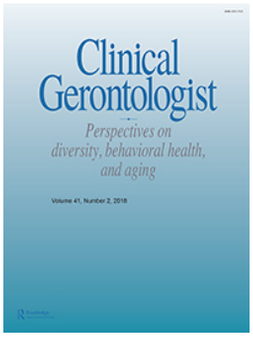

Clinical Gerontologist

ISSN: 0731-7115 (Print) 1545-2301 (Online) Journal homepage: http://www.tandfonline.com/loi/wcli20

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To cite this article: Christopher A. Webb, Ruifeng Cui, Caitlin Titus, Amy Fiske & Michael R. Nadorff (2018) Sleep Disturbance, Activities of Daily Living, and Depressive Symptoms among Older Adults, Clinical Gerontologist, 41:2, 172-180, DOI: 10.1080/07317115.2017.1408733

To link to this article: https://doi.org/10.1080/07317115.2017.1408733

Accepted author version posted online: 11 Dec 2017.
Published online: 22 Dec 2017.

CLINICAL GERONTOLOGIST
2018, VOL. 41, NO. 2, 172–180
https://doi.org/10.1080/07317115.2017.1408733

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NEW AND EMERGING PROFESSIONALS

Sleep Disturbance, Activities of Daily Living, and Depressive Symptoms among Older Adults

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ABSTRACT

Objective: Research suggests sleep disturbance plays a role in depression and risk for suicidal behavior (i.e., ideation, attempts, death by suicide). How sleep disturbance affects suicide risk is unclear and one's ability to perform activities of daily living (ADLs) may help explain this relation. This study examined associations between sleep problems, ADLs, and either depressive symptoms or suicide risk among older adults. We hypothesized that ADLs would mediate relations between sleep problems and depressive symptoms and suicide risk.

Method: Participants (N = 134; age ≥65) were recruited through Amazon's Mechanical Turk. Participants completed questionnaires that assessed insomnia symptoms, nightmares, ADLs, depressive symptoms, and suicidal behaviors.

Results: Nightmares were associated with depressive symptoms and suicide risk but not independently associated with ADLs. Insomnia symptoms were associated with depressive symptoms, suicide risk, and ADLs. ADLs mediated the relation between insomnia symptoms and depressive symptoms. The insomnia symptom—suicidal behavior relation and the nightmare—suicidal behavior relation were significantly mediated by a pathway containing ADLs and depressive symptoms.

Discussion: ADLs help explain how insomnia symptoms and nightmares confer suicide risk among older adults, either independently or in association with depressive symptoms.

Clinical Implications: Practitioners should attend to ADL performance when treating older adults with insomnia and depression.

KEYWORDS

Activities of daily living; depressive symptoms; insomnia symptoms; older adults; suicide risk

Introduction

Late-life depression is an important public health problem associated with increased morbidity and mortality, including risk of suicide (Conwell, Van Orden, & Caine, 2011). Evidence suggests that sleep disturbance plays a role in depression (e.g., Nadorff et al., 2013b) and risk for suicidal behavior (i.e., ideation, attempts, death by suicide; e.g., Nadorff, Fiske, Sperry, Petts, & Gregg, 2013a). The mechanism through which this role works is unclear. One's ability to engage in activities of daily living (ADLs)—as in completing activities such as bathing or rising from bed without assistance—may be one such mechanism. This study aimed to test a model predicting that sleep disturbances are associated with depressive symptoms and risk for suicidal behavior, in part, through diminished ability to carry out ADLs.

Two sleep problems associated with depression and suicidal behavior are insomnia and nightmares (e.g., Pigeon & Perlis, 2008; Sjöström, Wærn, & Hetta, 2007). Prevalence rates for insomnia range from approximately 10–60% in older adults (Ohayon, 2002) and insomnia increases risk for, and perpetuates, depression in many older adults (Pigeon et al., 2008). Further, the treatment of insomnia symptoms improves co-occurring symptoms of depression (Manber et al., 2008; Taylor, Lichstein, Weinstock, Sanford, & Temple, 2007). Insomnia symptoms are also associated with suicidal behavior among older adults, and this relation is mediated by depressive symptoms (Golding, Nadorff, Winer, & Ward, 2015; Nadorff, Fiske, Sperry, Petts, & Gregg, 2013).

