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## Factors Associated with Sleep Disruption Among Community-Dwelling Older Adults in the Health and Retirement Study

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FACTORS ASSOCIATED WITH SLEEP DISRUPTION AMONG  
COMMUNITY-DWELLING OLDER ADULTS IN THE HEALTH AND  
RETIREMENT STUDY

by

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A DISSERTATION

Submitted to the graduate faculty of The University of Alabama at Birmingham,  
in partial fulfillment of the requirements for the degree of  
Doctor of Philosophy

BIRMINGHAM, ALABAMA

2009

FACTORS ASSOCIATED WITH SLEEP DISRUPTION AMONG  
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RETIREMENT STUDY

LAURA L. WILLIAMS

SCHOOL OF NURSING

ABSTRACT

Introduction

The purpose of this study was to examine behavioral outcomes and sleep disruption in aging adults using data from the 2004 wave of the longitudinal Health and Retirement Study (HRS). It was hypothesized that sleep disruption is associated with behavioral outcomes and sociodemographic variables in a population-based sample.

Methods

The 2004 HRS data (N=20,129) represents a cross-sectional analysis of community dwelling aging adults born in the US at or before 1923 through 1953. Data are stratified by date of birth to provide five cohorts of aging elderly. The HRS *Psychosocial Leave-Behind Participant Lifestyle Questionnaire (PLBQ)* was given to a random sample of participants (N=1,439; 52.5% male; 47.5% female; 91.5% White; 5.2% Black; Response Rate 76.8%) who completed the 2004 HRS wave. Portions of the HRS including age, gender, race, marital status, education, income, comorbidities, and sleep measures were matched to the subjects who completed the PLBQ. An index of sleep disruption items was computed and sleep sensitive behaviors (cynical hostility, optimism, pessimism and social participation) were computed according to instrument directions.

## Results

After controlling for sociodemographic variables, sleep disruption independently predicted social integration ( $t=2.135, p<.0001$ ), pessimism ( $t=3.995, p<.0001$ ), cynical hostility ( $t=3.854, p<.0001$ ), and negatively predicted optimism ( $t=-4.876, p<.0001$ ). Oldest-old adults had no greater sleep disruption than younger aging adults ( $\chi^2=1.234, p=.872$ ), although 59% of the oldest-old subset reported frequent waking during the night. Women reported more sleep disruption than men ( $t=3.270, p<.001$ ), but all subjects reported frequent waking during the night (Men=58%; Women=68%). Married participants reported more sleep disruption than divorced or widowed participants ( $t=2.161, p=.03$ ). Blacks had no greater sleep disruption than Whites ( $t=.812, p=.417$ ). Higher education was the most influential SES predictor for sleep disruption ( $F=15.309, p<.0001$ ), and income did not independently predict sleep disruption ( $t=1.297, p=.195$ ).

## Conclusion

Sleep disruption predicts negative behavioral outcomes, when controlling for sociodemographic variables. Sleep disruption was greater among women and married participants, but there were no racial differences. Education was also a strong influence on sleep disruption. Further research should examine the role of sleep disruption in other behavioral and attitudinal traits.

Keywords: sleep disruption, health and retirement study, social integration, pessimism, optimism, cynical hostility

## DEDICATION

This dissertation is dedicated to my husband Brad, and my children Josh and Jake. Brad, your unconditional love and constant support is the only thing that has made this possible. Josh and Jake, thanks so much for letting me work, and for always believing in your mom. I love each of you eternally.

I also wish to dedicate this work to all the elders I have had the privilege of caring for.

## ACKNOWLEDGEMENTS

This dissertation would not be possible without the contributions of many. I am forever grateful to Dr. Mary G. Umlauf, whose guidance has been invaluable for the past 5 years. Her leadership, enthusiasm, and expertise are most appreciated.

I wish to thank my committee members, Dr. Erica Pryor, Dr. Patricia Drentea, Dr. David Vance, and Dr. Eileen Chasens. All have provided their unique expertise to this work, and I am fortunate to have had the opportunity to work with each of them.

