

The Moderation of Raising One's Grandchildren on the Relation Between Sleep and Depressive Symptoms

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Background: Recent evidence has shown that poor quality sleep is associated with depression, particularly among older individuals. Moreover, given that grandparent caregivers are more likely to report being depressed, it is crucial to identify whether poor sleep quality results in more depressive symptoms when older individuals are also caring for their grandchildren. Thus, the current study examined how caregiving status was associated with the relation between sleep quality and depressive symptoms and the further moderation of gender (ie, 3-way interaction).

Participants: The sample (N = 459, Mean age = 62.43, 58.40% female) was a subset of individuals recruited in the second wave of the MIDUS project completed in 2009.

Methods: Participants answered the Center for Epidemiological Studies Depression Scale (CESD), the Pittsburgh Sleep Quality Index (PSQI), and a question regarding grandparent caregiving status. Moderation analyses were conducted using AMOS 26.0.

Results: The interaction between global sleep quality and grandparent caregiving status was significant in predicting depressive symptoms, and the interactions examining global sleep quality, subjective sleep quality, sleep latency, sleep duration, sleep efficacy, sleep medication, and daytime dysfunction were significant for males when examined separately, whereby increased sleep difficulties were associated with more depressive symptoms. In all sleep domains, the slope of the interactions was sharper for grandparent caregivers, particularly for males.

Conclusion: Significant differences between interactions for males and females indicated 3-way interactions, such that interactions were significant for males and not females. Therefore, the relation of sleep on depressive symptoms was dependent on grandparent caregivers' status and gender.

Keywords: caregiving grandparents, depressive symptoms, sleep quality

Due to unfortunate circumstances such as imprisonment, addiction, and death, the rate of grandparents caring for their grandchildren is extremely common in the United States. According to the most recent census, over two million grandparents are currently living with and helping to raise nearly five million grandchildren in the United States.¹ Thus, this group is a substantial part of the population. Additionally, this group is at risk for an increased likelihood of mental and physical health problems such as depression and poor sleep quality due to the increased stress and burden of taking care of their grandchildren, often with limited resources.²

However, the risk of mental and health problems and low resources also is a common circumstance shared among older adults in general.³ Indeed, previous

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literature has indicated a strong association between depression and insomnia, particularly among older adults, linking mental and physical health.³ Therefore, it is critical to determine if being a grandparent caregiver results in a stronger correlation between depression and various sleep issues, over and above the association with age. The current study sought to determine if grandparent caregiver status moderated the connection between sleep quality and depressive symptoms in older adults. Moreover, it was investigated whether gender would further moderate this relation.

Older Adults' Sleep and Depressive Symptoms

Generally, studies have shown a strong connection between depression and poor sleep quality. For example, Baglioni et al⁴ found the odds ratio of insomnia predicting depression when examining longitudinal studies was 2.60. Both of these problems increase the likelihood of other psychological issues, medical problems, lower quality of life, and even death.⁵ Although sleep problems are commonly thought of as a symptom of depression, several studies have shown that sleep difficulties are more likely to precede depression than come subsequent to it.^{4,6,7} For instance, Ohayon and Roth examined this relation in a large multi-national study, finding that in most cases, insomnia began before (>40%) or at the same time (>22%) than the mood disorder.⁷ Further, research has extended these findings to older adults as well,^{8,9} suggesting that insomnia is more than merely a symptom of mood disorders, instead, it is a risk factor for their development across the lifespan.

Depression and sleep issues are particularly a problem for older adults.^{3,10} Bao et al¹¹ conducted a meta-analysis and systematic review examining the connection between sleep disturbances and depression among older adults. They found that sleep disturbances increased the relative risk of having depression by 1.92. Similarly, older individuals with depression had a relative risk of 1.72 for having poor sleep quality. Maglione et al¹² found that worse sleep quality and higher sleep latency was related to worsening depression symptoms among older women.

Moreover, research has indicated that difficulty paying bills or low SES was related to worse sleep quality (eg, insomnia) and depression.^{13,14} Thus, a better understanding of which factors influence sleep and depression among older adults is needed. Grandparent caregivers, who tend

to experience an increased level of stress, are a group that may be at particular risk for suffering from depression and poor sleep quality.¹⁵ Indeed, research has indicated that mothers of adolescents (but not fathers) reported an association between insomnia and depressive symptoms, suggesting that parents experience these difficulties.¹⁶

Biological Mechanisms

Circadian rhythms, the body's natural response to light and darkness, and homeostatic/recovery drive, often measured through slow-wave activity (SWA), work together to promote sleep onset and maintenance. When examining the connection between sleep and depression using physiological measures, research has indicated that depressed individuals often experience a disruption in both their circadian and homeostatic drives.¹⁷ For example, they may experience impaired sleep continuity in the form of increased wakefulness and reduced sleep efficiency.¹⁸ This phenomenon may occur due to hyperarousal, which increases the time it takes to fall asleep, and which researchers have argued can be viewed as an alteration in SWA and a decreased pressure to sleep.¹⁷ While this hypothesis has not been tested, antidepressant medication does regulate SWA.¹⁹ Moreover, SWA may be decreased in individuals with increased sleep latency due to decreased regional cerebral blood flow in the orbitofrontal and anterior cingulate cortex, a phenomenon also observed in people experiencing depression.²⁰

