep disturbance and fatigue postpartum (Lee, Zaffke, & McEnany, 2000). In fact, Lee (2000) and colleagues found that while all mothers showed improvement in their sleep three months postpartum, new mothers did not return to their prepregnancy baseline sleep quality, but rather more closely resembled baseline sleep quality for experienced mothers. Considering that 20-30% of young children experience sleep problems (Mindell, Kuhn, Lewin, Meltzer, & Sadeh, 2006), there may be residual effects to sleep quality for many mothers well beyond the initial postpartum months. However, the vast majority of studies have been conducted within the first six months postpartum. Among its meaningful contributions to the current literature, the present study extends the investigative period to 18 months postpartum to explore the potential effects older infants may have on sleep disturbance.

Further, some research has shown that experienced mothers have lower sleep efficiency than new mothers during pregnancy (Lee, Zaffke, & McEnany, 2000). This could be indicative of an additional challenge experienced mothers have of being responsible for nighttime care of

multiple children which may have an additive effect on the mothers' sleep disturbance. Multiple children could similarly have an effect on fathers, as well. The present study investigates the presence of such an effect on parental sleep, which, to our knowledge, has not previously been researched.

Postpartum adults are also more vulnerable to psychiatric disorders such as anxiety and depression (Ross, Murray, & Steiner, 2005). Indeed, as many as 85% of postpartum women experience negative mood or the "baby blues" in the first week following delivery, and 10-15% of mothers experience a major depressive episode during the postpartum period, commonly recognized as postpartum depression (Ross, Murray, & Steiner, 2005). In recent years it has been hypothesized that sleep disturbance may be a contributing cause of postpartum depression (Ross, Murray, & Steiner, 2005; Park, Meltzer-Brody, & Stickgold, 2013). Our study will provide support to this hypothesis by testing sleep disturbance as a mediating variable on depressive symptoms in parents of infants.

Hypothesis 1: Given that even experienced mothers suffer from sleep disturbance, we predicted that having multiple children would have an additive effect; that is, the number of children would be associated with sleep disturbance.

Hypothesis 2: We predicted that having a child 18 months old or younger would be associated with sleep disturbance.

Hypothesis 3: We hypothesized that these sleep disturbances would in turn be associated with increased depressive symptoms.

We investigated this model for both mothers and fathers.

Method

Participants

Participants for the present study were recruited to take part in a larger marital intervention study that focused on cardiovascular outcomes. Distressed couples seeking marital therapy were recruited from a community mental health clinic, and a comparison group of well-adjusted couples were recruited using a multi-method approach (e.g., flyers, newspaper advertisements, internet, referral, etc.). Participants were excluded if they were taking medications that influence blood pressure, were pregnant, or could have become pregnant during the study (i.e., not preventing pregnancy). The final sample consisted of 216 participants (108 couples), of which 96 participants (48 couples) were actively seeking therapy. The participants ranged in age from 19 to 72 years old, with an average age of 28.86 ($SD = 9.20$), and an ethnicity breakdown as follows: 82% White (Caucasian), 7% Hispanic, 4.5% “Other,” 1.5% African American, 1.5% Native American, 1.5% “Mixed,” 1% Asian, and 1% did not disclose their ethnicity. The number of children ranged from 0 to 10 children, with 42 participants having an infant (18 months old or younger). Distressed couples were offered marital therapy at no charge and all couples received monetary compensation for completing the study. The project received IRB approval by the Human Subjects committee at Brigham Young University.

Procedure

After ensuring participants met inclusion criteria via phone prescreening and obtaining informed consent, all participants completed questionnaires assessing general demographics (i.e., age, ethnicity, income, years married, number of children), physical health (i.e., health history, sleep), mental health (i.e., depressive symptoms, general stress) and psychosocial measures (i.e., marital adjustment, social support). Participants were also weighed and measured to assess body

mass index (BMI) and waist circumference. These procedures were repeated 12-weeks later.

