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ABSTRACT

Objectives: This cross-sectional study examined whether age moderates the relation between sleep problems and suicide risk and investigated whether sleep problems are differentially associated with suicide risk in younger (18–40) and older (60+) adults.

Methods: MTurk workers ($N = 733$) completed the Pittsburgh Sleep Quality Index, Suicidal Behavior Questionnaire–Revised, Patient Health Questionnaire, and demographic questions. Analysis of variance and linear regressions were utilized.

Results: Older adults scored lower on four PSQI components, symptoms of depression, and suicide risk than younger adults. Age significantly moderated the relation between sleep problems and suicide risk after controlling for gender and depressive symptoms, $F(5, 635) = 72.38$, $p < .001$. Sleep problems significantly related to suicide risk in younger adults ($t = 6.47$, $p < .001$) but not in older adults ($t = 0.57$, $p = .57$). Sleep medication use was related to suicide risk in both groups, whereas daytime dysfunction was related to suicide risk in older adults and sleep disturbances were related to suicide risk in younger adults.

Conclusions: The relation between sleep problems and suicide risk differs between younger and older adults. This study adds to the literature suggesting that sleep medications may not be appropriate for older adults.

Clinical Implications: Sleep problems are significantly related to suicide risk in younger adults but not older adults. Sleep medication use is associated with suicide risk regardless of age.

Introduction

Suicide remains among the top 11 leading causes of death annually in the United States (Centers for Disease Control and Prevention, National Center for Injury Prevention and Control, n.d.), and White, older adult men are at the highest risk for suicide of all groups (Curtin & Hedegaard, 2019). Suicide is particularly difficult to prevent in late-life because older adults are less likely to seek help and utilize more lethal attempt methods than earlier in the lifespan (Conwell, Van Orden, & Caine, 2011). Thus, it is especially important to identify and heed suicide risk factors in late-life as there are fewer opportunities to identify risk and intervene.

Sleep problems have been well established as a major risk factor for psychiatric illness and suicide in adults and older adults (Liu et al., 2020; Nadorff, Drapeau, & Pigeon, 2018). Meta-analyses across the lifespan have found that sleep disturbances were significantly associated with suicidal ideation, attempt,

and death by suicide, and depressive symptoms did not moderate these relations (Bernert, Kim, Iwata, & Perlis, 2015; Pigeon, Pinquart, & Conner, 2012). For older adults, insomnia symptoms have also been found to be associated with suicidal thoughts, though these effects were mediated by depressive symptoms (Nadorff, Fiske, Sperry, Petts, & Gregg, 2012). Additionally, older adults who reported longer histories of insomnia symptoms and nightmares had higher suicide risk (Golding, Nadorff, Winer, & Ward, 2015). Sleep problems also become notably more common in late-life. With increasing age, sleep onset latency and wake after sleep onset (both frequency and duration) increase, whereas sleep duration, sleep efficiency, and time spent in stage 3 and rapid eye movement (REM) sleep decrease (Floyd et al., 2000; Redline et al., 2004). Poor sleep in late-life may at times be partially attributed to health problems, disability, medication usage, and circadian

clock shifts in older adults who experience these age-related factors (Ancoli-Israel, 2009; Neikrug & Ancoli-Israel, 2010). As sleep problems are an important risk factor for suicide and sleep patterns change and worsen with age, the relation between sleep problems and suicide risk may thus differ between younger and older adults.

The literature has demonstrated that sleep problems are associated with suicide risk in the general population (e.g., Bernert et al., 2015) and in older adult samples (e.g., Golding et al., 2015). However, no studies have investigated whether the relation between sleep and suicide risk differs between older and younger adults within the same data collection, thus minimizing confounding factors. The present study investigated the relation between sleep problems and suicide risk among a community sample of younger (ages 18–40) and older (ages 60+) adults and whether age moderated the relation between sleep problems and suicide risk. Additionally, the study investigated differences between the two age groups in the specific sleep problems that are associated with suicide risk. Due to the scant literature on age moderating the relation between sleep problems and suicide risk, no a priori hypotheses were set, and analyses were exploratory in nature.

