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Are Age-Related Changes in Sleep Magnified in Individuals with Depressive Symptoms?

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ARE AGE-RELATED CHANGES IN SLEEP MAGNIFIED IN INDIVIDUALS WITH DEPRESSIVE SYMPTOMS?

A Thesis Presented

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ABSTRACT

Across the lifespan, sleep becomes shorter, lighter, and more prone to disturbances (Campbell & Murphy, 2007; Ohayon, Carskadon, Guilleminault, & Vitiello, 2004). Additionally, the majority of depressed individuals experience sleep problems (e.g., Tsuno, Besset, & Ritchie, 2000). The present study examined main and interactive effects of age and depressive symptoms on sleep outcomes in a sample of 119 individuals (53 younger; 66 older) with and without depressive symptoms. Understanding how age affects sleep quality in individuals with depressive symptoms has implications for optimal treatment and prevention strategies at different stages in life. Results showed that greater depressive symptoms were significantly associated with poorer overall sleep quality ($p < .01$) and two components of sleep quality, namely daytime dysfunction ($p < .01$) and sleep disturbance ($p < .05$). Age was a significant predictor of sleep duration ($p < .05$). No significant interaction effects were found between age and depressive symptoms on sleep outcomes. The lack of age-related effects was surprising and reasons why age-related effects were not found are discussed.

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CHAPTER I

INTRODUCTION

Sleep problems are prevalent in the general population (e.g., Stewart et al., 2006; Breslau, Roth, Rosenthal, & Andreski, 1996; Foley et al., 1995) but are especially problematic for persons suffering from depression. For example, a recent review of research on sleep problems in depressed persons found that poor sleep quality is present in approximately 50 to 90 percent of depressed individuals (Tsuno, Besset, & Ritchie, 2005). In fact, sleep problems are such a common feature in depression that they constitute a part of the DSM-IV diagnostic criteria for a Major Depressive Episode (APA, 2005). Sleep problems, such as insomnia, also are associated with decreased quality of life and increased risk for future psychiatric illness (e.g., Neubauer & Smith, 2006; Koch, Haesler, Tiziani, & Wilson, 2006; Taylor, Lichstein, Durrence, Reidel, & Busch, 2005; Foley, et al., 1995).

Thus, sleep problems and depression are highly related (Neubauer & Smith, 2006; Tsuno, Besset, & Ritchie, 2005; Rao et al., 2005; Buysse, 2004; Breaslau, Rosenthal, & Andreski, 1996; Pilcher & Huffcutt, 1996), and appear to affect each other in a bi-directional manner (Buysse, 2004), with depression increasing the risk for sleep problems, and sleep problems increasing the risk for depression. Since there are robust age-related differences in sleep architecture and sleep problems (Campbell & Murphy, 2007; Ohayon, Carskadon, Guilleminault, & Vitiello, 2004), it is possible that age moderates the association between depression and sleep.

Determining differential effects of depression on sleep problems for older and younger adults is important. Research along these lines has implications for developing age-appropriate treatment and prevention strategies for depressive episodes. The current study will extend the literature on the association between

depression and sleep by comparing dimensions of sleep quality in younger and older adults with a range of depressive symptoms. Thus, it will provide an important initial step towards understanding how sleep is disrupted in younger and older adults with depressive symptoms.

Age-related Changes in Sleep

To understand sleep problems that accompany depressive symptoms in younger and older adults, it is important to first consider naturally occurring changes in sleep with age because they may be mirrored in the type of sleep problems experienced by depressed persons. Age-related changes in sleep architecture are well documented (Campbell & Murphy, 2007; Ohayon, Carskadon, Guilleminault, & Vitiello, 2004). Older age is associated with early morning awakening, decreased REM sleep latency, decreased total sleep time, decreased sleep efficiency (i.e., amount of time in bed spent sleeping), decreased slow-wave sleep (deep sleep), and an increase in time awake after sleep onset during the night (Ohayon, Carskadon, Guilleminault, & Vitiello, 2004). In other words, older age is related to a shorter, lighter, and more disturbed sleep. Thus, not surprisingly, older adults also experience more sleep disorders, such as insomnia, than younger adults (Buysse, 2004).

Despite the propensity for shorter and less efficient sleep, older adults do not appear to suffer from excessive sleepiness in the daytime. In fact, although older and younger adults tend to nap at different times of the day, the duration of naps do not appear to differ with age (Yoon, Kripke, Youngstedt, & Elliott, 2003). This suggests that even though older adults experience shorter and lighter nighttime sleep, they do not spend more time napping than do younger adults (Campbell & Murphy, 2007). Thus, older adults may be able to adjust to the changes in sleep so that they do not affect their feelings of sleepiness during the daytime. In fact, younger adults have

been found to experience more daytime sleepiness than healthy older adults (Levine, Roehrs, Zorick, & Roth, 1988). This suggests that younger adults are not immune to sleep problems, and may perhaps be more sensitive to disturbed sleep with regard to daytime dysfunction. Overall, in summary, there is clear evidence that sleep changes with age and that sleep problems are different in younger and older adults, with older adults having more problems maintaining and initiating sleep, and younger adults showing more daytime sleepiness.

Thus, it seems reasonable to expect that age might play an important role in the association between depression and sleep problems. To compare sleep characteristics in older and younger depressed individuals, it is also important to consider age-related differences in the presentation and experience of depression. These differences may also help understand potential age-related effects in how depression affects sleep.

Age-related Differences in Depression

Depressive symptomatology is manifested differently across the lifespan and younger and older adults tend to seek help for different kinds of depressive symptoms. The most robust difference between depressed younger and older adults appears to be in the presentation of somatic complaints (e.g., Nguyen & Zonderman, 2006; Kim, Pilikonis, Frank, Thase, & Reynolds, 2002). For example, older adults present with more somatic symptoms and anxiety, and are less likely to report a depressed mood or feelings of low self-esteem than younger adults (King & Markus, 2000). Furthermore, item analysis of depression measures, such as the Beck Depression Inventory (BDI), show further evidence of age-related differences in somatic symptom presentation in depressed individuals. Kim and colleagues (2002) found that depressed older adults reported more somatic symptoms and fewer

cognitive symptoms on the BDI than depressed middle-aged adults. Older adults also reported disturbed sleep more frequently than the middle-aged individuals. Since sleep problems are a common somatic complaint in depression, and there are age-related differences in somatic complaints, older adults with depression may exhibit more sleep problems relative to younger depressed persons.