Finally, I would like to acknowledge my colleagues in the PhD program at UAB who have participated in this journey with me. I am truly blessed to be in the company of such skilled clinicians and researchers. I know we will all make the world a better place.

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## LIST OF ABBREVIATIONS

CHD	Coronary Heart Disease
ELSA	English Longitudinal Study on Aging
IOM	Institute of Medicine
HERS	Heart and Estrogen/Progestin Replacement Study
HS	Cook and Medley Hostility Scale
HRS	Health and Retirement Study
LOT-R	Life Orientation Test-Revised
NANDA	North American Nursing Diagnoses Association
NCHS	National Center for Health Statistics
NIA	National Institute on Aging
OSA	Obstructive Sleep Apnea
PFC	Pre-Frontal Cortex
PLBQ	Psychosocial Leave-Behind Questionnaire
REM	Rapid Eye Movement
RLS	Restless Leg Syndrome
SDB	Sleep-Disordered Breathing
SDS	Sleep Disruption Score
SES	Socioeconomic Status
SHHS	Sleep Heart Health Study
SWAN	Study of Women's Health Across the Nation
SWS	Slow Wave Sleep

## CHAPTER 1

### Introduction

In 1900, a 65-year old person could expect to live another 11.9 years on average. By 2003, that life expectancy had increased to 18.3, nearly an additional six and a half years of living on average. In the population over age 85, life expectancy for the year 2003 was 6.8 more years [National Center for Health Statistics (NCHS), 2006]. In a report released by the US Department of Health and Human Services, the Centers for Disease Control, and the NCHS (2005), the most rapidly growing segment of the American population is adults 55-64 years of age. Twenty-nine million people were in this age group in 2004. That number is projected to be 40 million by 2014 (NCHS, 2005). The aging of Americans is of utmost importance to healthcare professionals and to the nation at large. If healthcare professionals are to adequately address an aging America, then sleep quality of aging adults must be considered for physical, emotional, and psychosocial well-being.

Sleep disorders and sleep deprivation have emerged as significant comorbidities for chronic disease, as well as possible underlying causes of morbidity and mortality. This evidence prompted the release of an Institute of Medicine (IOM) report in 2006 entitled “Sleep Disorders and Sleep Deprivation: An Unmet Public Health Problem” (IOM, Committee on Sleep Medicine and Research, 2006). There are estimates that 50 to 70 million people in the United States suffer from a chronic sleep disorder, and that primary sleep disorders affect 10-40% or more of the general

population (Hossain & Shapiro, 2002; National Heart, Lung and Blood Institute, 2003; Partinen & Hublin, 2005). This encompasses a myriad of sleep disorders that have been identified, including but not limited to, obstructive sleep apnea (OSA), chronic insomnia, restless leg syndrome (RLS), and narcolepsy, all of which meet criteria as public health disease (Partinen & Hublin, 2005).

Nowhere are the consequences of inadequate sleep more critical than in aging adults. Sleep disruption in older adults is common and frequently goes untreated (Kamel & Gammack, 2006). As age increases, so does the propensity for disrupted sleep. Older adults frequently exhibit less sleep efficiency, shorter deep sleep periods, increased sleep onset latency (time taken to fall asleep), increased night awakenings, and increased daytime sleepiness (Bliwise, 2005). A National Institute on Aging (NIA) study of over 9,000 elders ages 65 and over found that greater than 50% had at least one chronic sleep complaint (Almeida and Pfaff, 2005; Ancoli-Israel, 2005; Foley, Monjan, Brown, et al., 1995). Ancoli-Israel, Kripke, Klauber, Mason, Fell, and Kaplan (1991) reported that 51% of men and 39% of women had severe sleep-disordered breathing in a population of older adults, ages 65-95 years.

Several sleep-related disorders appear to occur more frequently with advancing age (Ersser, Wiles, Taylor, Wade, Walsh & Bentley, 1999). Age is also the most important risk factor for insomnia (Richardson & Doghramji, 2005). Chronic medical illness, such as congestive heart failure, COPD, and diabetes may contribute to sleep disruption. Sleep loss has negative effects on cognition and mood, may exacerbate psychiatric and chronic illness, impairs



balance and attention, and even threatens morbidity and mortality (Ancoli-Israel, 2006).

