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Original Research Report

The Association between Subjective Memory Complaints and Sleep within Older African American Adults

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Abstract

Objective: The purpose of the current study is to examine the association between subjective memory complaints and sleep (quantity and quality) in African American older adults.

Method: Participants from the Baltimore Study of Black Aging (BSBA; n = 351; mean age = 71.99) completed a self-report sleep scale, subjective memory complaint scale, global cognitive status measure, and demographic questionnaire.

Results: Worse overall sleep quality was significantly associated with subjective reports of difficulty recalling the placement of objects, recalling specific facts from reading materials, and worse memory currently compared to the past. Specific sleep parameters (e.g., longer sleep latency and shorter sleep duration) were associated with negative appraisals of participants' ability to do specific tasks involving memory (e.g., difficulty recalling placement of objects). Participants classified as poor sleepers (Pittsburgh Sleep Quality Index [PSQI] total score > 5) were more likely to report worse memory now compared to the past than participants classified as good sleepers (PSQI total score ≤ 5).

Conclusions: Evaluation of sleep may be warranted when older adults, particularly African Americans, communicate concerns regarding their memory. Insufficient sleep may be a useful marker of acute daytime dysfunction and, perhaps, cognitive decline. Given memory problems are the hallmark of dementia, our findings support further evaluation of whether poor sleep can aid in the diagnosis of cognitive impairment.

Keywords: African Americans—Older adults—Sleep—Subjective memory complaints

Approximately, 25% to 88% of older adults report experiencing memory problems (Jonker, Geerlings, & Schmand, 2000; Reid & Maclullich, 2006; Sims et al., 2011). However, the literature has not clearly identified the reason(s) for these memory complaints. Some evidence suggests that memory complaints are associated with cognitive decline or risk for cognitive impairment (Dufouil, Fuhrer, & Alperovitch, 2005; Geerlings, Jonker, Bouter, Ader, & Schmand, 1999; Jorm, Christensen, Korten, Jacomb, & Henderson, 2001; Lam, Lui, Tam, & Chiu, 2005; Schmand, Jonker, Hooijer, & Lindeboom, 1996; Wang, van Belle, & Crane, 2004). Specifically, memory complaints have often been associated with worse performance on objective cognitive measures (Bassett & Folstein, 1993; Gagnon et al., 1994; Jonker et al., 2000; Lam et al., 2005), particularly cognitive screening measures, such as the Mini-Mental

State Examination (MMSE) (Folstein, Folstein, & McHugh, 1975a). Alternatively, evidence has suggested that complaints are more reflective of affective disorders more than cognitive deficits, as measured by objective measures of cognition (Ancoli-Israel, 2005; Reid & Maclullich, 2006; Zlatar, Muniz, Galasko, & Salmon, 2017). To further complicate our understanding of older adults' memory complaints, participant characteristics such as age (Larrabee & Crook, 1994; Mogle, Muñoz, Hill, Smyth, & Sliwinski, 2017; Reid & Maclullich, 2006), female gender (Crook, Feher, & Larrabee, 1992; Gagnon et al., 1994), and low levels of education (Bassett & Folstein, 1993; Jonker et al., 2000) are associated with worse appraisals of memory functioning. Memory complaints likely relate to other factors, such as sleep, which continue to be unexplored and can further improve our understanding of older adults' negative appraisals of their memory.

Sleep is a vital component of adults' health and well-being. Insufficient sleep has been associated with morbidity (Blazer, Hays, & Foley, 1995; Foley et al., 1995; Ohayon & Vecchierini, 2005), cognitive dysfunction (Blazer et al., 1995; Nebes, Buysse, Halligan, Houck, & Monk, 2009), and mortality (Kripke, Garfinkel, Wingard, Klauber, & Marler, 2002), particularly in older adults. In terms of cognitive functioning, sleep is associated with worse performance on objective measures of cognitive abilities, such as memory, (Gamaldo, Allaire, & Whitfield, 2008, 2010; Nebes et al., 2009), risk for cognitive impairment (Gamaldo, Allaire, & Whitfield, 2012; Neikrug & Ancoli-Israel, 2010), and biomarkers of dementia (Spira et al., 2013). Although limited research has focused on sleep as it relates to older adults' memory complaints, there is some evidence supporting an association between sleep disturbances and memory complaints (Kang et al., 2015; Kronholm et al., 2009). However, prior studies have often gauged memory complaints with a single question or a sum score of participants' responses across multiple questions. Likewise, prior research has typically assessed sleep quantity or a clinical categorization of good versus bad sleepers using a self-administered, standardized questionnaire (Kang et al., 2015; Kronholm et al., 2009). Further research is needed to explore how disruptions in other sleep parameters (e.g., quality and latency) relate to negative self-appraisals of memory on specific everyday tasks (e.g., recalling names, events, and objects).