During the 12-week period, distressed couples seeking therapy received either standard couple's therapy or emotion focused therapy (EFT). Randomized trials have demonstrated that EFT is effective in increasing marital quality compared to wait-list controls over an 8-week period; therefore, participants were required to complete a minimum of 8 sessions within the 12-week period (Denton, Burleson, Clark, Rodriguez, & Hobbs, 2000). No significant differences in marital quality were found between the treatment types and therefore the data from the groups was combined. The well-adjusted group did not receive any treatment.

Measures

Sleep disturbance. Items were drawn from the Pittsburgh Sleep Quality Index (PSQI; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989) for use during the parent study. Items selected for the current study were used to assess subjective sleep quality (4-point scale ranging from *Very Good* to *Very Bad*), sleep latency ("*On an average night during the past month, how long has it usually taken you to fall asleep after you laid down to go to sleep?*"), and wakefulness after sleep onset (WASO; "*On an average night during the past month, how many minutes of sleep did you lose because you woke up in the middle of the night?*"). These items were used to generate clinically meaningful indicators of insomnia, corresponding to well-established diagnostic criteria (see Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition) by dichotomizing the responses to reflect the presence of persistent, clinically significant symptomology.

Although the full measure has good psychometric properties (internal consistency of 0.83; test-retest reliability of 0.85; sensitivity of 89.6%, specificity of 86.5%; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989) the reliability and validity for the individual items are

unknown. However, this likely does not pose a problem to the purposes of the present study as these items are used to acquire data on simple and specific behaviors and are not being used to evaluate latent constructs. Additionally, examining different facets of sleep, rather than using insomnia as an omnibus measure, better suits the purposes of this study; children, especially infants, are more likely to lead to problems with WASO and subjective sleep quality than with sleep latency.

Depressive symptoms. The Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977) was used to assess depressive symptoms. The CES-D is comprised of 20 clinically derived items that make up 9 symptom groups (i.e., sadness, loss of interest, appetite, sleep, thinking/concentrating, guilt, tiredness, movement, and suicidal ideation) and has been established as a reliable and valid measure of depression ($\alpha = 0.85 - 0.91$; ICC = 0.87; $r = 0.27 - 0.75$ for the SF-36; $r = 0.69 - 0.75$ for the SCL 90; Radloff, 1977; Miller, Anton, & Townson, 2008). To avoid non-independence issues with the sleep measure, the sleep item was removed from the CES-D, a common practice in the literature (see Roane, Seifer, Sharkey, Van Reen, Bond, Raffray, & Carskadon, 2013).

Analytic Strategy

We used the Actor-Partner Interdependence Model (APIM) to examine the influence of children on clinically significant sleep problems and depressive symptoms (see Figure 1). The APIM allows us to account for the non-independence of couple data while at the same time modeling the characteristically dynamic and interdependent features of couple relationships. For example, we can account for the longitudinal stability of the wife's depressive symptoms (actor effect) while modeling the effects of the husband's insomnia on the wife's depressive symptoms (partner effect). Specifically, we examined the influence of number of children and presence of

an infant (a dummy variable where having a child 18 months old or younger = 1) on clinically significant ratings of sleep quality, sleep latency, and clinically significant wakefulness after sleep onset (WASO) while controlling the receipt of marital therapy and the longitudinal stability of sleep and depressive symptoms. However, because we used Generalized Structural Equation Modeling (GSEM) for binary outcomes, we cannot report model fit statistics.