Nightmares, defined as dreams that distress and wake the individual (Levin & Nielsen, 2007), are

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also associated with depression and risk of suicidal behavior. Up to 68% of older adults experience nightmares (Nielsen & Zadra, 2005) and older adults suffering from depression or anxiety report more nightmares than those without these psychiatric problems (Mallon, Broman, & Hetta, 2000). Nadorff and colleagues (2013) found frequency of bad dreams was associated with symptoms of depression, anxiety, and poor quality of life in older adults. Nightmare experiences are also associated with suicidal ideation (e.g., Golding et al., 2015; Nadorff et al., 2013a; Nadorff, Nazem, & Fiske, 2011).

Research has found a relation among sleep disturbance, depression, and suicide behavior; however, there is limited postulation of theories or mechanisms of action explaining these relations, all of which have focused on the relation between insomnia and suicide risk. These include serotonergic dysfunction, hyperarousal, mood dysregulation, hopelessness regarding sleep problems, and cognitive deficits that impair decision-making and problem solving (McCall & Black, 2013; Woznica, Carney, Kuo, & Moss, 2015). The latter is of particular interest here. Sleep-related cognitive deficits have been linked to daytime dysfunction (Schmidt, Gay, & Van der Linden, 2008) and thus it is conceivable that inability to sleep could lead to cognitive or motor problems that would limit a person's ability to engage in ADLs or to strategize how to accomplish ADLs through alternative means. If these limitations to ADLs became severe enough, they could lead to depression and suicidal behavior. As there is limited research on mediators of the relation between sleep problems and depression and suicide risk, the present study seeks to fill the gap in the literature by examining the potential mediating role of ADL performance in the relation between sleep and mental health issues.

Indeed, empirical findings are consistent with the notion that the relation between sleep disturbance and depressive symptoms or suicidal behavior may be due to the deleterious effect of sleep disturbance on daytime functioning. Prospective studies have found that poor sleep quality is associated with decreased ability to perform ADLs (Goldman et al., 2007; Suzuki, Murase, Tanaka, & Okazawa, 2007). Additionally, McCracken and Iverson (2002) found an association between insomnia and disability independent of chronic pain and depression. Adults and older adults who required assistance to complete ADLs were at greater risk for depression (Leggett, Zarit, Nguyen, Hoang, & Nguyen, 2012; Valenza et al., 2013). Sleep disturbances are also related to impairment in other demographic groups as well, including: diminished academic performance and increased depression in adolescents (Wolfson & Carskadon, 1998) and risk of cognitive fatigue and physical injury among college athletes (Reilly & Edwards, 2007).

Present Study

This study examined the effect of impaired ADLs —operationalized as one's ability to engage in routine tasks (e.g., household chores, maintaining personal hygiene) or physical aptitude (e.g., standing or walking without assistance)—on the relations between sleep problems (i.e., insomnia, nightmares) and either depressive symptoms or suicide risk. Evidence supports a relation between sleep and both physical functioning and psychological concerns (e.g., Valenza et al., 2013). Thus, we hypothesized that a) ADLs would mediate the relation between insomnia and depressive symptoms; b) ADLs would mediate the relation between insomnia and suicide risk; c) ADLs would mediate the relation between nightmares and depressive symptoms; and d) ADLs would mediate the relation between nightmares and suicide risk. We included age, gender, race/ethnicity, physical health, and education as covariates.