Similarly, rapid eye movement (REM) sleep is also impaired as studies have found it is shortened but that the number of eye movements is increased, indicating disruptions in circadian rhythms.¹⁸ Some research even has linked disturbances in circadian rhythm to genetic differences, and some of these genes have been connected to psychological disorders, such as bipolar disorder.²¹ Others have argued that a decrease in neurotransmitters, such as serotonin, is related to circadian rhythm disruptions in depression and insomnia.²²

The difficulties disentangling the biological mechanisms behind sleep difficulties (eg, insomnia) and depression are made more challenging due to the bidirectional nature of the disorders. Indeed, research indicates that the relation between sleep and depression is bi-directional, in that people with sleep difficulties are more likely to become depressed, and people with depression often sleep too much or too little.⁵ Moreover, inadequate sleep or increased depression can make it more challenging to engage in positive coping strategies, which may reduce

sleep quality (eg, insomnia) and increase depression.¹⁵ Given that similar biological differences are seen in people with depression and sleep difficulties (eg, insomnia), such as decreased regional cerebral blood flow in the orbito-frontal and anterior cingulate cortex, it is challenging to determine directionality.²⁰

Grandparent Caregiving and Depression

Being a grandparent caregiver can provide positive rewards such as a purpose for living, feelings of appreciation, hope, and the joy of helping loved ones.²³ However, this caregiving position also comes with a great deal of stress, adverse health effects, and increased psychological problems.²⁴ Research also has indicated that grandmother caregivers reported more depressive symptoms than non-caregiving grandmothers living with their children and grandchildren or non-caregiving grandmothers who do not co-reside.¹⁵ Indeed, many grandparent caregivers neglect their own health needs, have limited resources, and may have difficulty paying their bills.²⁵ It is, therefore, not surprising that grandparent caregivers are at increased risk for depression. Unfortunately, no known studies have yet examined poor sleep quality among grandparent caregivers. However, given the high prevalence of sleep complaints among older adults and links to stress as a risk factor, it is likely that poor sleep quality occurs in this population and may be particularly troublesome.

Stress-Process Model

According to the stress-process model of Pearlin et al,²⁶ four domains must be considered when investigating caregiving: background of the stress, primary and secondary stressors, variables which might mitigate or worsen stress, and the caregiver's outcomes. Regarding the history and context of the stress, grandparent caregivers are likely to experience stress due to increased age, lower education, and lower socioeconomic status than their peers, all of which may increase their burdens.²⁷ The primary stressor is the situation which led to them becoming grandparent caregivers, with the secondary stressor being the act of taking care of their grandchildren. In the current study, the stressor of various sleep issues complicates life. It is likely to be worse for individuals dealing with caregiving as well, resulting in the outcome increased depression. Additionally, gender is expected to play an important role due to how males and females deal with stress and family differently.²⁸

Gender

Generally, research has indicated that women are more likely to report depressive symptoms, but previous literature examining gender differences in individuals who experience poor sleep quality (eg, insomnia) is mixed.^{29,30} Indeed, some studies indicate that women are more likely to report insomnia,³¹ where others suggest no gender differences in either objective or subjective sleep measures.³² Another study found that women have better sleep quality, longer sleep time, shorter sleep latency, and higher sleep efficiency, but yet report more sleep-related complaints.³⁰

Moreover, a study found that gender moderated the relation between sleep quality and negative affect, such that adolescent girls and adolescents who were higher in depressive symptoms had a stronger connection between poor sleep quality and negative affect than boys and participants low in depressive symptoms.³³ However, gender did not moderate the relation between sleep disturbance and negative affect. Thus, gender likely plays a vital role in the connection between depression and sleep difficulties, but little to no research of this kind has been conducted within older adults or grandparent caregivers.

Although grandmothers are far more likely to take on the responsibility of grandparent caregiving than grandfathers, studies have shown that grandfathers do take responsibility for their grandchildren and that their experiences differ from grandmothers.³⁴⁻³⁷ Using a sample of custodial grandmothers and grandfathers, researchers found that custodial grandmothers reported more depression than grandfathers, but no difference on caregiving mastery, suggesting that caregiving has a differential impact upon grandmothers and grandfathers.³⁵ More generally, studies have indicated that when women are caregivers, they report more stress, depression, and hardship than male caregivers.³⁸ Moreover, grandmother caregivers are more likely to be unmarried, older, and have more financial difficulties.²⁷ Unfortunately, scant evidence has examined grandfather caregivers, and none have looked at how the connection between sleep and depression might differ for grandfather caregivers and grandmother caregivers.

Current Study

Thus, research has indicated a strong connection between poor sleep quality and depression, particularly for older adults.¹¹ Given the added stress that grandparent caregivers experience, it is likely that this connection would be even stronger in this population.²⁴ Finally, grandmother caregivers have been

shown to experience more stress as a result of their added caregiving responsibilities (eg, being responsible for their grandchildren, children, partner, etc.), and they are likely to be more influenced by poor sleep quality and depression than non-caregiving grandparents.³⁵ Based on previous literature, the following hypotheses were made: 1) poorer sleep quality would be associated with higher depressive symptoms 2) grandparent caregiving status would moderate the relation between poor sleep quality and depressive symptoms, such that grandparent caregivers would have a stronger connection between sleep quality and depressive symptoms, and 3) gender would further moderate this relation, resulting in a 3-way interaction, such that the relation would be stronger for females.