There is additional value in examining how memory complaints relate to sleep among older African Americans exclusively. Currently, Africans Americans are three times more likely than their Caucasian counterparts to be diagnosed with dementia, particularly Alzheimer's disease (Dufouil et al., 2005). While some African Americans have been accurately identified as cognitively impaired, some individuals have been incorrectly classified as cognitively impaired and subjected to unnecessary stressors (Aiken-Morgan, Whitfield, & Paige, 2014; Black & Simpson, 2014). Subjective complaints often promote further clinical evaluation of cognitive status (Reid & Maclullich, 2006). In addition, diagnostic criteria for dementia, particularly Alzheimer's disease, often include subjective complaints of memory. In a prior study, however, several authors of the current study observed that the subjective memory appraisals of African Americans were associated more with psychological well-being (i.e., stress and externalized locus of control) than objective measures of cognitive deficits (Sims et al., 2011).

Considering African Americans are more often diagnosed with dementia, and subjective memory complaints may help to explain inaccurate diagnosis, it is vital to examine the underlying reasons for memory complaints within African Americans, so that subjective reports of memory difficulties do not lead to the automatic interpretation of cognitive impairment related to neurodegenerative disease. Also, given that high rates of sleep disturbances are observed in African Americans (Durrence & Lichstein, 2006), it is possible that impaired sleep may be an additional factor worth considering in explaining older African Americans' memory complaints.

Accordingly, the current study will explore three specific aims. The first aim examines the association between memory complaints and sleep (i.e., quality, latency, duration, efficiency, disturbances, use of sleep medications, and daytime dysfunction). We hypothesize that memory complaints will be associated with worse sleep. The second aim explores whether memory complaints are related to sleep after accounting for participant characteristics (i.e., age, sex, depressive symptoms, locus of control, global cognitive status) often associated with sleep and/or memory complaints. We hypothesize that memory complaints will be significantly associated with worse sleep even after for accounting for participant characteristics. The third aim is to determine whether good and bad sleepers, based upon a commonly used clinical cutoff of 6 or more for bad sleepers on the Pittsburgh Sleep Quality Index (PSQI) global score, were different in their subjective memory complaints. We hypothesize that poor sleepers will more likely have memory complaints than good sleepers.

Methods

Participants

The study sample included African American older adults living independently and enrolled in the Baltimore Study of Black Aging: Patterns of Cognitive Aging (BSBA: PCA). Participants were recruited from 29 senior housing facilities in Baltimore, MD. The inclusion criteria included being ≥50 years of age and willingness to participate in the study. Data for BSBA were collected across two different waves: 2006–2008 (Wave 1) and 2009–2011 (Wave 2). During each test session, a trained research assistant administered a 2-hr battery of sociodemographic, physical health, and mental health measures in a vacant public room in the participant's apartment building. Additional details of the BSBA study design are described in a previously published manuscript (Sims, Allaire, Gamaldo, Edwards, & Whitfield, 2009).

At the end of Wave 1 data collection, the BSBA: PCA included 602 participants (449 females and 153 males). The current study only included data collected in Wave 2 because sleep measures were introduced and administered in this follow-up wave. Out of the 450 adults who participated in Wave 2 data collection, the current study included 351 participants. Ninety-nine participants were excluded in the current study because they did not complete all the measures necessary for the current study. Compared to participants included in the current study, the participants that were excluded (n = 99) were significantly younger in age (included participants mean age = 71.99, SD = 8.91 vs. excluded participants mean age = 69.44, SD = 10.00; $t(145) = -2.29$, $p < .05$). There were no differences between the included and excluded participants in terms of education ($t(448) = 0.29$, $p > .05$), sex (χ^2 (1) = 0.44, $p > .05$), and MMSE total ($t(448) = -0.35$, $p > .05$). Among the 351 participants, the average number of chronic conditions (i.e., diabetes, cardiovascular disease, hypertension, arthritis, broken hip, stroke, heart attack, angina, circulation problems, asthma, gout, gallbladder problems, ulcers, thyroid trouble, tuberculosis, kidney trouble, and cancer) was 3.98 (SD = 2.24, range 0–11). The top three conditions that participants reported had been diagnosed by a physician were hypertension (n = 293, 85%), arthritis (n = 224, 67%), and diabetes (n = 124, 36%). A majority of participants (n = 264, 89%) diagnosed with hypertension reported they were consistently taking medication to treat their hypertension. An institutional review board approved the BSBA study and all participants provided written informed consent.