Methods

Participants and procedures

Participants were recruited from Amazon's Mechanical Turk (MTurk workers; Smith, Roster, Golden, & Albaum, 2016). Inclusion criteria were a) age 18 years or older and b) residing in the U.S., as data from U.S. workers are more reliable (Smith et al., 2016). Exclusion criteria were a) deviation greater than one year on two separate age questions and/or failing the majority of six attention checks (2 participants excluded), b) repeat study attempts (6 participants/12 participant entrees excluded), and c) non-completion of the study (51 participants excluded). Similar methods have been employed in research on older adults, sleep disturbances, and depressive symptoms (Webb, Cui, Titus, Fiske, & Nadorff, 2018). A total of 1,009 participants began the study and 944 participants met initial study criteria. Participants were separated into two groups based on their age: younger adults (ages 18–40; $n = 301$) and older adults

(ages 60 and older; $n = 432$). An additional 211 participants between the ages of 41 and 59 were thus further excluded from analyses. Of this group, 144 of the participants were in the 50–59 range. Given the similarities between these participants and those in the older adult group, it was decided that comparisons between these groups would not be appropriate. The decision to examine the two age groups selected was made due to the total sample having a bimodal age distribution that approximated these two age groups. The age groups used in this study are similar to that of past research on age differences in the relation between sleep and mental health (e.g., Gould, Beaudreau, O'Hara, & Edelstein, 2016).

The demographics and attention check performance of MTurk workers are similar in quality to traditional survey participants (Berinsky, Huber, & Lenz, 2012). The study was approved by the West Virginia University Institutional Review Board, and participants were required to provide informed consent to begin the study. Participants were then asked to complete measures on sleep problems, depressive symptoms, and suicide risk followed by demographic questions that included age, gender, race, education, marital status, and employment status. Lastly, all participants were provided with a list of phone numbers for different mental health hotlines (i.e., crisis, sexual abuse, domestic violence, and crime victims hotlines).

Measures

Suicidal Behaviors Questionnaire–Revised

The Suicidal Behaviors Questionnaire-Revised (SBQ-R; Osman et al., 2001) is a four item self-report measure of suicidal ideation and behaviors during one's lifetime and the frequency of one's suicidal ideation within the past year. Total scores range from 3–18 with cutoff scores of 7 and 8 for community adult and older adult samples, respectively (Osman et al., 2001). In the present study, SBQ-R internal consistency was .83, and skew and kurtosis were elevated at 1.87 and 3.48, respectively. Skew and kurtosis were improved to .96 and −.18, respectively, through logarithmic transformation.

Patient Health Questionnaire-9

The Patient Health Questionnaire-9 (PHQ-9; Kroenke, Spitzer, & Williams, 2001) is a nine item self-report measure of depressive symptoms over

a two-week timeframe. Each item is rated on a scale from 0 (not at all) to 3 (nearly every day). In analyses predicting suicide risk, the PHQ-8 scoring excluding item 9 was used. The PHQ-9 and PHQ-8 both had an internal consistency of .91.

Pittsburgh Sleep Quality Index

The Pittsburgh Sleep Quality Index (PSQI; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989) is an 18 item self-report measure of sleep problems over a one-month period. The first four items assess average bedtime, wake time, sleep onset latency, and total sleep time. Ten items assess for causes of poor sleep (e.g., snoring, bad dreams, pain). The last four items assess sleep quality, sleep medication usage, daytime sleepiness, and problems with enthusiasm. Scoring consists of seven separate component scores with a range of 0–3: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction. These component scores are then summed to create a total global score, with higher scores indicating more sleep problems. Scores higher than 5 are indicative of a sleep disorder. In this sample, normality (skew = 0.64, kurtosis = 0.17) and internal consistency (α = .75) of the PSQI were adequate.

Data analytic plan

Analysis of variance (ANOVA) was used to compare rates of sleep problems, symptoms of depression, and suicide risk between younger (age 18–40) and older (age 60+) participants. A moderation model (PROCESS Model 1; Hayes, 2018) was used to investigate whether the relation between sleep problems and suicide risk was moderated by age when controlling for gender and depressive symptoms. This analysis was conducted both with and without participants age 41–59. Additional multiple linear regressions investigated which sleep problems were significantly associated with suicide risk for younger and older adults separately while controlling for age, gender, and depressive symptoms. All seven PSQI sleep problem component scores were entered into the model simultaneously in order to account for Type I error. Lastly, sensitivity analyses were conducted to investigate the relation among age, sleep, and recent/current vs. lifetime

suicidal ideation. Ideation history was coded 0 = never, 1 = lifetime (SBQ-R item 1 response greater than 1) and 2 = current/recent (SBQ-R item 2 response greater than 1).