Method

Participants

Data for the current study came from the Midlife in the United States (MIDUS) study and is freely available online. MIDUS data collection was reviewed and was originally approved by the Education and Social/Behavioral Sciences and the Health Sciences IRBs at the University of Wisconsin-Madison. The current archival investigation is exempt from IRB approval since it is a secondary analysis of de-identified data. The surveys were administered over the phone and self-administered questionnaire. A subset of individuals ($N = 466$) recruited in the second wave of the MIDUS biomarkers project completed in 2009 answered the sleep, grandparent caregiving, and depressive symptoms variables of interest.

Regarding grandparent caregiving status, 14.2% reported they were grandparent caregivers ($N = 66$). Of those who reported being grandparent caregivers, the mean number of years they were responsible for their grandchildren was 4.60 ($SD = 4.05$), with the majority of them reporting one year (24.2%), two years (22.7%), and four years (10.6%). Of these, 7 participants were removed because they reported having cared for their grandchildren for less than a year. Thus, the final sample ($N = 459$) consisted of 59 grandparent caregivers and 400 non-caregiving grandparents.

The mean age of participants was 62.43 years old ($SD = 10.04$), and 58.5% were female. The majority of participants reported they graduated from high school (26.1%), followed by some college (24.3%), bachelor's degree (22.1%), master's degree (12.0%), associate's degree (7.2%), below high school diploma (5.7%), and Ph.D./equivalent (2.6%). There were no significant differences between grandparent

caregivers and non-caregiving grandparents for education level. When asked about their current financial situation, 42.4% reported that paying their bills were "not at all difficult," 32.5% reported "not very difficult," 20.1% reported "somewhat difficult," and 5.0% reported "very difficult." See [Table 1](#) for a further breakdown of demographics by grandparent caregiving status.

Measures

Center for Epidemiological Studies Depression Scale

The CESD is a 20-item measure of depressive symptoms within the past two weeks, using a 4-point Likert scale.³⁹ The CESD has been found to have a Cronbach's alpha of 0.85 to 0.94, indicating excellent internal consistency.⁴⁰ The CESD features an item asking about restless sleep, and this was deleted for the purposes of the correlations and structural equation models to avoid content overlap with the PSQI. However, the full 20-item version of the CESD was used when reporting means and standard deviations, to facilitate comparisons with other research.

Pittsburgh Sleep Quality Index

The PSQI is a 19-item self-administered questionnaire to measure the perceived quality of sleep.⁴¹ Most items are scored from 0 (not during the past month) to 3 (three or more times a week), with higher scores indicating poorer sleep quality. The remaining items ask questions such as, "When do you usually go to bed?". The PSQI measures seven domains: perceived sleep quality, sleep latency, sleep duration, sleep efficacy (how long someone is asleep while they are in bed), sleep disturbances (ie, noise, pain), use of sleep medication, and daytime dysfunction (sleepiness) over the past month. The seven components can be added together for a global sleep quality score. Previous studies have indicated excellent reliability (0.83), and that global sleep scores greater than 5 indicate significant sleep difficulty with diagnostic sensitivity and specificity of 89.6% and 86.5%, respectively.⁴¹

Grandparent Caregiving Status

Caregiving status was defined using an item that asked, "Have you ever given care to your grandchildren?" Grandparent caregivers were defined as those who answered yes to this question. These individuals reported having cared for their grandchildren for at least one year, though some reported having cared for their grandchildren for 20 years. The average amount of time caring for grandchildren was 4.60 years. Non-caregiving grandparents were defined as

Table 1 Demographics Means (Standard Deviation) and Percentages

		Overall	GPC (N=59)	Non-GPC (N=400)	Males	Females
Age		62.43 (10.04)	61.31 (10.49)	62.60 (9.97)	63.86 (9.94)	61.42 (9.97)
Gender	(% female)	58.39%	66.10%	57.40%	–	–
Marital Status %	Married	75.5%	59.3%	77.9%	90.5%	64.9%
	Separated/Divorced	14.1%	20.4%	13.3%	8.4%	18.3%
	Widowed	10.0%	20.3%	8.5%	1.1%	16.4%
	Never Married	0.2%	0.0%	0.3%	0.0%	0.4%
Education %	< High School	5.7%	10.2%	5.8%	5.8%	6.7%
	High School	26.1%	23.7%	26.4%	21.5%	29.6%
	Some College	24.3%	30.5%	23.4%	25.5%	28.1%
	2-year College	7.2%	10.2%	6.8%	10.0%	5.2%
	4-year College	22.1%	15.3%	23.1%	28.4%	17.6%
	Master's Degree	12.0%	6.8%	12.8%	12.1%	12.0%
	Ph.D./MD/JD	2.6%	3.4%	2.5%	3.7%	1.9%
Trouble Paying Bills %	Very Difficult	5.0%	6.8%	4.8%	2.6%	6.7%
	Somewhat Difficult	20.1%	35.6%	17.8%	16.3%	22.8%
	Not Very Difficult	32.5%	35.6%	32.1%	36.8%	29.5%
	Not At All Difficult	42.4%	22.0%	45.4%	44.2%	41.0%

Abbreviations: GPC, grandparent caregiver; Non-GPC, non-caregiving grandparent.