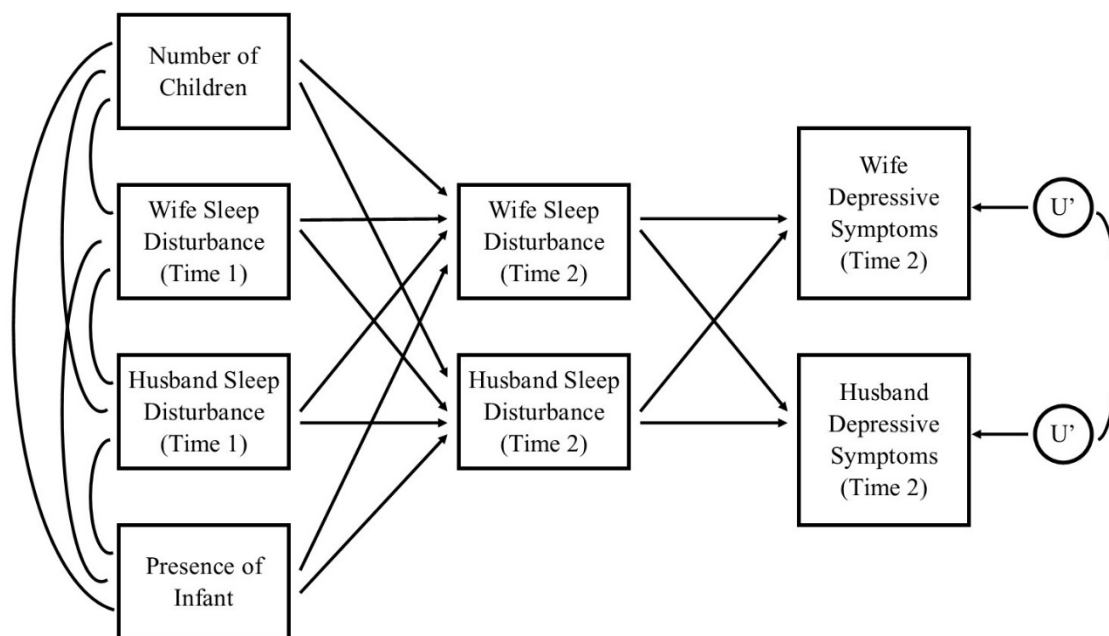


Figure 1. The Actor-Partner Interdependence Model (APIM) used to examine the influence of children on clinically significant sleep problems and depressive symptoms. Though included in the analyses, wife and husband depressive symptoms at time 1 are not depicted in the figure.

Using G*Power 3.1.9.2 (Faul, Erdfelder, Lang, & Buchner, 2007) we estimate that we have sufficient power to detect an effect that children may have on sleep outcomes, and consequently on depressive symptoms. A recent review of the relationship between postpartum

sleep disturbance and depression found effect sizes that ranged from 0.4 to 1.7, with the majority of them being large or very large effect sizes (Bhati & Richards, 2015). Insana and Montgomery-Downs (2012) also found large effect sizes (0.80 – 0.92) when evaluating sleep in postpartum parents (i.e., mothers and fathers). To achieve power of 0.95 with a conservative effect size of 0.40, a total sample size of 29 is recommended. Because we are interested in whether the number of children produces an additive effect on sleep outcomes, we are able to utilize the full sample of 216 participants, including those who do not have children ($n = 124$). Similarly, because we are interested in whether the presence of an infant has an effect on sleep outcomes, we are able to utilize the full sample, including those who do not have an infant ($n = 174$), as comparison.

Results

We first examined the outcome subjective sleep quality. Actor paths were significant for husbands and wives, meaning that subjective sleep quality at time 1 significantly predicted subjective sleep quality at time 2 for husbands and wives respectively, but no other variables significantly predicted clinically significant ratings of poor subjective sleep quality. The parent study included a marital intervention, therefore we controlled for the receipt of marital therapy in this and subsequent analyses and found no significant effect.

Next, we examined the outcome sleep latency. Actor paths were significant for both husbands and wives, but no other variables significantly predicted clinically significant ratings of sleep latency.

Finally, we examined WASO and found that actor paths were significant for both husbands and wives. There was a significant partner effect of earlier husband WASO on later wife WASO ($OR = 0.08$, 95% $CI [0.01, 0.62]$); this corresponds with .08 odds (a 92% reduction)

of reporting clinically significant WASO if husband reports earlier WASO. Having an infant was significantly associated with increased wife WASO ($OR = 8.24$, $95\% CI [1.29, 52.60]$); this corresponds with an 8.24 increase in odds. This increase in WASO, in turn, was associated with increased depressive symptoms for wives ($B = 2.65$, $95\% CI [0.17, 5.12]$).