Sleep Problems in Depression: Age Effects

While a large body of research has studied sleep in individuals experiencing depressive symptoms (e.g., Mayers & Baldwin, 2006; Tsuno, Besset & Ritchie, 2005; Fava, 2004; Jensen 2003; Rodin, McAvay & Timko, 1998), few studies have examined age-related differences on sleep variables. However, there is some evidence for age-related differences in sleep architecture in depressed individuals (Lauer, Riemann, & Berger, 1991). Specifically, sleep efficiency, sleep period time, and REM sleep latency showed a more rapid decrease in older depressed individuals compared to depressed younger adults and non-depressed controls. These results suggest that the sleep changes seen in the depressed older adults may represent an augmentation of normal sleep changes seen with older age. Specifically, the shorter and lighter sleep seen with normal aging appears to be greater in depressed older adults. Furthermore, there was a faster increase in time awake after sleep onset as the age of depressed individuals increased, compared with the non-depressed controls. This finding may be due to the higher propensity for sleep disorders, such as insomnia, associated with older age.

Studies that examined self-reported sleep problems in depressed individuals have indicated some evidence that older adults are more likely to experience early morning awakenings and intermittent insomnia, relative to younger and middle-aged adults (Lauer, Riemann, & Berger, 1991). In contrast, depressed younger adults

appear to experience more hypersomnia than depressed older adults (Husain et al., 2005). These findings are consistent with results presented by Lauer and colleagues (1991) mentioned above, which suggests that sleep complaints seen in younger and older adults mimic the age-related differences in sleep seen across the lifespan. In other words, the depressed older adults were experiencing sleep problems associated with age-related changes in sleep, such as a shorter sleep duration and insomnia. Conversely, the depressed younger adults experienced an increased need for sleep.

Significance

Since sleep changes in the context of depression and aging, it is relevant to ask how age and depression may interact to affect sleep. This work is important because differences in sleep problems for younger and older individuals with depressive symptoms may reveal age-related sleep symptoms that can be differentially targeted in treatment. A recent review of sleep and depression found that disturbed sleep is one of the most important predictors of an initial depressive episode, and disturbed sleep has also been suggested to be a valuable predictor of relapse (Tsuno, Besset, & Ritchie, 2005). Thus, interventions targeted towards sleep problems experienced by younger and older adults with depressive symptoms might be important for relapse prevention. For example, educating depressed individuals about the role of sleep as a risk factor for depression could aid in preventing a new depressive episode. Additionally, good sleep hygiene could be taught to depressed individuals, as well as educating them about the beneficial effects of physical activity on sleep and mood (e.g., Koch, Haesler, Tiziani, & Wilson, 2006). Finally, learning about age-related differences in sleep could add to the present knowledge of the characteristics of depression and may potentially influence diagnosis.

Understanding how age relates to mood and sleep could also have important implications for non-depressed individuals. Previous research has suggested that the mood of younger adults may be more negatively affected by disturbed sleep than older adults. For example, Brendel and colleagues (1990) found that the mood of younger adults was more negatively affected by sleep deprivation than the mood of older adults. These results suggest that sleep problems may have the potential to trigger negative mood to a greater extent in younger than older adults. Thus, younger adults may be particularly vulnerable to mood disruptions if they are experiencing poor sleep quality, and may therefore have a greater risk for developing a first-time depressive episode. In fact, older and younger adults may have different emotional reactions to sleep. The mood of younger adults appears to be more sensitive to sleep duration than the mood of older adults. In a recent study, younger adults were found to experience the lowest levels of negative mood following sleep duration of 7-8 hours. However, when sleep duration exceeded 7-8 hours, negative mood increased. Thus, it appears as though younger adults may not benefit from unlimited sleep and may in fact experience an increase in negative mood following sleep that exceeds 7-8 hours. Conversely, the mood of older adults did not appear to be negatively affected by longer sleep duration. Instead, an increase in sleep duration longer than 5 hours was associated with a steady decrease in negative mood (Ready, Marquez & Akerstedt, under review). Thus, it appears as though longer sleep duration is beneficial for decreasing negative mood in older adults. In addition, it does not appear that too much sleep (beyond 7-8 hours) is associated with an increase in negative mood in older adults.

The Current Study

The current study is one of the first to examine sleep quality in younger and older adults with a range of depressive symptoms. Sleep quality was assessed with the Pittsburgh Sleep Quality Index (PSQI), which provides an overall score of sleep quality, as well as scores for individual components of sleep quality (e.g., sleep efficiency, daytime sleepiness). With regard to overall sleep quality, considering the high incidence of sleep problems in depressed individuals (Tsuno, Besset, & Ritchie, 2005), it was hypothesized that the individuals experiencing clinically significant depressive symptoms would experience worse sleep quality than the individuals without depressive symptoms. Thus, we predicted a main effect of depression on overall sleep quality. In addition, since sleep becomes shorter and lighter, more prone to disturbances, and more disordered with age we expected a main effect of age on overall sleep quality (Ohayon, Carskadon, Guilleminault, & Vitiello, 2004; Buysse, 2004). Finally, and most important, we expected age to moderate the effects of depression on sleep problems, such that the older individuals with depressive symptoms would report the poorest overall sleep quality compared to younger depressed persons and controls.

In addition to overall sleep quality, the current study also examined age-related differences in specific components of sleep quality (i.e., sleep efficiency, daytime dysfunction, sleep duration, and sleep disturbances) in younger and older adults with depressive symptoms. It was hypothesized that younger and older adults with depressive symptoms would experience problems in different dimensions of sleep quality. Specifically, it was hypothesized that the normal age-related changes in sleep would be magnified in older and younger adults with depressive symptoms. Consistent with previous research, older adults with depressive symptoms were

expected to have the most sleep disturbances (e.g., waking up during the night) and decreased sleep efficiency. In contrast, younger adults with depressive symptoms would experience the most daytime sleepiness and have longer sleep duration (Husain et al., 2005; Lauer, Riemann, & Berger, 1991).