Sleep Parameters

The Pittsburgh Sleep Quality Index (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989) was used to assess sleep in the last month. The questionnaire estimates seven sleep component scores (i.e., quality, latency, duration, efficiency, disturbances, use of sleep medications, and daytime dysfunction) that are summed to provide an overall sleep quality score (global PSQI score). The global PSQI score can range from 0 (good sleep) to 21 (poor sleep). The PSQI has been shown to have good sensitivity (89.6%) and specificity (86.5%) in differentiating good and bad sleep and high correlation with the common sleep disorders (e.g., primary insomnia and sleep apnea). Consistent with prior studies (Kang et al., 2015; Saint Martin, Sforza, Barthélémy, Thomas-Anterion, & Roche, 2012) and clinical practice, a binary score was estimated by recoding any overall sleep quality scores >5 as 1 ("poor" sleeper) and any overall sleep habit scores ≤5 as 0 ("good" sleeper). This study included the global PSQI score, each of the seven component scores, and sleep classification score (good vs. poor sleepers).

Memory Complaints

The 6-item Memory Complaint Questionnaire (MAC-Q) (Crook et al., 1992) assessed participants' appraisals of their everyday memory functioning. The MAC-Q measured participants' ability to recall several tasks (i.e., a person's name just introduced to you, telephone numbers/zip codes used on a daily/weekly basis, location of objects (e.g., keys) in home/office, facts from reading materials (e.g., newspaper/magazine), items intended to be purchased at store. In addition, it consists of a global item (memory now as compared to high school) that is given more weight in the scoring of a total score for the scale. The scale has shown a satisfactory internal consistency (Cronbach's α = .57) and reliability for the total (α = 0.67) and items (α range = 0.46–0.78) (Crook et al., 1992). For each question, participants respond to the following categories: (a) much better now, (b) somewhat better now, (c) about the same, (d) somewhat poorer now, and (e) much poorer now. The MAC-Q total score reflected a potential range of 7–35, with higher scores reflecting more memory complaints. For MAC-Q items, response categories were collapsed into a binary variable of 0 (much better now, somewhat better now, and about the same) and 1 (somewhat poorer now and much poorer now). The MAC-Q total score and the memory complaint binary item scores were included in this study's analyses.

Covariates

Covariates included demographic variables, depressive symptomology, and global mental status. Demographic variables included age, sex, and education. Age was measured as a continuous variable. Sex was coded as a binary variable with 1 indicating female participants and 0 indicating male participants. Education was measured by self-report of the number of years of education attained. Depressive symptoms were assessed using the 20-item Center for Epidemiological Studies Depression (CES-D) Scale (Andresen, Malmgren, Carter, & Patrick, 1994; Teresi et al., 2002). The CES-D is commonly used in detecting depressive symptoms in older adults across diverse populations (Foley et al., 1995). Higher values on the total CES-D suggest greater depressive symptomology. Stress was measured with the Perceived Stress Scale (PSS), a widely used scale of an individual's appraisal of stressful events (Cohen, Kamarck, & Mermelstein, 1983). Higher scores on the total PSS score suggested higher levels of perceived stress. The Locus of Control (LC) 12-item scale was used to measure the amount of an individual's perceived control over life events (Rotter, 1966). Low scores reflected an individual's perception that events are attributed to their personal control (internalized locus of control). In contrast, high scores suggested that individuals are more likely to attribute events to external circumstances (externalized locus of control). Global mental status was measured using the Mini-Mental State Examination (MMSE) (Folstein, Folstein, & McHugh, 1975b). The MMSE is a commonly utilized measure of functioning across several cognitive abilities (i.e., memory, orientation, attention, calculation, language, and visuospatial skills), with higher scores suggesting better cognitive status.

Statistical Analyses

Univariate statistics were employed to characterize the participants that were included in this project. Pearson correlations were run to examine the relationship between the sleep quality parameters (overall sleep quality and each component score) and memory complaint total score. Spearman rho correlations were conducted to examine the relationship between the sleep quality parameters (overall sleep quality and each component score) and each of the memory complaint items. Utilizing a clinically relevant diagnostic score, an independent samples *t* test was conducted to assess potential differences between "good" and "poor" sleepers on the sum of memory complaints. Chi-square tests were conducted to assess sleep group ("good" vs. "poor" sleepers) differences on each binary memory complaint item. A linear regression analysis was conducted to examine whether the overall sleep quality was significantly associated with the total MAC-Q score even after accounting for age, sex, years of education, depressive symptoms, perceived stress, locus of control, and global mental status. Logistic regression analyses were conducted to examine the association between the sleep parameters (overall sleep quality and each component score) and each of the binary memory complaint items. Analyses were performed using the Statistical Package for the Social Sciences (SPSS) Version 20.