### Statement of the Problem

Adequate sleep is essential for physical and mental well-being, including mood and behavior. Older adults face physiological and pathological changes in sleep architecture as they age, resulting in reduced deep sleep and more opportunities for sleep disruption (Ancoli-Israel & Cooke, 2005; Bliwise, 2005). Sleep disruption in older adults is rarely the result of one condition and is usually multifactorial in nature (Avidan, 2005). Along with advancing age, gender and social/environmental factors have been associated with sleep disruption. Although little data exists on racial differences, Blacks tend to report less sleep complaints than Whites of the same community-dwelling or chronic disease status (Blazer, Hays, & Foley, 1995; Fabsitz, Sholinsky, & Goldberg, 1997; Kutner, Bliwise, & Zhang, 2004). Elderly women tend to report more sleep disruption than elderly men, but the highest incidence of sleep disruption resides with elderly men over age 85 (Bliwise, King, Harris, & Haskell, 1992; Foley, Monjan, Simonsick, Wallace, & Blazer, 1999; Groeger, Zijlstra, & Dijk, 2004; Ursin, Bjorvatn, & Holsten, 2005). Increased sleep disruption is also associated with lower income, lower education, and widowhood (Foley et al., 1999).

Although the physiological manifestations of sleep disruption are well documented, behavioral research performed in the last 20 years has identified important cognitive and behavioral deficits that reach beyond a simple relationship

to sleepiness (Beebe & Gozal, 2002; Marrone, Bonsignore, Insalaco, & Bonsignore, 1998). Although the causal mechanism remains debatable, the neurophysiological function of sleep appears to affect behavioral outcomes. Sleep disruption prevents the restorative processes of sleep, resulting in nervous system dysfunction. Nervous system dysfunction is manifested behaviorally as reduced cognitive performance and maladaptive behaviors such as negative affect and mood disruption (Beebe & Gozal, 2002). Despite this association, few population-based studies have examined behavioral outcomes of sleep disruption such as cynical hostility, optimism, pessimism, and social participation, within a neurophysiological framework. Even fewer studies have attempted to assess the direct effects of sleep disruption on behavioral outcomes while controlling for the influence of demographic and environmental factors such as age, race, marital status, gender and socioeconomic status (SES).

### Purposes of the Study

The purposes of this study are as follows: (a) to examine the behavioral outcomes of sleep disruption in community-dwelling aging adults while controlling for age, gender, race, marital status and socioeconomic status in the Health and Retirement Study (HRS), (b) to examine the frequency of sleep disruption across age subsamples of community-dwelling aging adults, and (c) to examine the influences of age, gender, race, marital status, and SES on sleep disruption across age subsamples in community-dwelling aging adult subjects.

### Research Questions

1. Will sleep disruption be an independent predictor of social integration, optimism, pessimism, and cynical hostility in community-dwelling aging adults in the HRS, when sociodemographic factors are controlled?
2. What is the relationship between sociodemographic factors and sleep disruption?

### Aims and Hypotheses

**Aim 1.** To characterize the impact of sleep disruption on behavioral outcomes.

**Hypothesis 1a:** Sleep disruption will be an independent predictor of decreased social integration when age, gender, race, marital status and SES are controlled among community-dwelling aging adults in the HRS.

**Hypothesis 1b:** Sleep disruption will be an independent predictor of increased pessimism when age, gender, race, marital status, and SES are controlled among community-dwelling aging adults in the HRS.

**Hypothesis 1c:** Sleep disruption will be an independent predictor of decreased optimism when age, gender, race, marital status, and SES are controlled among community-dwelling aging adults in the HRS.

**Hypothesis 1d:** Sleep disruption will be an independent predictor of increased cynical hostility when age, gender, race, marital status, and SES are controlled among community-dwelling aging adults in the HRS.

**Aim 2.** To determine the extent of sleep disruption and sociodemographic factors among community-dwelling aging adults in the HRS.

**Hypothesis 2a:** Sleep disruption will be more frequently reported among the “oldest-old” community-dwelling aging adults in the HRS.