CHAPTER II

METHOD

Participants

Data for this study were gathered from a larger study investigating how depressive symptoms affect recall for autobiographical events in younger and older adults. Data collection began in fall of 2005 and was completed in 2006. Participants were 67 younger adults and 70 older adults. The younger adults ranged in age from 18 to 25 years old, and the older adults were 65 years and older. The older adults were recruited from the western Massachusetts area through posters, fliers, advertising in newspapers, and talks at various community organizations. Furthermore, individuals from an IRB approved participant pool of over 100 older adults were contacted for participation. The younger adults are University of Massachusetts undergraduate students recruited through an online sign-up for Psychology experiments, and advertisements on campus and in the community. The inclusion criteria required participants to be in relatively good self-reported health, have the ability to travel to the campus for participation in the study, and have the ability to participate in computerized testing. Exclusion criteria included a current or past neurologic illness, current or past psychiatric diagnoses besides depression, and current or past diagnosis of substance abuse or dependence. The older adults were reimbursed $15 for participation and the undergraduate students received 3 extra credit points upon completion of the study.

Procedure

The younger adults were initially assessed for depressive symptoms with the Zung Self-Rating Depression (SDS) Scale through an online prescreening. All participants, including the younger adults, were screened for depressive symptoms

over the telephone by using the short version of the Center for Epidemiologic Studies Depression Scale (CESD-10, Andresen, Malmgren, Carter, & Patrick, 1994). A score of 10 or above was considered to show moderate signs of depression, and a score of 9 or below was considered to show mild or absent symptoms of depressive symptoms.

All participants signed an IRB approved consent form before taking part in the study. As a part of data collection for the larger study at our university Memory, Mood, and Aging laboratory, each participant completed a series of sleep questionnaires and was interviewed by an undergraduate research assistant regarding depressive symptoms.

Measures

Zung Self-Rating Depression (SDS) Scale

The Zung SDS was used as an initial assessment of depressive symptoms through an online prescreening of the younger adults. The Zung SDS is a 20-item self report measure of depression, and the possible range of scores is 20-80. A score of 60 and above is thought to indicate moderate depressive symptoms (Zung, 1965).

Center for Epidemiological Studies Depression Scale Short (CESD-10)

The CESD-10 (Andresen, Malmgren, Carter, & Patrick, 1994) was used to screen participants for depressive symptoms over the telephone before initial entry to the study. A score of 10 or greater was considered to reflect moderate depressive symptoms. The CESD-10 is a short version (10 items) of the Center for Epidemiological Studies Depression Scale (CESD). The CESD-10 includes selected items from the four domains that make up the original CESD scale, namely, depressed affect, positive affect, somatic complaints, and interpersonal problems. The CESD-10 assesses current state and asks for the occurrence of symptoms during the past week. Responses are rated on a 4-point (0 = rarely or none of the time, less than

1 day; 3 = all of the time, 5-7 days) scale. The CESD-10 has been shown to correlate highly with the original CESD (*r* ranging from .88-.95), indicating a high degree of agreement between the versions. The CESD-10 demonstrates strong internal consistency reliability (α= .76 to .80) (Kohut, Berkman, Evans, & Cornoni-Huntley, 1993). The possible range of scores on the CESD-10 is 0-30.

Center for Epidemiological Studies Depression Scale (CESD)

The CESD was used to assess depressive symptoms and was administered and scored by undergraduate research assistants. The CESD was designed for research purposes and it is a self-report index of depressive symptoms (Radloff, 1977). It consists of 20 items that assess depressed mood, feelings of guilt and worthlessness, feelings of helplessness and hopelessness, loss of energy, and sleep and appetite disturbances (Radloff & Teri, 1986). The CESD is designed to assess a participant's current symptoms and asks how often each symptom occurred during the past week. Responses are rated on a 4-point scale (0 = rarely or none of the time, less than 1 day; 3 = most or all of the time, 5-7 days). The possible range of scores on the CESD is 0-60. The CESD has been found to measure four factors of depression; depressed affect, positive affect, somatic complaints, and interpersonal problems (Kohut, Berkman, Evans, & Cornoni-Huntley, 1993). Two split-half correlations found the CESD to have high internal consistency reliability (.85 to .92) (Radloff, 1977). The average two-week test-retest reliability is .57; this moderate to low score is expected because the scale measures a current state and depression is thought to fluctuate over time (Radloff, 1977).

Pittsburgh Sleep Quality Index (PSQI)

The PSQI is a self-report measure of sleep quality. The scale was developed to discriminate between "good" and "poor" sleepers, to be easily interpreted by

clinicians and researchers, and to assess a variety of sleep disturbances that are thought to affect sleep quality. The scale asks about participants' sleep during the past month and the participant estimates his/her average bedtime, sleep latency, time of rising in the morning, and number of hours slept. Responses to the remaining questions regarding sleep disturbances and daytime functioning are rated on a 4-point scale (0 = not during the past month; 3 = three or more times per week). The PSQI generates seven component scores: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction. The PSQI also yields a global score thought to reflect overall sleep quality. The possible range of scores is 0-21 with higher scores indicating more disturbances (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). A cut-off score of five points has been found to distinguish between good and poor sleepers (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). The seven component scores of the PSQI have overall high internal consistency reliability ($\alpha = .83$), indicating that each of the seven components measure a particular aspect of the same overall construct (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). The global PSQI score has been found to have high test-retest reliability across a 28-day time period ($r = .85$), and the test-retest of component scores ranged from .65 (medication use) to .84 (sleep latency) (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). Furthermore, the PSQI has been found to discriminate well between sleep disturbed patients and controls.

Physical Symptom Checklist (PSC)

The PSC is a 44-item instrument that assesses a broad spectrum of physical symptoms (Cameron, Leventhal, & Leventhal, 1993, 1995). Participants rate the

extent to which they experienced each symptom over the past week. The scale yields an overall global score, as well as subscales for symptom types.

Analyses

To identify age-related differences in physical symptoms, a *t*-test was conducted between younger and older adults with the global PSC score as the outcome variable. If age-group differences in physical symptoms were found, these were controlled for in the following analyses. Furthermore, any sleep-related items on the depression measure were excluded in order to remove confounding information.

To answer whether there were age-related differences in total sleep problems, as well as different components of sleep quality, regression analyses were conducted (Baron & Kenny, 1986). We tested our hypothesis that there would be a main effect of depression on overall sleep quality. A linear regression was conducted with depressive symptoms (i.e., CESD) as the independent variable, and sleep quality as the dependent variable (i.e., PSQI Total). If the regression coefficient for depressive symptoms was significant, then depressive symptoms predicted total sleep problems. We tested our second hypothesis that there would be a main effect for age on overall sleep quality, by conducting a linear regression with Age Group as the independent variable and sleep quality as the dependent variable. If the regression coefficient for age was significant, then total sleep problems differed for older and younger adults.