Results

Sample Characteristics

Table 1 illustrates the distribution of participant sample characteristics. The average age of the participants was 71.99 years (*SD* = 8.91, range 51–96). Participants were mostly women (77%) and had an average education of 11.52 years (*SD* = 2.88, range 3–22). On average, participants had total CES-D score of 13.00 (*SD* = 4.22; range 0–37), which is below the cutoff (CES-D score ≥ 16) for high depressive symptoms. Average MMSE total for the sample was 24.78 (*SD* = 3.08, range 11–30). Based upon the MMSE cutoff score of <24 (Folstein et al., 1975b), 235 participants (67%) would be considered cognitively unimpaired, while 116 participants (33%) would be identified as at risk for cognitive impairment. Global PSQI score ranged from 1 to 18 (mean = 7.17, *SD* = 2.94) but a majority of the participants (*n* = 250; 71%) had PSQI scores suggestive of poor sleep (PSQI Global Score > 5). Participants, on average, had a total MAC-Q score of 15.37 (*SD* = 6.33, range 7–35). Twenty-four percent of the participants (*n* = 86)

Table 1. Sample Characteristics (*n* = 351)

	n (%)	Range	Mean	*SD*
Age, years	—	51–96	71.99	8.91
Gender, female	269 (76.6)	—	—	—
Education years		3–22	11.52	2.88
CES-D total		0–37	13.00	4.22
LC total		15–84	43.46	11.36
PSS total		3–43	19.35	7.21
MMSE total		11–30	24.78	3.08
MAC-Q total		7–35	15.37	6.33
Difficulty recalling person's name	63 (17.9)			
Difficulty recalling telephone numbers/zip codes	51 (14.5)			
Difficulty recalling location of objects in home/office	62 (17.7)			
Difficulty recalling facts from reading materials	47 (13.4)			
Difficulty recalling items intended to be purchased	49 (14.0)			
Memory worse now compared to past	86 (24.5)			
PSQI Global Score		1–18	7.17	2.94
C1. Subjective sleep quality		0–3	0.69	0.69
C2. Sleep latency		0–3	0.97	0.85
C3. Sleep duration		0–3	1.13	0.93
C4. Habitual sleep efficiency		0–3	2.43	1.09
C5. Sleep disturbances		0–3	1.07	0.52
C6. Use of sleep medication		0–3	0.29	0.83
C7. Daytime dysfunction		0–3	0.59	0.94
PSQI Category Groups				
Good Sleepers (Global Score ≤5)	101 (28.8)			
Bad Sleepers (Global Score >5)	250 (71.2)			

Note: CES-D = Center for Epidemiological Studies Depression Scale; LC = Locus of Control Scale; PSS = Perceived Stress Scale; MMSE = Mini-Mental State Examination; MAC-Q = Memory Complaints Questionnaire; PSQI = Pittsburgh Sleep Quality Index. C1 is the PSQI Component 1. C2 is the PSQI Component 2. C3 is the PSQI Component 3. C4 is the PSQI Component 4. C5 is the PSQI Component 5. C6 is the PSQI Component 6. C7 is the PSQI Component 7.

reported their memory was worse now compared to the past. Both recalling a person's name just introduced to you (18%) and recalling location of objects (e.g., keys) in home/office (18%) had the highest percent of participants reporting difficulties with these abilities.

Sleep as it Relates to Memory Complaints

Correlations indicated that worse overall sleep quality, as reflective of the PSQI global score, was significantly associated with reports of increased difficulty recalling the placement of objects in the home/office and retrieving specific facts from reading materials (e.g., newspaper/magazine; Table 2). However, worse overall sleep quality was not significantly associated with MAC-Q total score. Several of the PSQI component scores were significantly associated with the memory complaints items and MAC-Q total score. Specifically, worse sleep quality was associated with difficulty recalling the placements of objects in the home/office and worse memory now compared to the past. Poor sleep latency was associated with a higher MAC-Q total, difficulty recalling the placements of objects in the home/office, and difficulty recalling specific facts from reading materials. Shorter sleep duration was associated with a higher MAC-Q total and worse memory now compared to the past. Lastly, greater daytime dysfunction was associated with worse memory now compared to the past.

The hierarchical regression analysis revealed that worse overall sleep quality was not significantly associated with total MAC-Q total ($\beta = 0.10$, $SE = 0.12$, $p > .05$), even after adjusting for covariates ($F(8, 342) = 4.39$, $p < .001$; Table 3). Logistic regression analyses suggested that each one-unit increase in the PSQI global score was associated with an increase in the odds of participants reporting a difficulty recalling the placement of objects in the home/office (odds ratio [OR] = 1.12; 95% confidence interval [CI]: 1.02–1.24), remembering specific facts from reading materials (OR = 1.16, CI: 1.02–1.24), and worse memory now as compared to the past (OR = 1.10, CI: 1.01–1.21; Table 4), even after adjusting for covariates in the model. Among the PSQI component scores, a one-unit increase in poor sleep latency was associated with an increased likelihood of participants reporting a difficulty recalling the placements of objects in the home/office (OR = 1.62, CI: 1.11–2.37; Table 5), even after adjusting for the covariates. A one-unit increase in insufficient sleep duration was also associated with an increased likelihood of participants reporting worse memory now compared to the past (OR = 1.41, CI: 1.04–1.91), even after adjusting for covariates. The other memory complaint items were not significantly associated with the PSQI sleep components.