Results

The majority of the sample was White, married, women, college educated, and employed (Table 1). PHQ-8, SBQ-R, and PSQI total scores were significantly correlated with one another in both older and younger adults (Table 2). In the younger adult sample, 34.80% (103 of 296) scored at or above the clinical cutoff of 10 for the PHQ-8, 37.63% (108 of

Table 1. Demographic characteristics of the total sample and by age group.

	Total Sample	Younger Adults (18–40)	Older Adults (60+)
	n = 733	n = 301	n = 432
	n (%)	n (%)	n (%)
Gender			
Male	350 (47.7%)	161 (53.5%)	189 (43.8%)
Female	383 (52.3%)	140 (46.5%)	243 (56.3%)
Race			
White	630 (85.9%)	235 (78.1%)	395 (91.4%)
African American	41 (5.6%)	22 (7.3%)	19 (4.4%)
Hispanic	28 (3.8%)	20 (6.6%)	8 (1.9%)
Asian/Pacific Islander	23 (3.1%)	18 (6.0%)	5 (1.2%)
Other	11 (1.5%)	6 (2.0%)	5 (1.2%)
Education			
Less Than Highschool	2 (0.3%)	2 (0.7%)	0
Highschool	93 (12.7%)	38 (12.6%)	55 (12.7%)
Some College	252 (34.4%)	96 (31.9%)	156 (36.1%)
Four Year College	279 (38.1%)	138 (45.8%)	141 (32.6%)
Graduate Degree	107 (14.6%)	27 (9.0%)	80 (18.5%)
Relationship Status			
Single	203 (27.7%)	143 (47.5%)	60 (13.9%)
Cohabitating	66 (9.0%)	47 (15.6%)	19 (4.4%)
Married/Civil Union	297 (40.5%)	103 (34.2%)	194 (44.9%)
Seperated	12 (1.6%)	1 (0.3%)	11 (2.5%)
Divorced	110 (15.0%)	5 (1.7%)	105 (24.3%)
Widowed	45 (6.1%)	2 (0.7%)	43 (10.0%)
Employment Status			
Employed Full Time	345 (47.1%)	235 (78.1%)	110 (25.5%)
Employed Part Time	134 (18.3%)	36 (12.0%)	98 (22.7%)
Unemployed	43 (5.9%)	28 (9.3%)	15 (3.5%)
Disabled	14 (1.9%)	2 (0.7%)	12 (2.8%)
Retired	197 (26.9%)	0	197 (45.6%)

Younger adult ages ranged from 18–40 (N = 301, M = 30.79, SD = 4.75) and older adults were ages 60 or older (N = 432, M = 66.33, SD = 4.59).

287) scored at or above the clinical cutoff of 7 for SBQ-R, and 65.80% (179 of 272) scored at or above the clinical cutoff of 5 on the PSQI. As for the older adults, 14.35% (62 of 432) scored at or above the PHQ-8 clinical cutoff, 15.82% (65 of 411) scored at or above the clinical cutoff for the SBQ-R, and 60.45% (243 of 402) scored at or above the PSQI clinical cutoff.

ANOVA found that overall sleep problems did not significantly differ between older and younger adults, $p = .11$. However, regarding the PSQI components, older adults had lower (better) scores on subjective sleep quality, sleep latency, sleep duration, and daytime dysfunction as well as higher (worse) scores on sleep disturbances and use of sleeping medications, all $ps < .05$. Symptoms of depression and suicide risk were also lower among older adults than younger adults, both $ps < .001$. Younger adults had greater prevalence of any current/recent suicidal ideation (41%) compared to older adults (21%). Conversely, older adults had greater prevalence of no ideation history (62%) and prevalence of lifetime history (17%) compared to younger adults (47% no history, 13% lifetime history, respectively). These statistics are shown in Table 3.