Table 2 M, SD, and Alphas of Correlations Among Indicator Variables for Overall Sample

Total Sample	1.	2.	3.	4.	5.	6.	7.	8.	9.	α	M	SD
1. Global Sleep	I									0.72	5.62	3.58
2. Subjective Sleep	0.69	I								–	0.94	0.66
3. Sleep Latency	0.71	0.41	I							0.61	0.93	0.93
4. Sleep Duration	0.63	0.43	0.27	I						–	0.72	0.77
5. Sleep Efficiency	0.70	0.40	0.39	0.57	I					–	0.63	1.01
6. Sleep Disturbance	0.50	0.36	0.36	0.14	0.15	I				0.68	1.34	0.54
7. Sleep Medication	0.57	0.20	0.33	0.13	0.21	0.17	I			–	0.61	1.10
8. Daytime Dys	0.54	0.41	0.24	0.27	0.18	0.30	0.18	I		0.58	0.76	0.66
9. Depressive Sym	0.45	0.34	0.23	0.16	0.20	0.32	0.29	0.48	I	0.89	7.81	7.75

Notes: All p s < 0.05 unless noted as ns. Alphas not provided for variables that contain only one item or otherwise could not be calculated. Alpha, mean, and SD for CESD used with all 20 items.

Abbreviations: Dys, dysfunction; Sym, symptoms.

those individuals with one or more grandchildren who denied ever having had primary responsibility for their care. The current sample included 59 grandparent caregivers and 400 non-caregiving grandparents.

Statistical Analyses

The necessary sample size was determined using Jackson's N:q Rule,⁴² recommended by Kline⁴³ as empirically valid for maximum likelihood-based structural equation models.

The N:q Rule specifies an ideal sample size of 20:1 in terms of the ratio of cases to model parameters. In this case, a 20:1 ratio with 5 model parameters portends a necessary sample of at least 100 cases (exceeded by our 459 participants). Structural equation modeling was conducted using AMOS 25.0. The maximum likelihood method of covariance structure analysis was used. Hu and Bentler's⁴⁴ model fit criteria were used where the comparative fit index (CFI) and Tucker-Lewis index (TLI) > 0.90 or 0.95 and standardized

Table 3 M, SD, and Alphas of Correlations Among Indicator Variables by Gender

Total Sample	1.	2.	3.	4.	5.	6.	7.	8.	9.	♂M (SD)	♀M (SD)
1. Global Sleep	1	0.66	0.67	0.65	0.73	0.45	0.61	0.52	0.44	5.33* (3.38)	6.34* (3.66)
2. Subjective Sleep	0.75	1	0.36	0.37	0.38	0.33	0.23	0.35	0.39	0.92 (0.68)	0.96 (0.67)
3. Sleep Latency	0.73	0.50	1		0.24	0.35	0.27	0.35	0.25	0.71* (0.82)	1.06* (0.99)
4. Sleep Duration	0.61	0.52	0.34	1	0.61	0.14	0.19	0.30	0.20	0.70 (0.71)	0.74 (0.77)
5. Sleep Efficiency	0.66	0.44	0.44	0.49	1	0.17	0.22	0.21	0.15	0.52 (0.92)	0.69 (1.06)
6. Sleep Disturbance	0.57	0.41	0.43	0.15	ns	1		0.14	0.28	1.23* (0.62)	1.39* (0.54)
7. Sleep Medication	0.53	0.15	0.25	ns	0.16	0.24	1	0.15	0.23	0.45* (0.98)	0.74* (1.17)
8. Daytime Dys	0.58	0.44	0.28	0.24	0.16	0.34	0.24	1	0.50	0.81* (0.71)	0.77* (0.65)
9. Depressive Sym	0.44	0.39	0.25	0.13	0.12	0.44	0.23	0.50	1	7.63 (7.62)	8.00 (7.78)

Notes: All p s < 0.05 unless noted as ns. * indicates males and females were significantly different at $p < 0.05$ using t -tests. Males appear below the diagonal and females above. Mean and SD for CESD used with all 20 items.

Abbreviations: Sym, symptoms; Dys, dysfunction.

root mean square residual (SRMR) < 0.10 or 0.08 and root mean square error of approximation (RMSEA) < 0.08 or 0.05 indicate acceptable and good fit, respectively.

Paths found in the structural model were used to test hypothesis 1. Hypothesis 2 was tested by examining the interaction effects. Interaction terms included sleep quality (global sleep quality, subjective sleep quality, sleep latency, sleep duration, sleep disturbances, sleep efficiency, sleep medication, and daytime dysfunction) x grandparent caregiving status for a total of 8 interactions; all mean-centered. To better interpret each interaction, the sleep quality variables were investigated using separate models. Significant interaction terms were interpreted using simple slope analyses at ± 1 SD. Finally, pairwise parameter comparisons, a statistical test comparing the difference between path coefficients, were used to test hypothesis 3. This comparison produces a Z score indicating the statistical difference between two path coefficients. Specifically, female and male path coefficients were compared to determine relations moderated by grandparent caregiving status. Path coefficients for grandparent caregivers and non-caregiving grandparents were also compared.