Method

Participants and Procedure

Participants were recruited using Amazon's Mechanical Turk (mTurk). Given that we were investigating clinical phenomena, mTurk was chosen because it is common that samples recruited through mTurk resemble clinical samples (Shapiro, Chandler, & Mueller, 2013), which makes it ideal for studying clinical phenomena such as suicidal behavior. This study was approved by Mississippi State University's IRB. Participants were first shown a cover sheet describing the study and asked what

year they were born. Participants were permitted to complete the survey if their birth year was consistent with being at least 65. Those allowed to participate were compensated $.50 regardless of completion.

Materials

The Disturbing Dreams and Nightmares Severity Index (DDNSI) is a self-report questionnaire that measures nightmares, including frequency, intensity, and severity, over the past year. The DDNSI uses Likert-type questions to establish clinically significant nightmare symptoms. It has an internal consistency of α = .90 (Krakow et al., 2002a, 2002b). See Table 1 for the clinical cutoff scores and present sample's statistics for each measure.

The Insomnia Severity Index (ISI) is a seven item self-report measure of insomnia symptoms sleep onset, sleep maintenance, early awakening, overall satisfaction with current sleep patterns, and the extent to which sleep problems cause disruptions in daily life (Smith & Wegener, 2003). The ISI shows adequate internal consistency (α = .76; Bastien, Vallières, & Morin, 2001).

Medical morbidities were assessed with a list of 10 health problems (arthritis, heart trouble, depression, blood pressure, diabetes, anxiety, cancer, obesity, breathing problems, and back problems). Responses on these items were summed to create a scale from 0 to 10 with higher scores indicating greater medical morbidities.

The Geriatric Depression Scale – Short Form (GDS) is a 15-item self-report questionnaire that measures depressive symptoms experienced over the past week in geriatric populations and has a high-level of internal consistency (α = .94; Yesavage et al., 1983).

The Suicidal Behavior Questionnaire—Revised (SBQ-R) is a four-item self-report scale that assesses suicidal ideation (Osman et al., 2001). Although the mean observed in this study for suicide risk was high (M = 6.36, SD = 2.97), it is very comparable to another older adult data collection from mTurk (M = 6.86, SD = 2.87; Golding et al., 2015). The measure has an internal consistency alpha of .87 in nonclinical samples and .88 in clinical samples. Osman et al., 2001.

Functional status was assessed with a measure of activities of daily living from the Swedish Adoption Twin Study of Aging (Pedersen et al., 1991). The 21-item scale includes 12 items assessing physical ADLs and 9 items assessing instrumental ADLs, with higher scores indicating greater ability. The measure has been shown to have excellent internal consistency (Cronbach's α = .90; Fiske, Bamonti, Nadorff, Petts, & Sperry, 2013).

Self-reported health was assessed using the question "How would you rate your health at the present time?" (Bernard et al., 1997; Idler & Kasl, 1991). The item was rated on a four-point Likert-type scale ranging from poor to excellent and has been used as a global measure of health.

Table 1. Means, standard deviations, ranges, and internal consistencies for study variables.

Measure	*N*	*M*	*SD*	Sample Range	α	Clinical Cutoff	% Above Cutoff
ISI	134	11.10	6.03	0–31	.92	15	21.6%
DDNSI	132	4.38	6.81	0–27	.90	11	15.9%
GDS	133	5.51	4.50	0–15	.90	6	42.9%
SBQ-R	133	6.36	2.97	4–17	.82	7	36.1%
ADL	133	58.74	7.52	n/a	.96		

Note: Reported means (*M*) and standard deviations (*SD*) are not transformed; analyses used log-transformed values. Measure Abbreviations: Insomnia Severity Index (ISI), Disturbing Dreams and Nightmares Severity Index (DDNSI), Geriatric Depression Scale (GDS), Suicidal Behavior Questionnaire—Revised (SBQ-R), Activities of Daily Living (ADL).