Only one significant difference was observed between clinically relevant groups of good and poor sleepers (Table 6). Within the poor sleeper group, a larger percentage of individuals (28%) reported worse memory now as compared to the past than the good sleeper group (17%; $X^2(1) = 4.51$, $p < .05$). No other differences between good and poor sleepers were observed for the MAC-Q total score or the other memory complaint items.

Conclusion

To our knowledge, our study is the first to examine and observe an association between sleep and self-rated memory for objects and specific facts. Sleep parameters were more highly correlated with specific memory trait items than the MAC-Q total score. Worse overall sleep quality was significantly associated with subjective reports of difficulty recalling the placement of objects, recalling specific facts from reading materials, and worse memory currently compared to the past. More specifically, poor (longer) sleep latency was associated with difficulty recalling the placement of objects. In addition, poor (shorter) sleep duration was associated with worse memory now compared to the past.

Table 2. Relationship Between Subjective Memory Complaints and Sleep Parameters ($n = 351$)

	Memory complaint items[a]						MAC-Q
	Person's name	Telephone/Zip codes	Objects	Specific facts	Purchasing items	Memory now vs. past	Total[b]
PSQI components							
Sleep quality	−0.02	0.04	0.12*	0.09	0.08	0.15**	0.07
Sleep latency	0.05	0.06	0.19**	0.12*	0.06	0.11*	0.12*
Sleep duration	0.07	0.08	0.10	0.10	0.10	0.15**	0.11*
Sleep efficiency	−0.06	−0.08	0.04	0.04	−0.02	−0.07	−0.06
Sleep disturbances	0.01	−0.01	−0.00	0.09	−0.02	0.05	0.03
Sleep medicine	−0.10	−0.07	0.04	0.06	−0.07	−0.01	−0.03
Daytime dysfunction	0.03	0.03	0.01	0.07	0.00	0.14**	0.10
PSQI Global Score	−0.07	0.01	0.14**	0.16**	0.04	0.14**	0.09

Note: PSQI = Pittsburgh Sleep Quality Index.
*$p < .05$. **$p < .01$. [a]Spearman rho correlations conducted to examine association between the memory complaint item and sleep measure. [b]Pearson correlations conducted to examine association between memory complaint total and sleep measures. MAC-Q represents the Memory Complaint Questionnaire.

Utilizing a common PSQI classification of sleep groups, "poor sleepers" were more likely than "good sleepers" to report worse memory now compared to the past. Although the amount of memory complaints (MAC-Q total) was not significantly associated with overall sleep quality and could not differentiate good and poor sleepers, we did observe that a greater amount of memory complaints was associated with poor (longer) sleep latency and (shorter) sleep duration. These findings are partially supported by Kronholm and colleagues, who observed negative memory appraisals among individuals reporting short (≤6 hr) and long (>8 hr) sleep durations (Kronholm et al., 2009).

Table 3. Hierarchical Linear Regression Analysis for the Association Between MAC-Q Total and Overall Sleep Quality

	Model 1		Model 2	
	β	*SE*	β	*SE*
PSQI Global Score	0.09	0.12	0.10	0.12
Covariates				
Age			0.03	0.04
Sex			−0.15**	0.80
Education			−0.01	0.12
CES-D			−0.06	0.09
LC			0.17**	0.03
PSS			0.16*	0.06
MMSE			−0.18**	0.11
R^2		0.01		0.09
ΔR^2				0.08

Note: CES-D = Center for Epidemiological Studies Depression Scale; LC = Locus of Control Scale; PSS = Perceived Stress Scale; MMSE = Mini-Mental State Examination; MAC-Q = Memory Complaints Questionnaire; PSQI = Pittsburgh Sleep Quality Index.
*$p < .05$. **$p < .01$. MAC-Q represents the Memory Complaint Questionnaire. Model 1 represents the model unadjusted for covariates. Model 2 represents the model adjusted for covariates.

A potential explanation for why sleep latency and duration were uniquely associated with memory complaints could be attributed to the high likelihood that older adults recognize and report these types of sleep disturbances. Older adults often complain of poor sleep latency (trouble falling asleep), which is likely to influence their perception of obtaining inadequate sleep duration (Foley et al., 1995; Neikrug & Ancoli-Israel, 2010). In fact, trouble falling asleep is one of the symptoms associated with insomnia, a sleep disorder highly prevalent in older adults (Ancoli-Israel, 2005; Neikrug & Ancoli-Israel, 2010).