Next, and most important, we tested our third hypothesis that age moderates the association between depression and sleep quality. We conducted a moderated multiple regression with age, depressive symptoms, and their interaction as independent variables, and sleep quality as the dependent variable:

$$\text{PSQI Total} = \alpha + \beta_1 \text{ Age Group} + \beta_2 \text{ CESD} + \beta_3 (\text{Age Group x CESD}) + \text{Error}$$

If the interaction term was significant, then the association between depressive symptoms and overall sleep quality varied by age group and follow-up contrasts were conducted to determine the nature of the interaction.

Next, we examined age-related differences on specific components of sleep for depressed and non-depressed participants. First, we determined whether there is a main effect of depressive symptoms on specific components of sleep quality. We conducted several separate linear regressions with depressive symptoms as the independent variable, and specific components of sleep quality as the dependent variables. If the regression coefficient for depressive symptoms was significant, then there was a main effect of depressive symptoms on a particular component of sleep quality. To answer whether there was a main effect of age on different dimensions of sleep, we conducted separate linear regression analyses with age as the independent variable, and the specific components of sleep quality as dependent variables. If the regression coefficient for age was significant, then there was a main effect for age for a particular component of sleep quality.

Finally, to determine whether age moderates the association between depressive symptoms and specific components of sleep quality, several moderated multiple regression analyses were conducted. These analyses included age, depressive symptoms, and their product, as independent variables, and different components of sleep quality (i.e., sleep efficiency, daytime dysfunction, sleep duration, sleep disturbances), as the dependent variables. If the interaction term in the regression was significant, then the association between depression and sleep problems varied by age group for specific components of sleep quality. If any of the interaction terms were significant, follow-up analyses were conducted to determine the nature of the interaction.

CHAPTER III

RESULTS

Preliminary Analyses

The sample included 137 participants (67 younger; 70 older). Fourteen individuals (11 younger; 3 older) were excluded from analyses due to impaired delayed recall on the HVLT-R (i.e., performance less than 2 standard deviations below age-corrected mean). Furthermore, two individuals were excluded for neurologic diagnoses (1 younger; 1 older) of epilepsy and stroke, and two younger individuals were excluded due to ADHD diagnoses.

The final sample was comprised of 119 participants with 53 younger (72% female) and 66 older adults (73% female). The ethnic make up of the sample was Caucasian (83.9%), African-American (7.3%), Asian-American (3.6%), Hispanic (1.5%) and other ethnicities (2.9%). To test for possible age-group differences on demographic, independent, and outcome variables, a multivariate analysis of variance (MANOVA) was conducted (Table 1). Younger and older adults did not significantly differ with regards to self-reported physical symptoms on the PSC or annual household income. Older adults had completed significantly more education than younger adults ($F = 22.60$, $df = 1$, $p < .01$), however, this is likely due to the fact that all younger adults were current university undergraduates and had not yet completed their educational careers.

Furthermore, younger and older adults did not differ on the initial screening measure of depressive symptoms (CESD-10) prior to entering the study (Table 1). At the time of participation, however, younger adults reported significantly more depressive symptoms than did the older adults on the full CESD ($F = 6.84$, $df = 1$, $p <$

.01). Because of this age-related difference in depressive symptoms, all further analyses investigating effects of age on sleep controlled for depressive symptoms.

With regards to sleep, there were significant differences between younger and older adults on PSQI total ($F = 9.33$, $df = 1$, $p < .01$). T-tests were conducted on the PSQI component scores to obtain more information about these age group differences; there was a significant age group difference for the sleep duration component ($t = 3.02$, $df = 128$, $p < .01$) and a trend for the daytime dysfunction component (Table 1). The meaning of these age-related differences is not known, however, because the results are confounded by the significant difference in depressive symptoms between younger and older adults. The primary analyses, below, will address the impact of age group on sleep outcomes while controlling for depressive symptoms.

Internal consistency reliabilities of the primary measures were similar in younger and older adults. Specifically, overall internal consistency for CESD was strong (overall Cronbach's $\alpha = .92$) and was consistent across age groups (younger $\alpha = .93$; older $\alpha = .89$). For the PSQI, internal reliability was somewhat weaker than in previous samples ($\alpha = .63$), suggesting perhaps more across item variability in sleep problems in our sample, but again was similar in the two age groups (younger $\alpha = .64$; older $\alpha = .58$).

To ensure that the components of sleep quality were not redundant measures, we conducted correlations between the four components as well as overall sleep quality. The results indicated that the four components of sleep quality correlated moderately well with overall sleep quality (r ranging from .49 to .65). Furthermore, there were low to moderate correlations between the four components of sleep quality

(*r* ranging from -.09 to .33), thus indicating that the sleep quality components were not redundant measures.

Effects of Age, Depressive Symptoms, and their Interaction on Global Sleep Quality

A hierarchical regression was run to test for the effects of age, depressive symptoms, and their interaction on global sleep quality (Table 2). Depressive symptoms were added as the first independent variable, and age was entered next. Thus, the effects of age on global sleep quality could be determined after controlling for depressive symptoms, which is important because, as previously noted, younger and older adults differed significantly with regards to average depressive symptoms.

In the first step of the regression, depressive symptom total (i.e., CESD) was entered as a predictor of the global sleep quality score reported on the PSQI. The results supported the hypothesis that depressive symptoms significantly predict global sleep quality, indicating that greater depressive symptoms were associated with worse overall sleep quality (Table 2). In the next step, age group was entered as a predictor but was not significantly associated with global sleep quality. Thus, contrary to our hypothesis, older age was not significantly associated with poorer global sleep quality. CESD remained a significant predictor of global sleep quality after age was entered into the model. In the final step, the interaction between CESD and age group was entered as a predictor, but was not significantly associated with global sleep quality. Thus, results do not support the hypothesis that age moderates the effects of depressive symptoms on global sleep quality.

Effects of Depressive Symptoms, Age, and their Interaction on Components of Sleep Quality

Similar hierarchical regressions were run with each of the four components of sleep quality (i.e., sleep duration, daytime dysfunction, sleep disturbance, and sleep efficiency) as dependent variables. For sleep duration, the results indicated that depressive symptoms were not a significant predictor. In contrast, the results showed a main effect for age group (b = -48, β = -.28, t = -2.97, $p < .05$), indicating that younger adults reported longer sleep duration than the older adults, controlling for depressive symptoms. Thus, the results support the hypothesis that younger age is associated with longer sleep duration. There was no significant interaction effect of age group by depressive symptoms on sleep duration.