Results

Data were cleaned an analyzed using SPSS version 23.0. Initially, 932 individuals attempted the survey, but 496 participants were excluded for failing to meet the age criterion. We excluded those who exhibited careless responding (e.g., giving the same response on every item of a measure with reverse-coded items) and individuals whose age at the end of the study was not within one year of the birth year they provided at the outset. Subsequently, a total of 134 participants were included in the following analyses, and they ranged in age between 65–94 years old (*M* = 69.57, *SD* = 5.08). The sample was primarily female (63.4%) and Caucasian (87.3%). Additionally, 50.4% held at least an associate's degree and 38.3% held a bachelor's degree or higher.

The PROCESS macro (Hayes, 2013) for SPSS was used to analyze mediation effects. A two-tailed *p* value less than .05 can be inferred for an effect

when 0 is not included in the 95% confidence interval (CI) of the effect. The SBQ-R was slightly skewed (skew = 1.46, kurtosis = 1.60) so we conducted a log transformation, which greatly reduced the skew (skew = .40, kurtosis = −.44). All analyses statistically accounted for the following covariates: gender, age, racial/ethnic background, educational attainment, and self-reported health. Descriptive statistics for study variables in the present sample are presented in Table 1 along with clinical cutoff scores and percentage of sample above the clinical cutoff. See Table 2 for correlations among study variables.

The first hypothesis predicted ADLs would mediate the relation between insomnia symptoms and depressive symptoms (Figure 1a). Insomnia symptoms were significantly associated with depression symptoms independent of covariates.

Table 2. Correlations among study variables.

	Variables	1	2	3	4	5
1	Insomnia Severity Index	-	.26**	.53**	−.19*	.30**
2	Disturbing Dreams and Nightmares Severity Index		-	.22*	.09	.41**
3	Geriatric Depression Scale			-	−.24**	.45**
4	Activities of Daily Living				-	−.02
5	Suicide Behaviors Questionnaire					-

Note: *N* ranged from 131–134, *$p < .05$, **$p < .01$.

The unstandardized beta for the indirect effect of insomnia symptoms on depressive symptoms through ADLs was .01 (*SE* = .05), with a 95% confidence interval of .0001 to .0538. ADLs, thus, mediated the relation between insomnia symptoms and depression symptoms. To further test this relation, we added the number of health morbidities (e.g., diabetes, heart problems, etc.) as an additional covariate. Once this additional covariate was added, ADLs no longer significantly mediated the relation between insomnia symptoms and depressive symptoms (95% confidence interval = -.002 to .034).

Given that our data are cross-sectional, we also tested whether depression may mediate the relation between insomnia symptoms and ADLs. Depressive symptoms failed to mediate the relation between insomnia symptoms and ADLs (*B* = .09, *SE* = .05, 95% CI -.002 to .212).

The second hypothesis predicted the relation between insomnia symptoms and suicide risk would be mediated by ADLs (Figure 1b). Insomnia symptoms were associated with suicide risk independent of covariates and ADLs (*B* = −.02, *SE* = .01, *p* = .01). The unstandardized beta for the indirect effect of insomnia symptoms on suicide risk through ADLs was −.0001,