Moderation analyses were consistent for both the full sample, including those age 41–59, and without. Due to the potential issues with age overlap, we opted to only present the results that omit participants age 41–59. The moderation effect of age on the relation between sleep problems and suicide risk was significant, $F(5, 635) = 72.38$, $p < .001$. The analysis showed significant main effects of sleep problems ($t = 6.46$, $p < .001$), age ($t = 3.18$, $p = .002$), and depressive symptoms ($t = 8.84$, $p < .001$) on suicide risk. Further, the age by sleep problems interaction was significant, $t = -5.47$, $p < .001$. Specifically, the association between

Table 2. Correlations among measures in younger and older adults.

	PSQI	PHQ-8	SBQ-R
PSQI	-	.70	.33
PHQ-8	.69	-	.47
SBQ-R	.59	.58	-

PSQI = Pittsburgh Sleep Quality Index, PHQ-8 = Patient Health Questionnaire 8 item, SBQ-R = Suicidal Behaviors Questionnaire-Revised. Correlations for younger adults (ages 18–40, n = 296) are presented below the diagonal and older adults (ages 60+, n = 432) are presented above the diagonal. All correlations were significant at p < .001.

Table 3. ANOVA of sleep problems, depressive symptoms, and suicide risk by age.

	Younger Adults (18–40) n = 296 M (SD)	Older Adults (60+) n = 432 M (SD)	p
PSQI Total	6.69 (4.05)	6.19 (3.85)	.11
P1	1.17 (0.85)	0.99 (0.77)	**.004**
P2	0.99 (0.75)	0.72 (0.77)	**< .001**
P3	1.11 (1.02)	0.95 (0.90)	**.03**
P4	0.77 (1.10)	0.76 (1.04)	.90
P5	1.20 (0.57)	1.36 (0.57)	**< .001**
P6	0.53 (0.97)	0.71 (1.17)	**.03**
P7	0.94 (0.92)	0.71 (0.83)	**< .001**
PHQ-8	7.22 (6.07)	4.17 (4.90)	**< .001**
SBQ-R	6.40 (4.28)	4.70 (2.51)	**< .001**

PSQI = Pittsburgh Sleep Quality Index, observed range in full sample = 0–19, younger adults = 0–19, older adults = 0–18; PSQI Components include P1 = subjective sleep quality, P2 = sleep latency, P3 = sleep duration, P4 = habitual sleep efficiency, P5 = sleep disturbances, P6 = use of sleeping medications, and P7 = daytime dysfunction; PHQ-8 = Patient Health Questionnaire 8 item, observed range in full sample = 0–24, younger adults = 0–22; SBQ-R = Suicidal Behaviors Questionnaire – Revised, observed range in full sample and both age groups = 3–18.

sleep problems and suicide risk was significant for younger adults ($t = 6.47$, $p < .001$), but this association was not significant for older adults ($t = 0.57$, $p = .57$; Figure 1). Lastly, sleep problems were highest among the individuals with current/recent suicidal ideation and lowest among individuals with no suicidal ideation and age did not moderate this association ($t = -1.82$; $p = .07$). Sleep scores were 4.75 for younger adults and 5.28 for older adults with no ideation history, 7.11 for younger adults and 6.53 for older adults with lifetime ideation history, and 8.93 for younger adults and 8.48 for older adults with current/recent suicidal ideation.

To further elucidate differences between younger and older adults, the relations between PSQI component scores and suicide risk were investigated in multiple regression models for younger and older adults separately (Table 4). Results showed that among both groups, the use of sleep medications individually related to suicide risk, both $ps < .05$. Sleep disturbances for younger adults and daytime dysfunction for older adults also individually related to suicide risk, both $ps < .05$.