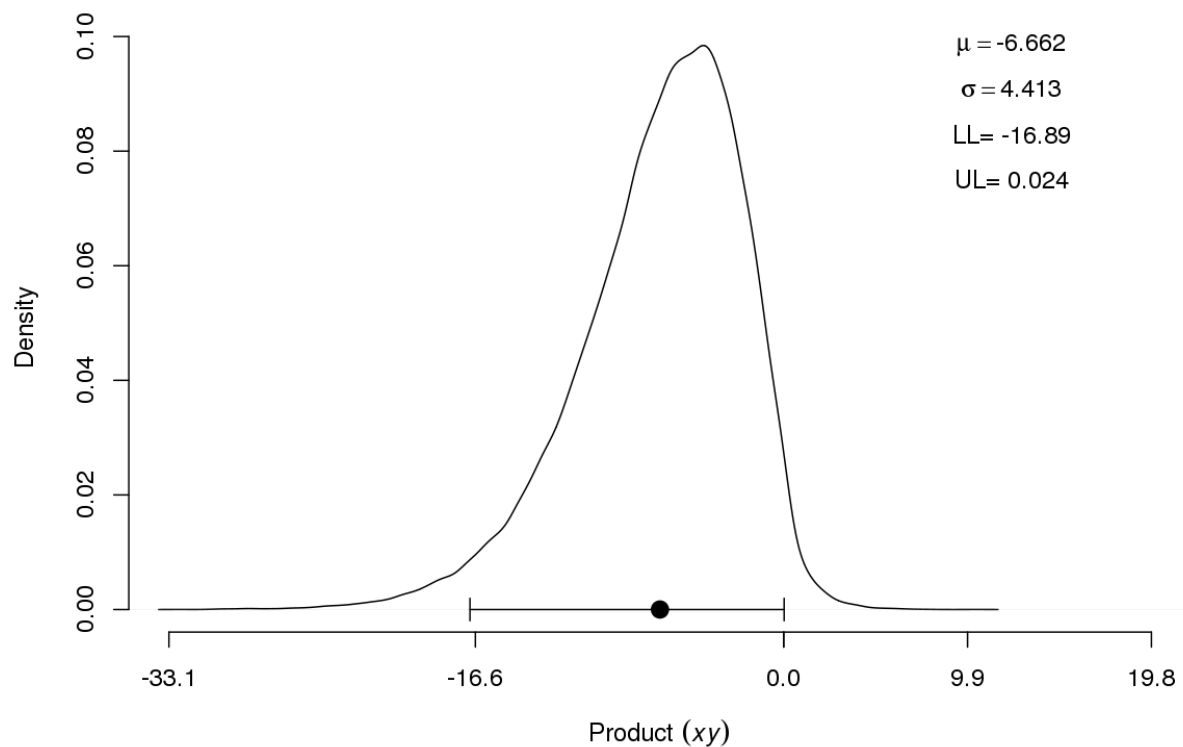


Figure 2. Density plot and confidence interval for indirect effect of husband WASO on wife depressive symptoms via decreases in wife WASO.

To more fully explore the dyadic nature of these data, we examined whether the husband partner effect influenced later wife depressive symptoms by decreasing her WASO and found that husband WASO was associated with decreased depressive symptoms for wives via less wife WASO (indirect effect $B = -6.66$, $95\% CI [-16.89, 0.02]$). Although the confidence interval was

quite wide and the upper bound of the indirect effect just included zero, the majority of plausible estimates provide evidence of an indirect effect (see Figure 2).

Discussion

These results support the well-documented claim that sleep is vitally important for our general well-being and daily functioning. They also demonstrate the importance of sleep for postpartum parents, especially mothers, who are generally sleep-deprived and at increased risk for depression. Although this study does not allow for causal claims, it provides support to the theory that sleep disturbance is a contributing factor in the development of postpartum depression by extending our understanding of the association between sleep and depressive symptoms. Specifically, mothers who reported less disturbed sleep also reported significantly fewer depressive symptoms. Additionally, we observed that the presence of an infant resulted in significant sleep disturbance for mothers. However, the number of children did not have a significant impact on parental sleep outcomes, contrary to our hypothesis. We also noted an interesting lack of significant results for the husbands in our sample – the presence of an infant was not significantly associated with sleep outcomes for husbands, nor was sleep disturbance associated with depressive symptoms.