Results

Please see Tables 2 and 3 for descriptive statistics and correlations across variables. Due to the correlation between sleep variables, collinearity statistics were examined and all VIF were below 1.66, well below accepted standards. In total, 53.1% of our sample reported a score of greater than the cut-off value 5 on the PSQI, indicating a risk for clinically-significant sleep problems, and 10.3% reported a score of greater than the cut-off value of 16 for the CESD, indicating they were at risk for clinically-significant depressive

disorders. As seen in Table 3, females reported poorer sleep quality in every domain except for daytime dysfunction, and these differences were statistically significant for global sleep quality ($t(464) = 9.32, p = 0.002$), sleep latency ($t(464) = 17.58, p < 0.001$), sleep disturbances ($t(464) = 6.19, p = 0.013$), and sleep medication ($t(464) = 7.79, p = 0.006$). Depressive symptoms were not significantly different between males and females. Table 4 describes the differences in sleep quality and depressive symptoms between grandparent caregivers and non-caregiving grandparents. Grandparent caregivers reported poorer sleep quality ($t(464) = 2.78, p = 0.006$), and more sleep disturbances ($t(464) = 2.37, p = 0.018$), sleep medication ($t(464) = 2.49, p = 0.013$), daytime dysfunction ($t(464) = 2.05, p = 0.041$), and depressive symptoms ($t(464) = 3.19, p = 0.002$).

The structural models, as described above and shown in Figure 1 and Table 5, provided excellent model fit with the following ranges of indicators (SRMR = 0.02-0.04;

Table 4 Variable Means (Standard Deviation) and t -Scores by Caregiving Status

	GPC	Non-GPC	t -Score
Global Sleep	7.03 (3.82)	5.73 (3.50)	2.79**
Subjective Sleep	1.07 (0.72)	0.93 (0.66)	1.74
Sleep Latency	1.01 (1.01)	0.91 (0.93)	0.83
Sleep Duration	0.83 (0.62)	0.70 (0.73)	1.15
Sleep Efficacy	0.81 (1.12)	0.58 (0.98)	1.63
Sleep Disturbance	1.49 (0.63)	1.32 (0.55)	2.36*
Sleep Medication	0.93 (1.23)	0.54 (1.05)	2.50**
Daytime Dysfunction	0.93 (0.66)	0.75 (0.66)	2.06*
Depressive Symptoms	10.62 (9.32)	7.38 (7.32)	3.19**

Notes: *Indicates significant at < 0.05 and ** at < 0.01. Full 20 item CESD used to test means.

Abbreviations: GPC, grandparent caregiver; Non-GPC, non-caregiving grandparent.

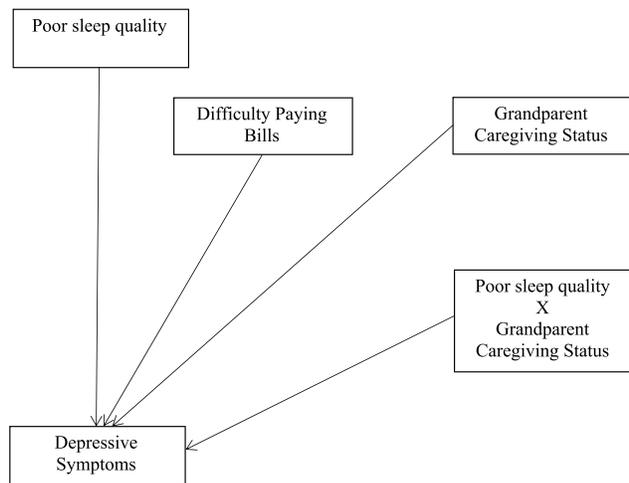


Figure 1 Structural model. $p_s < 0.05$ unless noted as ns. The overall path coefficient represents the overall total sample. Poor sleep quality included global sleep, subjective sleep, sleep latency, sleep duration, sleep efficiency, sleep disturbances, sleep medication, and daytime dysfunction. Each sleep variable was investigated using a separate model for a total of 8 models. Difficulty paying bills was treated as a covariate. A latent variable for the measurement error of depressive symptoms was included in the model but is not shown.

CFI = 0.93-0.99; TLI = 0.91-0.99; RMSEA = 0.02-0.07). Difficulty paying bills was a significant covariate in every model, contributing to variance in depressive symptoms. Table 5 shows path coefficients for grandparent caregivers vs non-caregiving grandparents. Only the path between subjective sleep quality and depressive symptoms was significantly different between caregiving and non-caregiving grandparents ($Z = 2.26, p = 0.024$), such that the path for grandparent caregiver was stronger. In the structural equation model, a three-way interaction was found between gender, sleep quality, and caregiving status was significant (see Figure 2–9). Indeed, except for subjective sleep quality, all interactions were significantly stronger for males than females. That is, the interaction was stronger for males for global poor sleep quality ($Z = 3.63, p < 0.001$), sleep latency ($Z = 3.55, p < 0.001$), sleep duration ($Z = 3.18, p < 0.001$), sleep efficiency ($Z = 2.23, p < 0.001$), sleep medication ($Z = 3.28, p < 0.001$), and daytime dysfunction ($Z = 3.61, p = 0.02$).