**Hypothesis 2b:** Sleep disruption will be more frequently reported by women than men.

**Hypothesis 2c:** Married participants will report less sleep disruption than those who are divorced or widowed.

**Hypothesis 2d:** Black participants will have no greater or less sleep disruption than White participants.

**Hypothesis 2e:** Higher education is the most influential SES surrogate of sleep disruption in community-dwelling aging adults.

### Conceptual Framework

The conceptual framework for this study will use an adaptation of the Beebe and Gozal (2002) framework to provide a neurophysiologic foundation for examining the influences of sleep disruption on behavioral outcomes. Sleep is a restorative process, especially for the central nervous system (Horne, 1988; Madsen, 1993; Maquet, 1995). The pre-frontal cortex (PFC) is one of the busiest centers of the brain during waking and conscious rest (Harrison, Horne, & Rothwell, 2000). The PFC controls executive functioning, such as planning and development of ideas, abstract reasoning, attention, and decision making. More importantly, the PFC controls mood, including interpersonal relationships, behaviors, and social cognition such as attitudes and rules (Grafman, 2001). Unlike other parts of the brain that remain active during sleep, the PFC demonstrates reduced activity during all phases of sleep and may require special regulation and restoration (Braun, 1998; Braun,

1997; Hobson, Stickgold, Pace-Schott, 1998; Maquet, 2000). Adequate sleep is crucial for restoration of this region (Finelli, Borbely, & Achermann, 2001; Horne, 1993; Maquet, 1995). The PFC shows some of the most substantial cortical volume decreases with aging, with men appearing to have greater volume loss in this region (Cowell, Turetsky, Gur, Grossman, Shtasel, & Gur, 1994; Murphy, DeCarli, McIntosh, Daly, Mentis, Pietrini et al., 1996). This natural decline in PFC function is then magnified by the presence of sleep disruption. This combination in turn should decrease the ability to maintain affect and stabilize behaviors, leading to the negative behavioral outcomes described above (Beebe & Gozal, 2002).

One such executive function is the regulation of self-affect. In this study, it is hypothesized that PFC dysfunction results in breakdown of the cognitive executive system. In particular, the ability to regulate affect is compromised, leading to emotional lability (moods), and potentially resulting in cynical hostility, decreased optimism, increased pessimism, and decreased social participation. Figure 1 contains the model utilized for this study. The impact of sleep disruption on regulation of affect will be discussed in the context of cynical hostility, optimism, pessimism, and social participation later in this chapter.

### *Demographics*

Chronological age affects sleep disruption due to the physiological changes that occur naturally with aging. The need for sleep does not decrease with age, but the ability to sleep does. The older adult experiences decreased sleep efficiency, quality of sleep slow-wave sleep, REM sleep, and timing of sleep. Older adults have increased onset to sleep, experience early morning awakening, nap more during the

daytime, and experience increased disruption during the entire sleep cycle (Ancoli-Israel, 2005; Bliwise, 2005; Richardson & Doghramji, 2005). Blacks do tend to have less sleep complaints, but there are conflicting reports among researchers (Blazer et al., 1995; Fabsitz et al. 2004; Kutner et al., 1997). Women tend to report insomnia more than men, tend to report lower moods after sleep deprivation and there is evidence that menopause prolongs sleep onset (Ancoli-Israel, 2005; Klink, Quan, Kaltenborn, & Lebowitz, 1992; Reynolds, Kupfer, Hoch, Stack, Houck, & Berman, 1986). However, research has demonstrated that men over age 85 have more overall sleep disruption than any other group (Sukying, Bhokakul, & Udomsubpayakul, 2003).

Sleep disruption can also result from social factors such as socioeconomic status (SES). Individuals with lower SES suffer from more sleep disturbance and poorer health than those with higher SES (Hunt, McEwen & McKenna, 1985; Segovia, Bartlett, & Edwards, 1989; Van Cauter & Spiegel, 1999). Sleep disruption has also been associated with lower education and widowhood (Foley et al., 1999). Although age is not a cause of SES, many elders have fixed incomes and more healthcare costs. These stressors, combined with lower educational attainment, and loss of significant others can contribute to insomnia and depression. These predictable events are more common among older adults.