The findings of this study also illustrate the importance of studying sleep using a dyadic approach so we can capture interdependent, dyadic effects such as how fathers can decrease mothers' depression symptoms by getting up to take care of the baby so the mother can sleep. This is a very interesting finding, and one that has a lot of potential to make clinically significant improvements in the physical and emotional well-being of parents, especially mothers. For example, the indirect reduction of depressive symptoms (i.e., 6.66 point reduction on the CES-D) in wives who had better sleep in association with greater sleep disturbance for husbands was

comparable to or even greater than reductions observed in several health or lifestyle-related interventions, which ranged from 1.62 to 5.1 point reductions on the CES-D (German, Sutcliffe, Siriron, Sherman, Larkin, Aramrattana, & Celentano, 2012; Kerr, Patrick, Norman, Stein, Calfas, Zabinski, & Robinson, 2008; Kieffer, Caldwell, Welmerink, Welch, Sinco, & Guzman, 2013; Tandon, Latimore, Clay, Mitchell, Tucker, & Sonenstein, 2015). Although addressing sleep problems in mothers can have a positive impact on their emotional and psychological health, these results also demonstrate the significant influence fathers can have in aiding or facilitating positive change for mothers, an effect that to date has not received much attention.

In a similar vein, the decreased depressive symptoms for mothers who had less disturbed sleep reveals potential benefits for implementing postpartum sleep interventions. Researchers have begun developing and implementing such interventions, but with mixed results (Bhati, 2015; Stremmer, Hodnett, Kenton, Lee, Weiss, Weston, & Willan, 2013). However, to our knowledge no postpartum intervention has been developed that targets both mothers and fathers in a dyadic approach. An intervention of this nature could be of particular benefit when considering the influence that postpartum parents have on each other's sleeping patterns and mental health. By receiving psychoeducation and sleep hygiene techniques specifically targeted towards postpartum mothers and fathers, they could acquire greater knowledge and more tools to use to improve the quality and quantity of their sleep, as well as their general health and well-being.

Limitations

Not knowing the reliability of using select items from the PSQI may threaten the validity of our statistical conclusions. Additionally, the validity of our constructs may be weakened by using only a single measure for both sleep disturbance and depressive symptoms, both of which

are self-report. Given the longitudinal nature of the study, there is the possibility that the participants had experiences beyond the control of the study that influenced their results between testing. The observed effects may also be a result of statistical regression. However, any differences that may have existed among participants as a result of receiving marital therapy (or not) are accounted for in our model.

Although the present study makes no attempt to establish causality, there are certain limitations to the extent we can attribute the results to our independent variables. For example, other factors besides sleep disturbance or the presence of an infant may reasonably have influenced depressive symptoms in mothers which were not taken into account, including stress, relationship satisfaction, and hormonal changes. Therefore, further research should be conducted to tease apart the nuances associated with sleep and postpartum depression. This could be done in part by utilizing a variety of full measures, including objective measures, administered to a larger, more specific population (i.e., postpartum couples). Additionally, the role husbands *with infants* play in improving wives' sleep quality and mood could be more definitively established by analyzing interactions among those variables. However, the present study was under powered to perform analyses with the required number of covariates.

Despite its limitations, the present study makes a considerable contribution to the existing literature by exploring the effects of older infants, and multiple children, on sleep disturbance and depressive symptoms in parents. More interesting yet, our research further demonstrates the importance of investigating the dyadic nature of sleep. Much research has been conducted to better understand the intricacies of postpartum problems, including sleep disturbance and depression, in mothers. However, far too little research has explored how fathers may be affected physically and emotionally by their infants, how fathers and mothers may be influencing the

health of one another, and how clinicians can intervene to help improve their quality of life.

There is an exciting amount of uncharted territory left to explore.

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