Next, daytime dysfunction was examined as the dependent variable. The results showed a significant main effect for depressive symptoms in predicting daytime dysfunction (b = .03, β = .50, t = 5.76, $p < .01$). Thus, in support of our hypothesis, the results indicate that greater depressive symptoms are associated with a higher level of daytime dysfunction. The second independent variable, age group, did not significantly predict daytime dysfunction. Thus, the hypothesis that younger adults would experience significantly more daytime dysfunction than older adults was not confirmed. In the third and final step, the age group by depressive symptoms interaction term was not a significant predictor of daytime dysfunction.

The third component of sleep quality, sleep disturbance, was examined as the dependent variable. In agreement with our hypothesis, depressive symptoms were found to significantly predict level of sleep disturbance (b = .02, β = .27, t = 2.90, $p < .05$), indicating that greater depressive symptoms were associated with higher levels of sleep disturbance. In the second step, age group was not found to be a significant

predictor of sleep disturbance. Finally, the results did not show a significant depressive symptom by age group interaction term in predicting level of sleep disturbance.

The last hierarchical regression was run to determine whether age group, depressive symptoms, and their interaction significantly predict sleep efficiency. The results indicated no significant main effects of either depressive symptoms or age group, and also no interaction effect, on sleep efficiency. Thus, hypotheses were not supported with regards to sleep efficiency.

CHAPTER IV

DISCUSSION

Sleep changes across the lifespan and sleep problems differ between younger and older adults. Furthermore, sleep problems and depression are strongly associated and thus it may be important to understand how depressive symptoms and sleep are related in different age groups. Understanding the impact of depressive symptoms on sleep in younger and older adults can potentially optimize the treatment and prevention of depressive episodes at different stages in life. The purpose of the present study was to examine the relationship between depressive symptoms and sleep in younger and older adults. Specifically, this study aimed to determine whether there were age-related differences in sleep problems in older and younger adults with and without depressive symptoms. While several studies have examined the association between sleep and depression, the present study is one of the first to examine this issue in different age groups. Additionally, the present study will deepen our understanding of the association between depression and sleep by examining specific dimensions of sleep quality.

Depressive Symptoms and Sleep Quality

Our results indicated that greater depressive symptoms were associated with worse overall sleep quality. This finding is in agreement with previous research that found a strong association between depressive symptoms and poor sleep quality (e.g., Mayers & Baldwin, 2006; Kupfer, 2006; Tsuno, Besset, & Ritchie, 2005; Fava, 2004; Rodin, McAvay, & Timko, 1998). For example, Rodin and colleagues (1998) found that feelings of depression in older adults were related to sleep disturbance. A review of the relationship between sleep and depression by Tsuno and colleagues (2005) found that insomnia is a common feature in depressed individuals. Tsuno and

colleagues (2005) also suggested that hypersomnia is a rather common complaint in depressives but that there are less clear findings with regards to objective evidence.

When specific components of sleep quality were examined, the results indicated that greater depressive symptoms were significantly associated with higher levels of sleep disturbance and daytime dysfunction. In a review by Mayers and Baldwin (2006), it was found that depressed individuals report more sleep disturbance than non-depressed individuals. Hence, our results confirm robust findings. With regard to daytime dysfunction our results support past findings that depressed individuals are more likely to suffer daytime dysfunction, such as daytime sleepiness, than are normal controls (Moo-Estrella, Solís-Rodríguez, & Arankowsky-Sandoval, 2005; Rao et al., 2005). For instance, Moo-Estrella and colleagues (2005) found that depressed college students experienced more daytime sleepiness than non-depressed students. Moreover, in a review, Fava (2004) suggested that daytime sleepiness resulting from sleep disturbance, such as insomnia, might be highly correlated with depression.

We did not find depressive symptoms to be significantly associated with sleep efficiency (time spent in bed spent sleeping). This result is surprising and contradicts previous findings. In particular, past research has found that depression is associated with decreased sleep efficiency (Lauer, Riemann, Wiegand, & Berger 1991; Kupfer, 2006; Knowles & MacLean, 1990) and it is unclear why our results are not in agreement. While we found depressive symptoms to be significantly associated with several of our sleep outcome variables, it is possible that the overall low levels of depressive symptoms in the entire sample may have impacted our results with regards to sleep efficiency. This issue will be discussed below.

We also did not find depressive symptoms to be a significant predictor of sleep duration. Past research has found that depressed inpatients have shorter sleep duration than non-depressed controls, and that that sleep duration decreased with age for both the depressed and non-depressed individuals (Lauer, Riemann, Wiegand, & Berger 1991). As mentioned above, it is possible that we did not have a high enough mean level of depressive symptoms to be able to determine any impact on sleep duration. Another explanation is that since depressed individuals exhibit both hypersomnia and insomnia, no distinct effect of depressive symptoms on sleep duration was discernible. In fact, in our sample, we found both younger and older depressed individuals with markedly short or long sleep duration. Sleep duration of 8 hours is considered to reflect healthy sleep, with shorter or longer duration being associated with sleep problems (Grandner &Kripke, 2004). Thus, when examining short sleep duration (less than 8 hrs) we found that it was slightly more prevalent in depressed younger adults, whereas longer sleep duration (more than 8 hours) was slightly more frequent in depressed older adults.

We also examined whether our data supported previous findings that indicate age-related difference in somatic versus cognitive symptoms of depression. Specifically, previous research found that older adults tend to endorse symptoms pertaining to somatic complaints on the BDI such as weight loss and sleep problems whereas younger adults endorsed more cognitive symptoms such as disappointment in self, sense of failure, and feelings of guilt (Kim, Pilikonis, Frank, Thase, & Reynolds, 2002). Furthermore, Nguyen and colleagues (2006) found that depressed older adults endorsed significantly more items on the somatic complains subscale of the CESD than depressed younger adults. Our results showed a significant difference between younger and older adults on only two CESD items (i.e., item #4: ‘I feel that I

was just as good as other people'; item #5: 'I had trouble keeping my mind on what I was doing'). Younger adults endorsed item five to a greater extent than older adults, which is consistent with greater endorsement of cognitive symptoms in younger persons. Conversely, older adults endorsed item four to a greater extent than the younger adults. Thus, overall, our results do not agree with previous findings that older adults endorsed more somatic and sleep-related complaints. It is possible that this atypical result is due to our unusual sample, as discussed below.