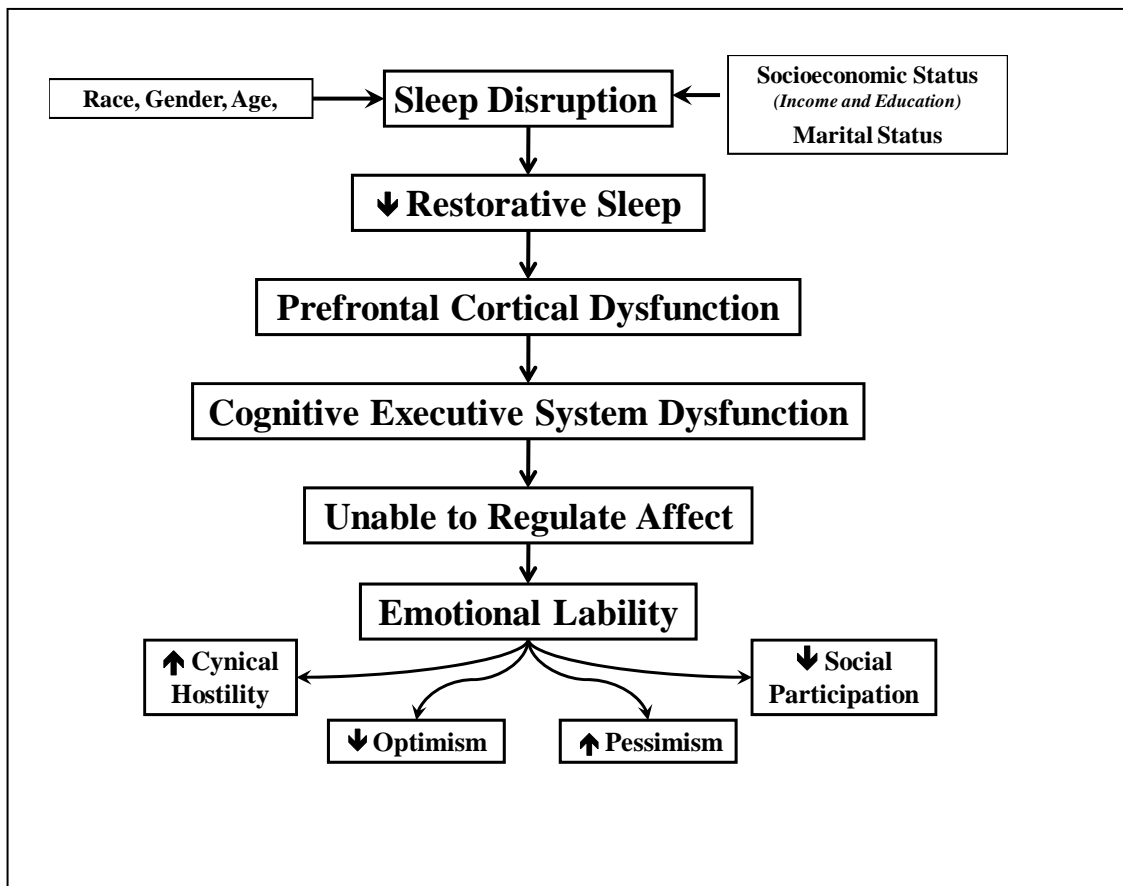


Figure 1. Conceptual Model.

*Note:* Adapted with permission from “Obstructive sleep apnea and the prefrontal cortex: towards a comprehensive model linking nocturnal upper airway obstruction to daytime cognitive and behavioral deficits” by Beebe, D. W., Author & Gozal, D., Author, 2002, *Journal of Sleep Research*, 11, p.11-16.

### *Sleep Disruption*

Very little data exist that support a definition of sleep disruption. As a nursing diagnosis, sleep disruption is defined as “time limited disruption of sleep (natural, periodic suspensions of consciousness) amount and quality” (Johnson, Bulechek, Dochterman, Maas, Moorhead, Swanson et al., 2005, p.17). Sleep disruption is also used as a synonym for insomnia, disturbed sleep or sleep disturbance (American Academy of Sleep Medicine, 2006). For the purposes of this paper, the North American Nursing Diagnosis Association (NANDA) diagnosis will be used.