Our findings did not support a prior result illustrating a significant difference between good and poor sleepers in the amount of memory complaints (Kang et al., 2015). Saint Martin and colleagues also did not observe a significant difference between good and poor sleepers on subjective report of cognitive difficulties, particularly for memory and attention, on several tasks everyday functioning (Saint Martin et al., 2012). A potential explanation for the inconsistencies across the studies is that the measures of subjective memory complaints varied across the studies. Although each study included a reliable and valid measure, the number and types of questions were different across the utilized measures. The current study used a 7-item scale designed to assess an adult's perception of their memory abilities. However, Saint Martin and colleagues (2012) used a 26-item subjective scale designed to assess an adult's perception of memory and attentional difficulties. Consistent with the current study, Kang and colleague (2015) used a scale designed to measure subjective memory complaints; however, the scale included several additional test items including additional measures of global judgment of memory function. Thus, the current study's memory complaint scale may not have included some everyday tasks perceived to be problematic due to memory difficulties, particularly for the poor sleepers.

Table 4. Odds Ratios (95% Confidence Interval) of Complaint on Memory Questionnaire Item Based Upon Overall Sleep Quality and Covariates

	Memory compliant items					
	Person's name	Telephone/zip codes	Objects	Specific facts	Purchasing items	Memory now vs. past
PSQI Global Score	1.05 (0.94–1.16)	1.03 (0.89–1.13)	1.12 (1.02–1.24)*	1.16 (1.04–1.30)**	1.07 (0.95–1.20)	1.10 (1.01–1.21)*
Covariates						
Age	1.01 (0.97–1.04)	1.00 (0.96–1.03)	1.01 (0.97–1.04)	1.00 (0.96–1.03)	1.02 (0.98–1.06)	1.03 (0.99–1.06)
Sex	0.41 (0.21–0.78)**	0.54 (0.27–1.07)	1.11 (0.54–2.27)	0.47 (0.22–0.98)*	0.37 (0.18–0.75)**	0.82 (0.44–1.53)
Education	1.05 (0.94–1.17)	1.00 (0.89–1.12)	0.94 (0.84–1.05)	1.07 (0.94–1.21)	0.96 (0.85–1.08)	1.02 (0.93–1.13)
CES-D	0.94 (0.87–1.03)	1.00 (0.92–1.08)	0.97 (0.91–1.05)	0.99 (0.92–1.07)	0.94 (0.86–1.03)	0.99 (0.93–1.05)
LC	1.03 (1.00–1.06)*	1.02 (0.99–1.06)	1.04 (1.01–1.07)**	1.04 (1.00–1.07)*	1.04 (1.01–1.07)*	1.02 (0.99–1.05)
PSS	1.02 (0.97–1.07)	1.04 (0.99–1.10)	1.05 (1.00–1.10)	1.05 (1.00–1.11)	1.05 (1.00–1.11)	1.06 (1.01–1.10)*
MMSE	0.84 (0.76–0.93)**	0.89 (0.80–0.98)*	0.92 (0.84–1.02)	0.89 (0.79–0.99)*	0.87 (0.78–0.98)*	0.88 (0.80–0.96)**

Note: CES-D = Center for Epidemiological Studies Depression Scale; LC = Locus of Control Scale; PSS = Perceived Stress Scale; MMSE = Mini-Mental State Examination; PSQI = Pittsburgh Sleep Quality Index.
*$p < .05$. **$p < .01$.

Table 5. Odds Ratios (95% Confidence Interval) of Complaint on Memory Questionnaire Item Based Upon Sleep Components and Covariates