Age and Sleep Quality

There was only one significant effect of age on the four components of sleep quality. Specifically, age was a significant predictor of sleep duration, independent of depressive symptoms. Younger adults reported sleeping for a significantly longer duration than did the older adults. Thus, our results are in agreement with well-established findings suggesting that sleep duration decreases with older age (e.g., Campbell & Murphy, 2007; Ohayon, Carskadon, Guilleminault, & Vitiello, 2004). For example, there is evidence that total sleep time is significantly lower in healthy older adults compared with healthy younger adults (Ohayon, Carskadon, Guilleminault, & Vitiello, 2004).

Regarding age, previous research has shown that older age is associated with more disturbed sleep and increased sleep disorders (e.g., Campbell & Murphy, 2007; Bliwise, Ansari, Straight, & Parker, 2005; Ohayon, Carskadon, Guilleminault, & Vitiello, 2004). We hypothesized that the older adults would report worse overall sleep quality than the younger adults, however, our results failed to support this hypothesis. Moreover, we failed to find support for our hypothesis that the older individuals experiencing greater depressive symptoms would report the worst overall sleep quality out of the entire sample. In fact, as discussed above, we found only one

significant effect of age on both total sleep quality and components of sleep quality after controlling for depressive symptoms.

Overall, it is unclear why we found so few significant effects of age on sleep quality. A possible explanation is that the older adults in our study were in very good health, which may have resulted in a better sleep quality than would have been expected from the general population of individuals aged 65 and above. In fact, our sample of younger and older adults did not differ significantly in terms of self-reported physical symptoms, and to be included in the study 'good' to 'very good' self-reported health had to be reported. Previous research has found poor health to be one of the major contributing factors to poor sleep quality in older adults (Ancoli-Israel & Alessi, 2005; Ohayon, 2002). Furthermore, it is suggested that old age is associated with more physical ailments and that these ailments likely contribute to a poorer sleep quality in an elderly population (Roberts, Shema, & Kaplan, 1999; Bliwise, King, Harris & Haskell, 1992). In fact, it has been suggested that healthy older adults sleep just as well as younger adults (e.g., Ohayon, 2002), and it is has been suggested that the sleep problems found in elderly individuals are secondary to medical comorbidities and not specific to aging per se (Foley, Ancoli-Israel, Britz, & Walsh, 2004). Thus, due to our healthy older adult sample, it is not surprising, in retrospect, that their sleep was not more disturbed than younger adults.

A further explanation for our lack of age-related findings may be that, in addition to a healthy older adult sample, our college students may have been a particularly vulnerable target group. There is some research suggesting that college students are at high risk for sleep difficulties (Carney, Edinger, Meyer, Lindman, & Istre, 2006; Coren, 1994: Lack, 1986). In particular, it has been suggested that college students are exposed to an irregular and often stressful daily schedule that

prevents a regular sleep cycle (Carney, Edinger, Meyer, Lindman, & Istre, 2006; Jensen, 2003). It is possible that our sample of younger adults experienced overall poorer sleep quality than the general population of young people, which may have contributed to few significant age group differences on sleep outcomes.

In fact, the mean PSQI score for the younger non-depressed adults was above the suggested cut-off score of five points that has been found to distinguish between good and poor sleepers (Buysse, Reynolds, Monk, Berman & Kupfer, 1989). In contrast, the mean PSQI score for the older non-depressed adults was below the cut-off point. This suggests that the non-depressed younger adults, overall, would be classified as poor sleepers, and that the majority of older adults would not. The mean difference between the two age groups was not statistically significant, however.

Limitations

In addition to the issues discussed above, the present study had several limitations that could explain why our findings did not support the hypotheses regarding age-related differences in sleep quality. One major limitation was that the younger adults reported significantly more depressive symptoms at the time of the study than did the older adults.

Another limitation was the low frequency of individuals with clinically significant depressive symptoms. When utilizing the cut-off score of 16 points suggested by Radloff (1977), only 34 percent of our sample could be considered to have clinically significant depressive symptoms. Furthermore, this cut-off score has been suggested to be too low to ensure adequate specificity in younger (Gotlib, Lewinsohn, & Seeley, 1995; Roberts, Lewinsohn, & Seeley, 1991) and older adults (Cheng & Chan, 2005; Haringsma, Engels, Beekman, & Spinhoven, 2004). Instead, a cut-off at 22 points has been suggested to more accurately predict individuals with

clinically significant depressive symptoms (Cheng & Chan, 2005; Haringsma, Engels, Beekman, & Spinhoven, 2004). Therefore, when using the more stringent cut-off, only 21 percent of the participants experienced clinically significant symptoms of depression. Thus, it can be inferred that our sample mostly included individuals with mild to moderate depressive symptoms, and the mean level of depressive symptoms in our two age groups may have been too low to optimally determine the effects of clinically significant depressive symptoms on sleep quality. Moreover, when comparing the age groups, the results showed that there were significantly more younger than older adults who experienced clinically significant depressive symptoms. In fact, when a cut-off score of 22 points was used, only 14 percent of the older adults reported clinically significant depressive symptoms compared with 28 percent of the younger adults. It is possible that higher mean levels of depressive symptoms are required to reflect differential impact on sleep quality in younger and older adults.

Future Directions

Although we failed to find support for most of our hypotheses regarding age-related differences in sleep problems among depressive individuals, this issue is in need of further investigation. Future studies should aim to include more representative samples of older and younger adults. A less homogenous sample of both older and younger individuals than in the current study may more accurately reflect the effects of depressive symptoms on sleep quality in younger and older adults. Moreover, future studies should attempt to include individuals with more severe depressive symptoms.

Conclusion

In summary, our study supports previous findings that depressive symptoms are associated with poorer sleep quality. While a robust relationship between depression and sleep has been established, there is still more to learn. For example, there is still more to learn with regards to depression and sleep at different points in the lifespan. Understanding this relationship in different age groups may lead to treatment strategies designed to target a particular stage in life. Moreover, it may be important to understand characteristics that make an individual with depressive symptoms particularly vulnerable to sleep problems. Our lack of age group effects suggests that the health status of an individual may be an important factor to consider when investigating sleep. Furthermore, our results suggest that the context of the individual may be an important factor to understand with regards to sleep problems. Specifically, college students may constitute a particularly disordered population with regards to sleep problems. Thus, understanding how the association between depression and sleep appears in different age groups and different contexts may lead to more optimal treatment and prevention strategies.