Discussion

To address a significant gap in the literature, the current study examined the relation of grandparent caregiving status on the sleep patterns and depressive symptoms of older adults. In the overall proposed model, treating sleep as a global construct, the pathways from global sleep to depressive symptoms, and the interaction between global sleep and caregiving status on depressive symptoms were

significant. More than 10% of our sample reported scores above the cut-off indicating a clinically significant risk for depressive orders, and over half reported scores above the cut-off indicating a clinically significant risk for sleep disorders. Thus, our results have both statistical and clinical significance.

The first hypothesis was supported in that poorer sleep quality was associated with higher depressive symptoms, consistent with prior literature.^{3,10} To further examine these relations, the relation of grandparent caregiving status on the sleep quality and depressive symptom association was analyzed in the second hypothesis, finding that grandparent caregiving status moderates the relation between poor sleep quality and depressive symptoms, as predicted. Specifically, the interaction was significant for global and subjective sleep quality. In general, poor sleep quality was more detrimental to depressive symptoms for individuals who were grandparent caregivers.

Hypothesis 3 stated that gender would moderate the relations among variables; that is, a 3-way interaction was hypothesized, where gender would moderate the interaction effect in addition to a 2-way interaction, among other effects. The results partially supported the hypothesis. When the interactions were examined separately for females and males, the interactions for all of the sleep quality variables except sleep disturbance was significant for males but not females, contrary to the prediction. It appears that taking on a caregiving role in later life affects the sleep and depressive symptoms of men more than women, perhaps because women are expected to take on caregiving roles their entire lives^{45,46} and may have already habituated to the effects wrought by these responsibilities.

Stress-Process Model

Our findings are consistent with the stress-process model of Pearlin et al.²⁶ The fact that caregiver stress amplifies the relation between sleep quality and depressive symptoms is meaningful and shows that mental health screening is particularly important for those with caregiving roles. Many specific stressors are likely to be elevated for caregiving grandparents, such as financial stress due to having additional expenses, and higher pressure on one's time due to the additional caregiving responsibilities. These are just a couple of the many stressors inherent in this role. This study helps lay the groundwork for future studies examining specific stressors and their role in modifying the sleep-depressive symptom relation.

Table 5 Path Coefficients for Variables and Interactions on Depressive Symptoms

		Overall	Males	Females	GPC	N-GPC
Global Sleep	GPCS	0.37*	0.43*	0.49*	0.57*	0.44*
	Global Sleep x GPCS	-.05	-.07	-.09		
		-.10*	<u>-.26*</u>	<u>0.03</u>		
Subjective Sleep	GPCS	0.29*	0.36*	0.30*	0.53*	0.30*
	Subjective Sleep x GPCS	-.09*	-.15*	-.09		
		-.09*	-.17*	-.06		
Sleep Latency	GPCS	0.20*	0.25*	0.23*	0.34*	0.23*
	Sleep Latency x GPCS	-.10*	-.24*	-.13*		
		-.05	<u>-.24*</u>	<u>0.03</u>		
Sleep Duration	GPCS	0.10*	0.16*	0.20*	0.13	0.18*
	Sleep Duration x GPCS	-.12*	-.18*	-.12*		
		-.02	<u>-.20*</u>	<u>0.09</u>		
Sleep Efficacy	GPCS	0.15*	0.15*	0.26*	0.30*	0.20*
	Sleep Efficacy x GPCS	-.10*	-.17*	-.10		
		-.05	<u>-.17*</u>	<u>0.01</u>		
Sleep Disturbance	GPCS	0.24*	0.42*	0.22*	0.40*	0.30*
	Sleep Disturbance x GPCS	-.09	-.13	-.11		
		-.06	-.09	-.02		
Sleep Medication	GPCS	0.25*	0.23*	0.29*	0.37*	0.26*
	Sleep Medication x GPCS	-.07	-.05	-.12*		
		-.06	<u>-.22*</u>	<u>0.06</u>		
Daytime Dysfunction	GPCS	0.41*	0.50*	0.47*	0.45*	0.49*
	Daytime Dysfunction x GPCS	-.09*	-.08	-.10		
		-.05	<u>-.20*</u>	<u>0.06</u>		

Note: *Indicates significant at < 0.05; Underlined indicates the interaction was significantly different for males and females using pairwise comparisons.

Abbreviations: GPCS, grandparent caregiving status.

Limitations

Limitations of this study include its cross-sectional nature and self-reported data. Thus, the results are of a much more subjective nature than those that may be obtained by objective measures such as actigraphy and polysomnography. However, the study utilized well-validated self-report

measures that are commonly used in the sleep and depression literature. Further, the sizeable nationwide sample is a tremendous asset, especially for the analysis of grandparent caregivers, a historically hard to recruit sample, which has led to many underpowered studies in the past.²⁴ Having a study that is adequately powered to detect interactions is

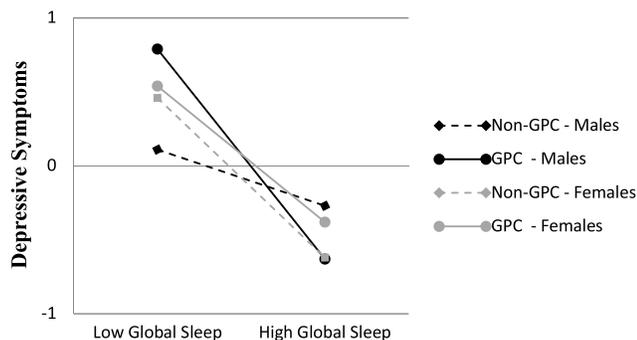


Figure 2 Global sleep x grandparent caregiving status. The interaction was significant only for males.