Discussion

The present study investigated differences in sleep problems between younger and older adults. Younger adults were similar to older adults in level of overall sleep impairment, with both groups reporting elevated sleep problems (i.e., both PSQI means
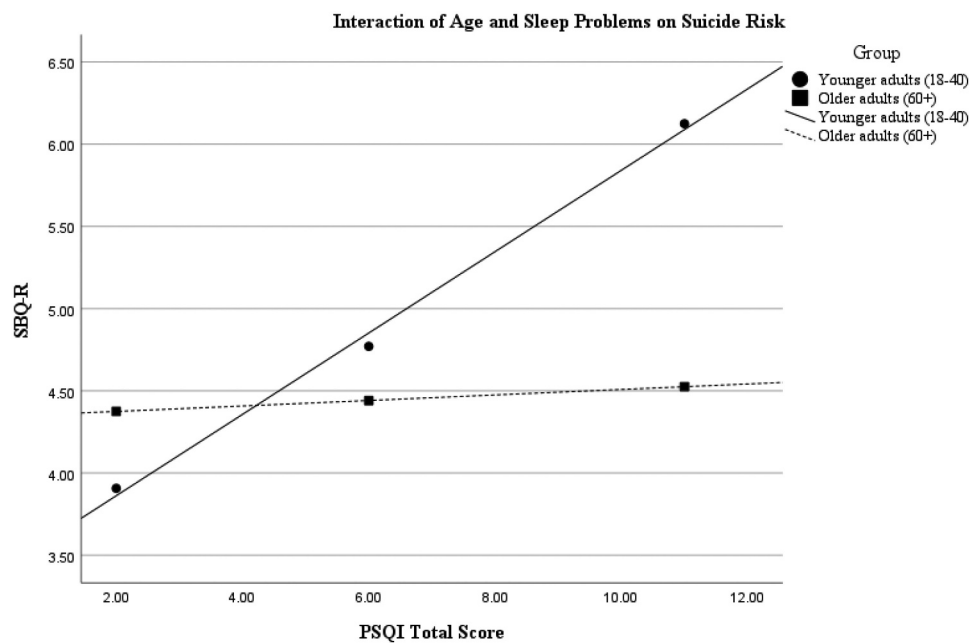
Figure 1. Age moderated the relation between sleep problems and suicide risk such that older adults had a lower suicide risk than younger adults with similar rates of sleep problems. PSQI = Pittsburgh Sleep Quality Index, possible range = 0–21, observed range for the full sample = 0–19; SBQ-R = Suicidal Behaviors Questionnaire – Revised total score, possible range = 3–18, observed range for the full sample = 3–18.

Table 4. Sleep problem component scores predicting suicide risk by age.

	Younger Adults (18–40, n = 296)				Older Adults (60+, n = 432)			
	B	SE	t	p	B	SE	t	p
Age	0.00	0.00	0.08	.94	0.00	0.00	0.98	.33
Gender	−0.01	0.03	−0.28	.78	−0.03	0.02	−1.50	.14
PHQ-8	0.01	0.00	4.12	< .001	0.02	0.00	5.39	< .001
PSQI Component								
P1	0.01	0.02	0.43	.67	−0.00	0.00	−0.30	.77
P2	0.03	0.02	1.32	.19	−0.00	0.01	−0.15	.89
P3	−0.01	0.02	−0.34	.73	−0.01	0.01	−0.89	.37
P4	0.02	0.02	1.39	.17	−0.00	0.01	−0.23	.82
P5	0.07	0.03	2.39	**.02**	−0.02	0.02	−1.31	.19
P6	0.04	0.02	2.89	**.004**	0.02	0.01	2.11	**.04**
P7	0.02	0.02	1.01	.31	0.03	0.02	2.00	**.047**

Note. PHQ-8 = Patient Health Questionnaire 8 item; PSQI = Pittsburgh Sleep Quality Index; PSQI Components include P1 = subjective sleep quality, P2 = sleep latency, P3 = sleep duration, P4 = habitual sleep efficiency, P5 = sleep disturbances, P6 = use of sleeping medications, and P7 = daytime dysfunction.

were above the clinical cutoff). This is consistent with previous findings from studies employing the PSQI, as Landry, Best, and Liu-Ambrose (2015) found a PSQI mean of 7.4 for adults age 55 and older, and Becker et al. (2018) found a PSQI mean of 6.87 for adults ages 18–29. Further, age was found to moderate the relation between sleep problems and suicide risk, such that sleep problems were significantly related to suicide risk for younger adults but not for older adults. Use of sleep medications was found to significantly relate to suicide risk for both age groups over and above depressive symptoms and other sleep problems, consistent with previous

literature (Brower et al., 2011). Sleep disturbances (e.g., trouble staying asleep, bad dreams, discomfort) were related to suicide risk in only younger adults, consistent with previous research (Nadorff, Nazem, & Fiske, 2011). Daytime dysfunction (i.e., daytime sleepiness, low enthusiasm) was related to suicide risk in only older adults, also in line with previous research (Lapierre et al., 2012).