Table 1

Descriptive Statistics for Younger and Older Adults for Demographic, Sleep and Depression Measures

	Younger		Older				
	M	*SD*	*M*	*SD*	*F*	*t*	*p*
Education	13.88	0.94	16.42	3.68	26.11		<.01
Income	6.47	2.59	5.81	2.15	2.32		ns
PSC Total	14.50	11.23	14.98	10.84	0.06		ns
CESD-10 Total	10.34	6.54	8.25	6.12	3.30		ns
CESD Total	15.76	11.59	9.70	9.23	10.20		<.01
PSQI Total	6.29	3.05	4.70	2.69	9.33		<.01
PSQI Sleep Duration	0.72	0.95	0.29	0.67		3.02	<.01
PSQI Sleep Efficiency	0.82	0.42	0.58	0.29		0.38	n.s
PSQI Sleep Disturbance	0.55	0.81	0.43	0.86		0.88	n.s
PSQI Daytime Dysfunction	1.08	0.82	0.83	0.66		1.96	<.10

Note. PSC = Physical Symptoms Checklist; CESD-10 = Center for Epidemiological Studies Depression Scale, short form (range 0-60); CESD = Center for Epidemiological Studies Depression Scale (range = 0-30); PSQI = Pittsburgh Sleep Quality Index (range = 0-21). The intervals for income were 5 = $ 20.001 - $ 25.000 and 6 = $ 25.001 - $ 30.000

Table 2

Effect of Age, Depressive Symptoms, and their Interaction on Global PSQI Score: Hierarchical Regression

	B	*SE B*	*β*	*p*
Step 1				
CESD	0.13	0.02	5.47	<.01
Step 2				
CESD	0.12	0.42	4.82	<.01
Age	-0.84	0.53	-0.14	ns
Step 3				
CESD	0.14	0.08	0.48	<.10
Age	-0.69	0.78	-0.11	ns
CESD x Age	-0.01	0.05	-0.07	ns

Note. CESD = Center for Epidemiological Studies Depression Scale; PSQI = Pittsburgh Sleep Quality Index.

REFERENCES

American Psychiatric Association (2000). *Diagnostic and statistical manual of mental disorders*, *4th edition, text revision*. Washington, DC: American Psychiatric Press, Inc.

Ancoli-Israel, S., & Alessi, C. (2005). Sleep and aging. *American Journal of Geriatric Psychiatry, 13,* 341-343.

Andresen, E.M., Malmgren, J.A., Carter, W.B., & Patrick, D.L. (1994). Screening for depression in well older adults: Evaluation of a short form of the CESD (Center for Epidemiologic Studies Depression Scale). *American Journal of Preventative Medicine*, *10,* 77-84.

Baron, R.M., & Kenny, D.A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical consideration. *Journal of Personality and Social Psychology*, *51,* 1173-1182.

Bliwise, D.L., Ansari, F.P., Straight, L-B. & Parker, K.P. (2005). Age-changes in timing and 24-hour distribution of self-reported sleep. *American Journal of Geriatric Psychiatry, 13,* 1077-1082.

Bliwise, D.L., King, A.C., Harris, R.B. & Haskell, W.L., (1992). Prevalence of self-reported poor sleep quality in a healthy population aged 50-65. *Social Science & Medicine, 34,* 49-55.

Brendel, D.H., Reynolds III, C.F., Jennings, J.R., Hoch, C.C., Monk, T.H., Berman, S.R., Hall, F.T., Buysse, D.J., & Kupfer, D.J. (1990). Sleep stage physiology, mood and vigilance responses to total sleep deprivation in healthy 80-year-olds and 20-year-olds. *Psychophysiology*, *27,* 677-685.

Breslau, N., Roth, T., Rosenthal, L., & Andreski, P. (1996). Sleep disturbance and psychiatric disorders: A longitudinal epidemiological study of young adults. *Biological Psychiatry, 39,* 411-418.

Buysse, D.J. (2004). Insomnia, depression, and aging. Assessing sleep and mood interactions in older adults. *Geriatrics*, *59,* 47-51.

Buysse, D.J., Reynolds III, C.F., Monk, T.H., Berman, S.R., & Kupfer, D.J. (1989). The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. *Psychiatric Research*, *28,* 193-213.

Cameron, L., Leventhal, E.A., & Leventhal, H. (1993). Symptom representations and affect as determinants of care seeking in a community-swelling, adult sample population. *Health Psychology*, *12,* 171-179.

Cameron, L., Leventhal, E.A., & Leventhal, H. (1995). Seeking medical care in response to symptoms and life stress. *Psychosomatic Medicine*, *57,* 37-47.

Campbell, S.S. & Murphy, P.J. (2007). The nature of spontaneous sleep across adulthood. *Journal of Sleep Research, 16,* 24-32.

Carney, C.E., Edinger, J.D., Meyer, B., Lindman, L., & Istre, T. (2006). Daily activities and sleep quality in college students. *Chronobiology International, 23,* 623-637.

Cheng, S-T. & Chan, A.C.M. (2005). The Center for Epidemiologic Studies Depression Scale in older Chinese: thresholds for long and short forms. *International Journal of Geriatric Psychiatry, 20,* 465-470.

Coren, S. (1994). The prevalence of self-reported sleep disturbances in young adults. *International Journal of Neuroscience, 79,* 67-73.

Fava, M. (2004). Daytime sleepiness and insomnia as correlates of depression. *Journal of Clinical Psychiatry, 65,* 27-32.

Foley, D., Ancoli-Israel, S., Britz, P. & Walsh, J. (2004). Sleep disturbances and chronic disease in older adults: Results of the 2003 National Sleep Foundation Sleep in America Survey. *Journal of Psychosomatic Research, 56,* 497-502.

Foley, D.J., Monjan, A.A., Brown, S.L., Simonsick, E.M., Wallace, R.B., & Blazer, D.G. (1995). Sleep complaints among elderly persons: An epidemiologic study of three communities. *Sleep, 18,* 425-432.

Gotlib, I.H., Lewinsohn, P.M., & Seeley, J.R. (1995). Symptoms versus a diagnosis of depression: Differences in psychosocial functioning. *Journal of Consulting and Clinical Psychology, 63,* 90-100.