	Memory compliant items					
	Person's name	Telephone/zip codes	Objects	Specific facts	Purchasing items	Memory now vs. past
PSQI components						
Sleep quality	0.80 (0.48–1.35)	1.00 (0.59–1.69)	1.26 (0.77–2.04)	0.95 (0.55–1.63)	1.37 (0.79–2.39)	1.26 (0.81–1.96)
Sleep latency	1.21 (0.82–1.77)	1.24 (0.83–1.85)	1.62 (1.11–2.37)*	1.29 (0.84–1.97)	1.13 (0.74–1.73)	1.24 (0.88–1.75)
Sleep duration	1.35 (0.96–1.90)	1.28 (0.90–1.83)	1.28 (0.91–1.80)	1.30 (0.90–1.89)	1.36 (0.94–1.98)	1.41 (1.04–1.91)*
Sleep efficiency	0.97 (0.75–1.26)	0.84 (0.65–1.10)	1.10 (0.82–1.48)	1.19 (0.85–1.68)	1.01 (0.74–1.36)	0.87 (0.69–1.10)
Sleep disturbances	1.28 (0.65–2.48)	0.78 (0.38–1.58)	0.57 (0.29–1.12)	1.14 (0.56–2.31)	0.77 (0.36–1.67)	0.71 (0.39–1.30)
Sleep medicine	0.61 (0.36–1.06)	0.72 (0.44–1.18)	1.03 (0.72–1.48)	1.12 (0.77–1.62)	0.68 (0.39–1.18)	0.88 (0.62–1.23)
Daytime dysfunction	1.24 (0.89–1.73)	1.09 (0.76–1.55)	0.94 (0.67–1.32)	1.18 (0.82–1.68)	1.05 (0.72–1.53)	1.29 (0.97–1.72)
Covariates						
Age	1.01 (0.97–1.04)	1.00 (0.96–1.03)	1.01 (0.97–1.04)	1.00 (0.96–1.03)	1.02 (0.98–1.06)	1.02 (0.99–1.06)
Sex	0.40 (0.20–0.78)**	0.58 (0.28–1.19)	1.36 (0.63–2.92)	0.47 (0.22–1.03)	0.43 (0.21–0.91)*	0.89 (0.46–1.72)
Education	1.04 (0.93–1.16)	0.99 (0.88–1.12)	0.92 (0.81–1.04)	1.07 (0.94–1.21)	0.95 (0.84–1.09)	1.02 (0.92–1.14)
CES-D	0.94 (0.87–1.02)	0.99 (0.91–1.07)	0.98 (0.91–1.05)	1.00 (0.92–1.07)	0.93 (0.85–1.02)	0.97 (0.91–1.03)
LC	1.03 (1.00–1.06)	1.02 (0.99–1.05)	1.04 (1.01–1.07)*	1.04 (1.00–1.07)*	1.03 (1.00–1.07)*	1.02 (0.99–1.04)
PSS	1.02 (0.97–1.07)	1.05 (0.99–1.11)	1.06 (1.01–1.12)*	1.05 (1.00–1.12)	1.06 (1.01–1.13)*	1.07 (1.02–1.12)**
MMSE	0.84 (0.75–0.94)**	0.89 (0.80–0.99)*	0.92 (0.83–1.02)	0.89 (0.79–0.99)*	0.87 (0.77–0.97)*	0.88 (0.80–0.96)**

Note: CES-D = Center for Epidemiological Studies Depression Scale; LC = Locus of Control Scale; PSS = Perceived Stress Scale; MMSE = Mini-Mental State Examination; PSQI = Pittsburgh Sleep Quality Index.
*$p < .05$. **$p < .01$.

Table 6. Differences Between Good and Poor Sleepers on Total Number of Memory Complaints and Memory Complaint Items

	Good sleepers $n = 101$	Poor sleepers $n = 250$	Statistic
MAC-Q total	14.67 (5.84)	15.65 (6.50)	$t(349) = -1.32$, $p > .05$
Memory complaint items			
Difficulty recalling person's name ($n = 63$)	16 (15.8)	47 (18.8)	$X^2(1) = 0.43$, $p > .05$
Difficulty recalling telephone numbers/zip codes ($n = 51$)	13 (12.9)	38 (15.2)	$X^2(1) = 0.31$, $p > .05$
Difficulty recalling location of objects in home/office ($n = 62$)	15 (14.9)	47 (18.8)	$X^2(1) = 0.77$, $p > .05$
Difficulty recalling facts from reading materials ($n = 47$)	9 (8.9)	38 (15.2)	$X^2(1) = 2.45$, $p > .05$
Difficulty recalling items intended to be purchased ($n = 49$)	10 (9.9)	39 (15.6)	$X^2(1) = 1.95$, $p > .05$
Memory worse now compared to past ($n = 86$)	17 (16.8)	69 (27.6)	$X^2(1) = 4.51$, $p < .05$

Note: MAC-Q represents the Memory Complaint Questionnaire. Numbers for MAC-Q total reflect mean and (standard deviation). Numbers for Memory Complaint Items reflect frequencies and (percentages).