The finding that the use of sleep medications and daytime dysfunction were the only two sleep issues that significantly related to suicide risk among older adults over and above depression symptoms has several clinical implications. First, providers should consider

utilizing Cognitive Behavioral Therapy for Insomnia (CBT-I). The American College of Physicians has called CBT-I the first-line treatment for chronic insomnia (Qaseem, Kansagara, Forciea, Cooke, & Denberg, 2016), and CBT-I has been shown to be both effective and well tolerated for older adults, thus representing an ideal alternative to medication (Rybarczyk, Lund, Garroway, & Mack, 2013). When medication must be used, non-benzodiazepine receptor agonist medications are preferred to benzodiazepine medication. Two recent reviews found that although effective, the limited literature on non-benzodiazepine receptor agonist medications for older adults preludes conclusions regarding the presence of adverse events due to these medications (Sateia, Buysse, Krystal, Neubauer, & Heald, 2017; Sys, Van Cleynenbreugel, Deschodt, Van der Linden, & Tournoy, 2020). Further, although not examined in an older adult sample, there is evidence that the use of non-benzodiazepine agonists in conjunction with an antidepressant may be useful in reducing suicidal ideation (McCall et al., 2019). Therefore, non-benzodiazepine medication should be used with caution, if used at all, and should be closely monitored and started at the lowest effective dose. According to the American Geriatrics Society Beers criteria, benzodiazepines commonly used to treat sleep problems are not recommended for older adults due to the increased risk of falls, fractures, cognitive decline, delirium, and motor vehicle accidents (Fixen, 2019). The current findings provide further support that hypnotic medications, especially benzodiazepines, should not be used by older adults with sleep problems given their association with suicide risk (Sateia et al., 2017). Additionally, clinicians should assess the suicide risk of younger adults who present with sleep disturbances and older adults reporting daytime sleepiness, low enthusiasm, or use of sleep mediations. Assessing and addressing these sleep concerns may help reduce suicide risk (Manber et al., 2011; Trockel, Karlin, Taylor, Brown, & Manber, 2015).

Limitations and future directions

The cross-sectional nature of the data precludes temporal or causal interpretations. Additionally, the use of MTurk to sample participants may have resulted in a more clinically-skewed sample than other sampling methods (Mason & Suri, 2012; Shapiro, Chandler, & Mueller, 2013), which may limit generalization to the overall population. Data were not collected regarding type of sleep medications used by the sample. Finally, the sample was rather homogeneous with 85.9% of participants being White, 87.0% being college educated, and 77.6% of the older adult group being in their 60′s. Therefore, readers should use caution when generalizing our findings to older adults with different demographics (e.g., middle-old and oldest-old adults).

With these limitations in mind, the findings still provide a notable contribution to the literature on the relation between sleep problems and suicide risk across the lifespan. Future studies may extend these findings through the use of objective measures (e.g., actigraphy) and longitudinal designs, replication in more clinical and diverse samples, and examining whether treating sleep concerns and reducing sleep medication use reduces suicide risk. Specifically, research may examine whether clinical interventions (e.g., behavioral activation) targeting daytime dysfunction, specifically daytime sleepiness and low enthusiasm, in older adults may help mitigate their suicide risk. Finally, different factors impact sleep across the lifespan, including physiology and physical health, and examining how these factors relate to sleep problems and suicide risk as we age would be a notable contribution to the field.

Clinical implications

- After accounting for gender and depressive symptoms, sleep problems are significantly associated with greater suicide risk for adults ages 18-40 but not for adults ages 60 and older.
- Previous research has found that reducing sleep problems, such as insomnia, is related to reduced suicidality, and our results support this relation. Clinicians treating suicidal patients would be wise to assess and address sleep problems in this population.
- Sleep medication use is associated with greater suicide risk. In both younger and older adults, the assessment of suicide risk among those taking sleep medications and discussion of decreasing or eliminating sleep medication may be of benefit.

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