Grandner, M.A. & Kripke, D.F. (2004). Self-reported sleep complaints with long and short sleep: A nationally representative sample. *Psychosomatic Medicine, 66,* 239-241.

Haringsma, R., Engels, G.I., Beekman, A.T.F., & Spinhoven, P. (2004). The criterion validity of the Center for Epidemiological Studies Depression Scale (CES-D) in a sample of self-referred elders with depressive symptomatology. *International Journal of Geriatric Psychiatry, 19,* 558-563.

Husain, M.M. et al. (2005). Age-related characteristics of depression: A preliminary STAR*D report. *American Journal of Geriatric Psychiatry*, *13,* 852-860.

Jensen, D.R. (2003). Understanding sleep disorders in a college student population. *Journal of College Counseling, 6,* 25-34.

Kim, Y., Pilikonis, P.A., Frank, E., Thase, M.E., & Reynolds, C.F. (2002). Differential functioning of the Beck Depression Inventory in late-life patients: Use of item response theory. *Psychology and Aging*, *17,* 379-391.

King, D.A., & Markus, H.E. (2000). Mood disorders in older adults. In S. Whitbourne. (Eds.), *Psychopathology in later adulthood.* New York, NY: John Wiley & Sons, Inc. pp.141-172.

Knowles, J.B. & MacLean, A.W. (1990). Age-related changes in sleep in depressed and normal subjects: a meta-analysis. *Neuropsychopharmacology, 3,* 251-259.

Koch, S., Haesler, E., Tiziani, A., & Wilson, J. (2006). Effectiveness of sleep management strategies for residents of aged care facilities: Findings of a systematic review. *Journal of Clinical Nursing*, *15,* 1267-1275.

Kohut, F.J., Berkman, L.F., Evans, D.A., & Cornoni-Huntley, J. (1993). Two shorter forms of the CES-D depression symptoms index. *Journal of Aging and Health*, *5,* 179-193.

Kupfer, D.J. (2006). Depression and associated sleep disturbances: patient benefits with agomelatine. *European Neuropsychopharmacology, 16,* S639-S643.

Lack, L.C. (1986). Delayed sleep and sleep loss in university students. *Journal of American College Health, 35,* 105-110.

Lauer, C.J., Riemann, D., Wiegand, M., & Berger, M. (1991). From early to late adulthood. Changes in EEG sleeo of depressed patients and healthy volunteers. *Biological Psychiatry*, *29,* 979-993.

Levine, B., Roehrs, T., Zorick, F., & Roth, T. (1988). Daytime sleepiness in young adults. *Sleep, 11,* 39-46.

Mayers, A.G., & Baldwin, D.S. (2006). The relationship between sleep disturbance and depression. *International Journal of Psychiatry in Clinical Practice, 10,* 2-16.

Moo-Estrella, J., Pérez-Benítez, H., Solís-Rodríguez, F., & Arankowsky-Sandoval, G. (2005). Evaluation of depressive symptoms and sleep alterations in college students. *Archives of Medical Research, 36,* 393-398.

Neubauer, D.N., Smith, M.T. (2006). Why treat insomnia? *Primary Psychiatry*, *13,* 46-50.

Nguyen, H.R., & Zonderman, A.B. (2006). Relationship between age and aspects of depression: Consistency and reliability across two longitudinal studies. *Psychology and Aging*, *21,* 119-126.

Ohayon, M.M., Carskadon, M.A., Guilleminault, C., & Vitiello, M.V. (2004). Meta-analysis of quantitative sleep parameters from childhood to old age in healthy individuals: Developing normative sleep values across the human lifespan. *Sleep,* 27, 1255-1273.

Ohayon, M.M. (2002). Epidemiology of insomnia: what we know and what we still need to learn. *Sleep Medicine Reviews, 6,* 97-111.

Pilcher, J.J., & Huffcutt, A.I. (1996). Effects of sleep deprivation on performance: A meta-analysis. *Sleep, 19,* 318-326.

Radloff, L.S., & Teri, L. (1986). Use of the Center for Epidemiological Studies Depression Scale with older adults. *Clinical Gerontologist*, *5,* 119-135.

Radloff, L.S. (1977). The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement*, *1,* 385-401.

Rao, V., Spiro, J.R., Samus, Q.M., Rosenblatt, A., Steele, C., Baker, A., Harper, M., Brandt, J., Mayer, L., Rabins, P.V., & Lyketsos, C.G.(2005). Sleep disturbances in the elderly residing in assisted living: Findings from the Maryland Assisted Living Study. *International Journal of Geriatric Psychiatry, 20,* 956-966.

Ready, R.E., Marquez, D.X. & Åkerstedt, A.M. (under review). Emotions in younger and older adults: Retrospective and prospective associations with sleep and physical activity.

Roberts, R.E., Shema, S.J. & Kaplan, G.A. (1999). Prospective data on sleep complaints and associated risk factors in an older cohort. *Psychosomatic Medicine, 61,* 188-196.

Roberts, R.E., Lewinsohn, P.M., & Seeley, J.R. (1991). Screening for adolescent depression: A comparison of scales. *Journal of the American Academy of Child Adolescent Psychiatry, 30,* 58-66.

Rodin, J., McAvay, G., & Timko, C. (1988). A longitudinal study of depressed mood and sleep disturbance in elderly adults. *Journal of Gerontology: Psychological Sciences, 43,* 45-53.

Stewart, R., Besset, A., Bebbington, P., Brugha, T., Lindesay, J., Jenkins, R., Singleton, N. & Meltzer, H. (2006). Insomnia, comorbidity, and impact and hypnotic use by age group in a national survey population aged 16 to 74 years. *Sleep, 29,* 1391-1397.

Taylor, D.J., Lichstein, K.L., Durrence, H.H., Reidel, B.W., & Bush, A.J. (2005). Epidemiology of insomnia, depression, and anxiety. *Sleep, 28,* 1457-1464.

Tsuno, N., Besset, A., & Ritchie, K. (2005). Sleep and depression. *Journal of Clinical Psychiatry*, *66,* 1254-1269.

Yoon, I-Y., Kripke, D.F., Youngstedt, S.D., & Elliott, J.A. (2003). Actigraphy suggests age- related differences in napping and nocturnal sleep. *Journal of Sleep Research*, *12,* 87-93.

Zung, W.W. K. (1965). A self-rating depression scale. *Archives of General Psychology*, *12,* 63-70.