Another explanation for the discrepancies in results is that our sample's average number of memory complaints was 15.37, which is much lower than prior studies with averages ranging from 24.3 (Reid & Maclullich, 2006) and 26.1 (Minett, Dean, Firbank, English, & O'Brien, 2005). Several of the current study's coauthors published a study on memory complaints in older African Americans from BSBA Wave 1 data collection. In this study, the sample had an average MAC-Q total of 11.73, which is slightly less than the current sample's average (Sims et al., 2011). Given our prior study and the current study observed relatively low number of memory complaints within older African Americans, this possibly supports that African Americans may be less inclined to vocalize concerns regarding their memory or to perceive mild memory concerns as problematic. To our knowledge, research has not explored the nature of subjective memory complaints in African Americans, specifically. Further research is needed to examine the underlying reasons African Americans may be less likely to have or communicate memory concerns. Another potential rationale for our findings is that not all of the items included in the memory complaint total score are relevant and/or of concern for some African Americans. Thus, it might be necessary to look at older African American adults' responses to each of the

specific memory complaint items rather than just a sum of the responses across the items. As observed in the current study, the reports of concern varied across the memory complaint items. Specifically, poor sleep was associated with memory for objects and specific facts, but not memory for names, telephone/zip codes, or items intended to be purchased. These findings may suggest the possibility that memory for objects or specific facts is more salient than names, phone numbers, zip codes, purchasable items in our sample, especially considering the latter group of items can be more easily recalled through memory aids (e.g., use of an address book or grocery lists). Lastly, this finding may further indicate a revised scale is needed to better account for older African Americans' perceptions of their memory efficacy.

There are limitations of the current study worth discussing. The first study limitation is that the current study uses a cross-sectional design, which limits our conclusions regarding the directionality of the associations between sleep and memory complaints. Thus, a follow-up longitudinal study will be useful in further expanding upon the current findings to determine whether worse sleep increases the likelihood of memory complaints or whether memory complaints leads to worse sleep as a result of participants ruminating about memory deficits near bedtime. It is likely that the current sample included individuals with diagnosable cognitive impairment. The second study limitation is that adults in our sample were not excluded if they met the MMSE cutoff for the risk of cognitive impairment. Our regression models adjusted for MMSE total scores to account for cognitive status but it is possible that these results may look different with a strictly cognitively unimpaired sample. The current sample was included to account for an ecologically-valid representation of community-dwelling, older African Americans without a formal clinical diagnosis of cognitive impairment, but likely exhibit interindividual differences on objective cognitive measures. The third study limitation is that the MAC-Q may not be accurately measuring participants' ability to successfully complete tasks of everyday functioning that rely on their memory abilities. While the MAC-Q is a commonly utilized measure of participants' appraisal of their memory abilities (Crook et al., 1992), it is possible that participants' perceptions of the memory capabilities are inconsistent with their ability to complete performance-based tasks of memory. The fourth study limitation is the inclusion of a subjective sleep measure. The current study included the PSQI, a commonly used and validated subjective scale of poor sleep quality. However, it is possible that memory complaints may not be associated with sleep parameters (e.g., latency and duration) when more objective sleep measurements are utilized, such as actigraphy or polysomnography. Subjective and objective sleep measures tend to correlate poorly (Landry, Best, & Liu-Ambrose, 2015; Van Den Berg, Van Rooij, &Vos, 2008; Williams, Kay, Rowe, & McCrae, 2013). Williams and colleagues (2013) suggested that the discrepancies between objective and subjective sleep measurements, particularly for older adults, may be reflective of negative mood/emotion. The inclusion of objective sleep measurements in future investigations could account for sleep parameters (e.g., sleep fragmentation and brain waveforms) and disorders (e.g., sleep apnea) that are difficult to measure with the PSQI. There is evidence to suggest sleep disorders, medications likely to influence sleep, negative mood/emotion, pain, comorbid health conditions, neurodegenerative disease, or combination of these issues may explain why poor sleep is associated with cognitive dysfunction (Crowley, 2011). Given some of these health issues are modifiable, additional research in this area could lead to the development of intervention programs designed to address older adults' concern regarding their memory. The fifth study limitation is that the findings may not be generalizable to other segments of the population due to selection of participants strictly from Baltimore, Maryland. Finally, although we conducted a number of statistical tests within and across models, these were based on specific research hypotheses established a priori. Nevertheless, additional studies are greatly needed to further confirm the significant pattern of results in this understudied research area.

Unlike many of the prior studies, the current study adds to the current literature by exploring how various sleep parameters relate to specific tasks involving memory. By incorporating this approach into the current study, our results suggest that a restricted inclusion of sleep and memory complaint parameters is likely to mask potential significant associations. From a clinical perspective, our study adds to the existing literature by further confirming that poor sleep may be another key correlate of memory complaints. While we acknowledge that the current study was not designed to adequately disentangle the underlying reason(s) for the association between sleep and memory complaints, our study does suggest that evaluating sleep may be useful in identifying cognitive dysfunction in older African Americans. Further research is needed to determine the directionality of the sleep and memory complaint relationship. Despite this recommendation for additional research, the current study's findings support that sleep should be evaluated when older adults communicate their concerns regarding their memory.

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Conflict of Interest

The authors have indicated no financial conflicts of interest.

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