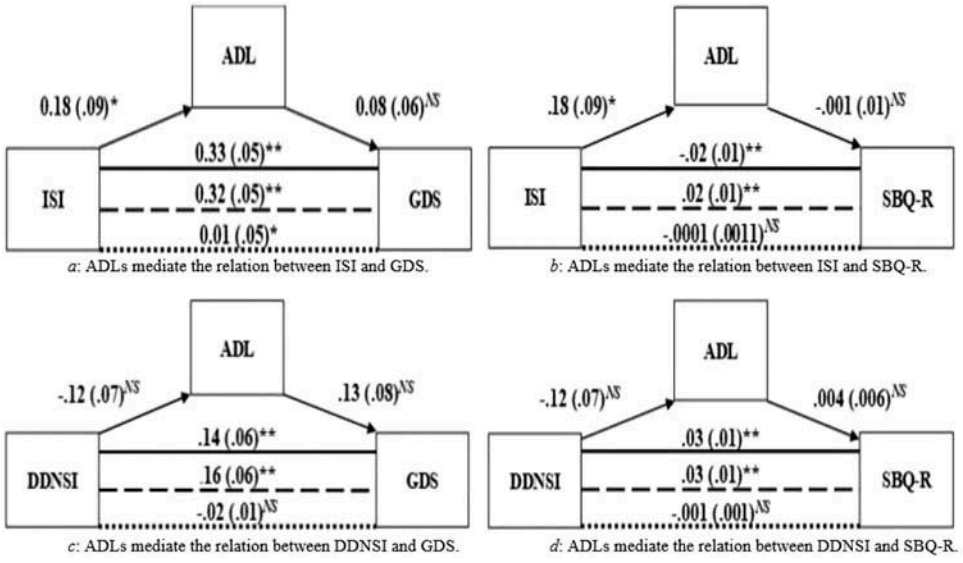

Figure 1. ADLs mediate the relations between (a) ISI and GDS legend, (b) ISI and SBQ-R, (c) DDNSI and GDS, and (d) DDNSI and SBQ-R. ISI indicates insomnia severity index, DDNSI indicates disturbing dreams and nightmares severity index, GDS indicates geriatric depression scale, SBQ-R indicates suicidal behavior questionnaire—revised, and adl indicates activities of daily living. Unstandardized betas (standard errors) are presented. * indicates $p < .05$, ** indicates $p < .01$, and ^{NS} indicates not significant. Model correcting for age, gender, education, physical health, and ethnic background. The solid line is the total effect, the dashed line is the direct effect after the indirect effect has been removed, and the dotted line is the indirect effect.

SE = .0011, 95% CI -.0023 to .0021. Thus, there is not a significant mediating effect.

We then examined whether ADLs and depressive symptoms may mediate the relation between insomnia symptoms and suicide risk (Figure 2a). We utilized PROCESS model 6, including the same covariates. As would be expected given the previous analysis, ADLs failed to mediate the relation between insomnia symptoms and suicide risk (*B* = −.0006, *SE* = .001, 95% CI -.004 to .001). The indirect pathway in which insomnia symptoms predict ADLs, which predict depressive symptoms, which predict suicide risk was significant (*B* = .001, *SE* = .001, 95% CI .000009 to .002216). Further, these findings held even when other medical morbidities were added to the model. The reverse order, where depressive symptoms predict ADLs, was not significant. Depressive symptoms were also found to mediate the relation between insomnia symptoms and suicide risk (*B* = .012, *SE* = .004, 95% CI .006 to .021).

The third hypothesis predicted ADLs would mediate the relation between nightmare symptoms and depression symptoms (Figure 1c). Nightmares were associated with depressive symptoms independent of the covariates and ADLs (*B* = .16, *SE* = .06, *p* < .01). The unstandardized beta for the indirect effect of nightmares on suicide risk through ADLs was −.02, *SE* = .01, 95% CI -.0501 to .0002. Thus, there is not a significant mediating effect.

The final hypothesis predicted that ADLs would mediate the relation between nightmare symptoms and suicide risk (Figure 1d). Nightmare symptoms were significantly associated with suicide risk independent of ADLs and the covariates (*B* = .03, *SE* = .01, *p* < .01). Nonetheless, the indirect effect of nightmare symptoms on suicide risk through ADLs was not statistically significant (*B* = −.001, *SE* = .001, CI: -.0027 to .0004).