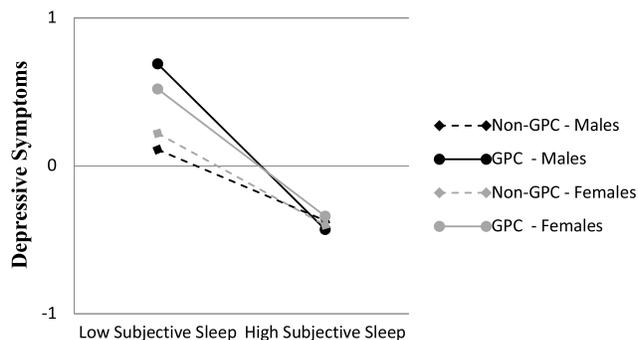


Figure 3 Subjective sleep quality x grandparent caregiving status. The interaction was significant only for males.

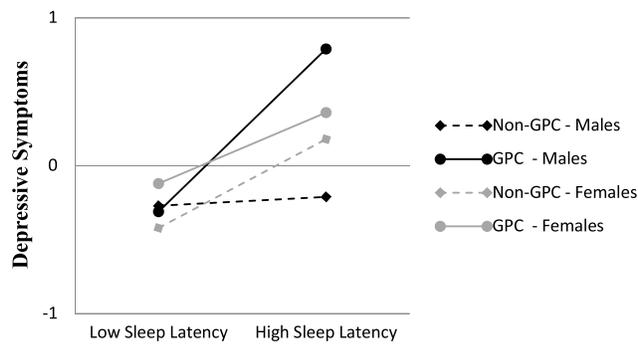


Figure 4 Sleep latency x grandparent caregiving status. The interaction was significant only for males.

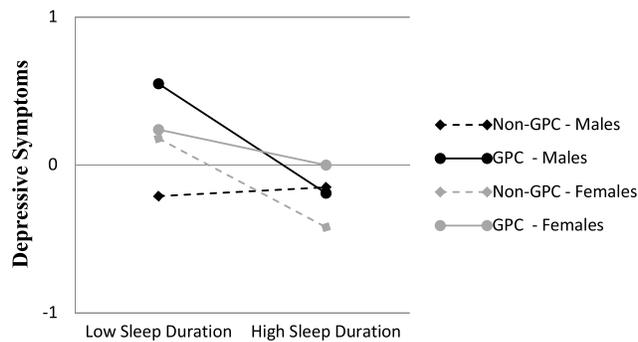


Figure 5 Sleep duration x grandparent caregiving status. The interaction was significant only for males.

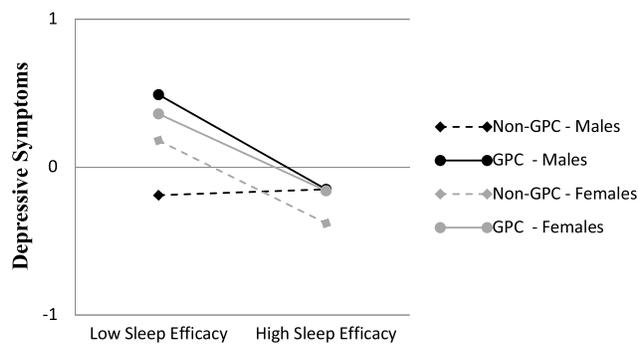


Figure 6 Sleep efficacy x grandparent caregiving status. The interaction was significant only for males.

a meaningful advance to this literature. The categorization of caregiving status by the single item on whether or not grandparents have ever assumed responsibility for their grandchildren is commonly used, but problematic as it does not account for the amount of responsibility, nor the duration of care.²⁴ It is also possible that some grandparents are reporting responsibility for their grandchildren without those children having lived with them and thus contributed to a daily source of stress (such as those who live nearby and watch their

grandchildren after school each day). Unfortunately, the question regarding grandparent caregiving status is asked in the past tense, so individuals may not have been providing care at the time of the survey. This wording makes it hard to determine causality or that caregiving contributed to their current depressive symptoms. Future studies are encouraged, wherever possible, to use a definition of grandparent caregiving that includes both one's grandchildren living in their household, and also having a primary responsibility for a variety of tasks related to the raising of those grandchildren.

Lastly, we were limited in the number of mediators and moderators we were able to include in the present study, as the focus was to establish whether these relations were present. We also were not able to predict gender differences due to the lack of prior literature. However, these are interesting findings that have the potential to build upon the literature. Thus, although we were not able to thoroughly examine whether related variables, such as stress and finances, may play a role in these relations, or fully explore the role of gender, we believe these are essential areas for future research.