We also examined the indirect pathway of nightmares through both ADLs and depressive symptoms in affecting suicide risk and found a significant indirect pathway of nightmares being associated with suicide risk through ADLs and depressive symptoms (*B* = −.0005, *SE* = .0004, 95% CI -.00173 to -.00003; Figure 2b). Further, this pathway remained significant even once medical morbidities were added to the model. Similar to insomnia symptoms, the inverse relation with depressive symptoms leading to ADLs was not significant. There was a significant indirect effect

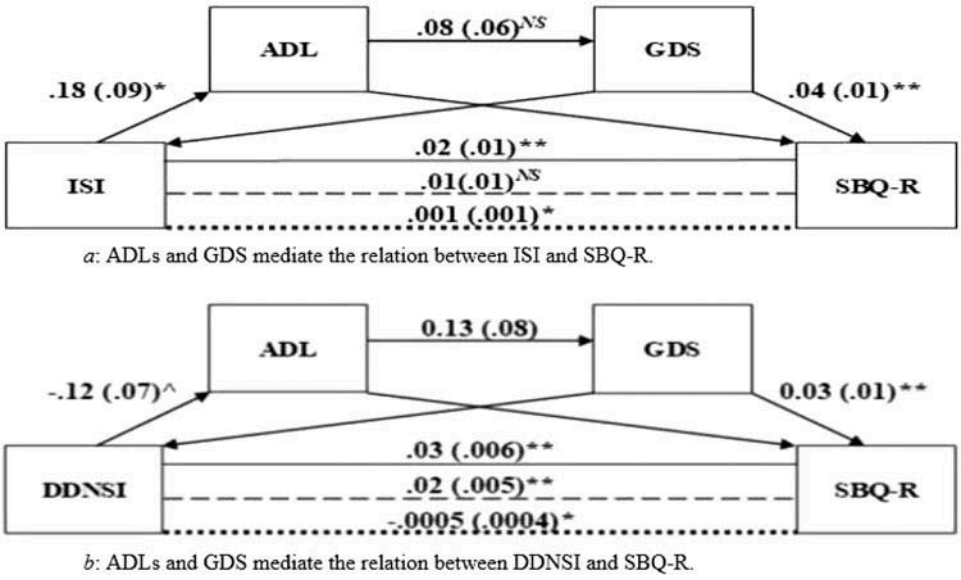

Figure 2. ADLs and GDS mediate the relation between (a) ISI and SBQ-R, and (b) DDNSI and SBQ-R. ISI indicates insomnia severity index, ddnsi indicates disturbing dreams and nightmares severity index, GDS indicates geriatric depression scale, sbq-r indicates suicidal behavior questionnaire—revised, and ADL indicates activities of daily living. unstandardized betas (standard errors) are presented. * indicates *p* < .05, ** indicates *p* < .01, NS indicates not significant, and. ^ indicates *p* < .10. Model correcting for age, gender, education, physical health, and ethnic background. The solid line is the total effect, the dashed line is the direct effect after the indirect effect has been removed, and the dotted line is the indirect effect.

for depressive symptoms mediating the relation between nightmares and suicide risk (B = .003, SE = .002, 95% CI -.001 to .008).

Discussion

The present study investigated whether sleep problems are associated with depressive symptoms and suicide risk, and whether these relations are mediated by ADLs. Results indicated that ADLs mediated the relation between insomnia symptoms and depressive symptoms. Higher levels of insomnia symptoms were associated with lower levels of ADLs, which were associated with higher levels of depressive symptoms. Insomnia symptoms are associated with cognitive impairments such as deficits in attention, memory, and problem solving (Fortier-Brochu, Beaulieu-Bonneau, Ivers, & Morin, 2012; Fortier-Brochu & Morin, 2014) in adults and general cognitive decline among older adults (Cricco, Simonsick, & Foley, 2001), which may explain the relation between symptoms of insomnia and poor ADL performance, particularly regarding tasks involving memory and reasoning (Ohayon, & Vecchierini, 2005; Perneczky et al., 2006). The relation between well-documented (e.g., Livingston, Blizard, & Mann, 1993; Pigeon et al., 2008), and research has indicated that impaired ADLs predict late-life depression (Haynie, Berg, Johansson, Gatz, & Zarit, 2001). Impairments in ADLs are associated with a lower quality of life, which is in turn associated with the development of depression symptoms (Vest, Murphy, Araujo, & Pisani, 2011). The present study is the first to demonstrate that ADL impairment mediates the relation between insomnia and depressive symptoms.