Implications for Research and Practice

These results not only support prior findings that both problematic sleep and raising one's grandchildren are related to depressive symptoms, but also demonstrate that the interaction of caregiving status with sleep independently contributes to depressive symptoms. That is, grandparents raising their grandchildren who suffer from any one of the seven categories of poor sleep quality may be at particular risk of reporting depressive symptoms. It is recommended that healthcare and other service providers who work with grandparents raising their grandchildren ask specifically about sleep issues in addition to mental and physical health and offer referrals to behavioral sleep medicine specialists when poor sleep quality is reported.⁸ That said, we recognize that these caregivers have many barriers that may get in the way of care. Thankfully, there are now online and app-based CBT sleep interventions available, and training and community clinics often offer sliding scale treatment. Thus, treatment is available for this at-risk group, but providers may have to help these caregivers find alternative forms of treatment instead of just providing an appropriate referral.

Conclusion

Previous research has found that older adults are prone to both depression and difficulties with sleep¹¹ and that stress is

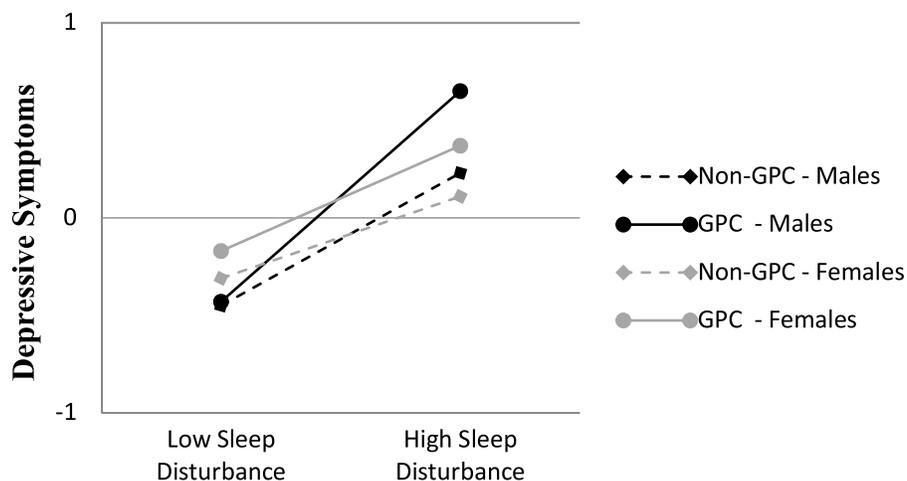


Figure 7 Sleep disturbance x grandparent caregiving status. Interactions not significant.

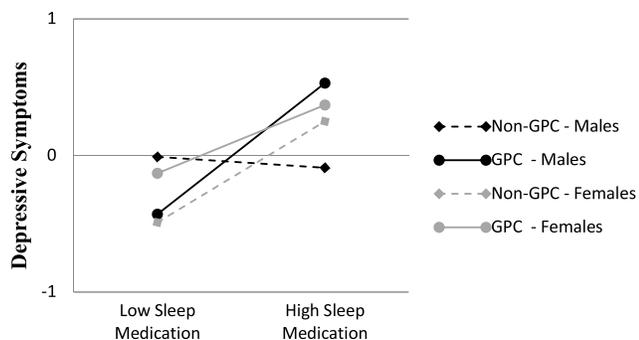


Figure 8 Sleep medication x grandparent caregiving status. The interaction was significant only for males.

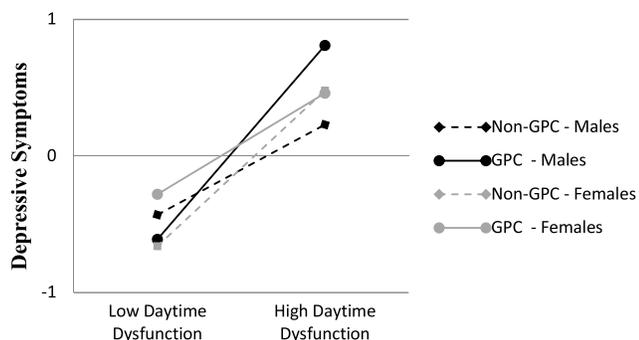


Figure 9 Daytime dysfunction x grandparent caregiving status. The interaction was significant only for males.

highly correlated with both of these variables.^{47,48} Given that grandparent caregivers report significantly higher levels of stress than their peers,²⁴ and that this is especially true of grandmother caregivers, the current research tested a model wherein depressive symptoms were associated with poor sleep quality, caregiving status, and their interaction, and

this was hypothesized to be further moderated by gender. The model was significant, with all hypotheses supported, though the interaction was the opposite of the predicted direction. Specifically, it was grandfathers and not grandmothers, as hypothesized, who had stronger associations of caregiving status and poor sleep quality with depressive symptoms. The results highlight the need to assess the sleep quality of grandparents raising their grandchildren and to provide behavioral sleep medicine referrals as an intervention designed to reduce depressive symptoms.

Statement of Significance

Older individuals are at risk for poor sleep quality and depression and often experience both. Grandparent caregivers are at risk for depression, but no known studies have examined sleep in grandparents caring for their grandchildren. Similarly, no known studies have examined how gender would differentially be associated within this relation. The current study’s findings pave the way for designing future interventions for grandparents raising their grandchildren aimed at improving sleep and ameliorating depression.

Disclosure

This project was not an industry-supported study, and the authors have no financial conflicts of interest. All authors have seen and approved this manuscript.

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