Our second hypothesis was not supported, as ADLs did not mediate the relation between insomnia symptoms and suicide risk. Additional analyses showed, however, that ADLs are indirectly associated with suicidal ideation through their association with depressive symptoms.

Our third and fourth hypotheses were not supported either. Despite there being main effects for insomnia symptoms predicting suicide risk, and nightmares predicting both depressive symptoms and suicide risk, there was not a significant indirect effect. Similar to the finding between insomnia and suicide, models of the relation between nightmares and suicide indicated that ADLs were associated with suicide risk through their association with depressive symptoms.

Although there was a significant indirect effect for both the relation between insomnia and suicidal ideation and the relation between nightmares and suicidal ideation through ADLs and depressive symptoms, these findings are exploratory in nature and should be interpreted with caution, given that not all the pathways are significant. Consequently, we suggest that future research seek to replicate these findings.

Of note, other factors, such as PTSD symptoms, may also serve as mediators between the sleep problem and depression/suicidality relation. Although the investigation of potential mediators in addition to ADLs was beyond the scope of the present study, the identification of additional mediators is important to fully understand the relation between sleep problems and mental health concerns and serve as potential avenues for future research.

There are some limitations to the present study. The study advertised for adults age 65 and older in the mTurk study description and on the consent form, which could have provided incentive for individuals younger than 65 to report a false age in order to participate in this paid study. It is unlikely, however, given the small monetary incentive and data check in this study. Of note, mTurk has been shown to be a valid method of recruiting older adult samples (Lemaster, Pichavavothin, & Strough, 2015) in the present study was consistent with validity checks used in past mTurk studies that have recruited older adult samples (e.g., Golding et al., 2015; Mather et al., 2012). Second, the cross-sectional nature of the present data precludes determination of temporal precedence between the relevant variables. Importantly, both directions of the mediation hypotheses were tested and statistically significant mediation only occurred in the hypothesized directions, thus providing support for the hypothesized mediational role of ADLs in the relation between sleep problems and depression and suicidal ideation. Prospective data,

however, are needed to establish the temporal precedence of the relevant variables. Past studies have investigated various putative mediators in their models of the relation between sleep problems and depression (e.g., stress; Brand, Gerber, Pühse, & Holsboer-Trachsler, 2010) as well as suicide risk (e.g., hopelessness; Woosley, Lichstein, Taylor, Riedel, & Bush, 2014). However, the present study is the first to our knowledge to examine the mediating role of ADL performance in the relation between sleep problems and depressive symptoms as well as suicidal ideation. We also only used one self-report measure to assess each domain, but utilized well-validated measures of the constructs we assessed. Lastly, although the present sample resembles the overall older adult population, the findings may not generalize to more racially diverse samples, samples with less depressive and suicidality symptomology, or non–community-dwelling samples of older adults. Future research is needed to extend these findings.

In conclusion, this is the first known study to find that the relation between insomnia and depressive symptoms is mediated by ADL impairment. Insomnia and depression often co-occur (Pigeon & Perlis, 2008), in individuals with insomnia and co-occurring depressive symptoms may be helpful in reducing depressive symptomology. Future research may examine other mediators of the insomnia depression relation.

Clinical Implications

- Practitioners treating late-life insomnia in individuals with co-occurring depressive symptoms should assess and address ADL impairment.
- Unresolved ADL deficits may impede improvement of depression symptoms in individuals receiving insomnia treatment.

Acknowledgments

The authors would like to thank the reviewers for their assistance in strengthening this study.

Funding

This work was supported in part by the Centers for Disease Control under Grant 5 R49 CE002109 to the West Virginia University Injury Control Research Center.

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