The impact of sleep disruption and sleep disorders is not limited to the affected individuals. Sleep disruption and sleep disorders disrupt families and communities, though little research exists in this area. Sleep disruption may impact well-being, income, and the ability to care for ill family members at home, leading to family conflict such as divorce or estrangement (IOM, 2006). Sleep disruption of the individual or caregiver also affects healthcare decision making. The sleep disruption that typically accompanies dementias is one of the most common reasons for a family’s decision to institutionalize a loved one (Mishima, Okawa, Hozumi, & Hishikawa, 2000).

### *Social Integration*

Decreased social integration has been linked to cognitive decline, depressive symptoms and overall health (Beland, Zunaunegui, Alvarado, Otero & Del Ser, 2005; Cole & Dendukuri, 2003; Zunzunegui, Alvarado, Del Ser, & Otero, 2003). Sleep disruption weakens the ability to participate in social relationships, and results



in social isolation (Friedman, Hayney, Love, Urry, Rosenkranz, & Davidson et al., 2005; Roberts, Shema, Kaplan, & Strawbridge, 2000; Roth & Ancoli-Israel, 1992). There is also evidence that unsatisfactory social relationships and social isolation are related to lower social support, with subjects reporting greater sleep disruption than those with higher levels of social support and social connectedness (Stephoe & Marmot, 2003, Wang, Karp, Winblad, & Fratiglioni, 2002).

Social integration is crucial to older adults; they are at risk for a decrease in maintaining and strengthening their social networks (Wang et al., 2002; Young & Glasgow, 1998). Infrequent social activities, social disengagement, poor social connections, limited family ties, and low engagement with family predict cognitive decline in older adults (Beland et al., 2005; Zunzunegui et al., 2003). Productive leisure activities reduce cognitive decline and delay onset of dementia (Crowe, Andel, Pedersen, Johansson, & Gatz, 2003; Richards, Hardy, & Wadsworth, 2003; Singh-Mantoux, Richards, & Marmot, 2003). Inadequate and poor quality sleep interferes with the cognitive function that permits and maintains social integration (Ancoli-Israel, 2005).

### *Optimism and Pessimism*

There is a recent interest among those in the scientific community in the effects of positive emotional states on quality of life and health outcomes (Stephoe, O'Donnell, Marmot, & Wardle, 2008). Optimistic individuals expect positive outcomes and are goal oriented (Raikkonen & Matthews, 1999). Although optimism has long been recognized in the preservation of mental health, optimism is a protector of physical health as well (Taylor, Kemeny, Reed, Bower, & Gruenewald,

2000). In a large study ( $n = 736$ ) which included members of the Whitehall II cohort, positive self-affect and psychological well-being were associated with better sleep (Stepptoe et al. 2008). Additionally, positive self-affect appeared to mediate the relationship between sleep problems and negative psychological factors. Positive self-affect reduced the influence of negative psychological risk factors on sleep by 20-73% (Stepptoe et al. 2008). Haack and Mullington (2005) note that long-term inadequate sleep may compromise optimistic outlook and, inevitably, psychosocial functioning.

Interestingly, Stepptoe et al. (2008) also noted that the relationship between positive affect and sleep disruption is a reciprocal relationship; sleep disruption compromises positive affect and psychological well-being. Most studies have examined the effect of optimism on improving sleep outcomes. Very little literature exists that examines whether sleep disruption compromises an optimistic outlook. Older adults who are optimistic may have better health promotion behaviors, a greater sense of self-control and worth, and use health services more effectively (Taylor et al., 2000).

Pessimistic individuals tend to give up their goals and are more likely to experience negative consequences of physical or emotional situations (Bromberger & Matthews, 1996). Pessimism or negative self-affect has been found to be a predictor of both stroke and hypertension (Jonas & Lando, 2000; Ostir, Markides, Peek, & Goodwin, 2001). Pessimism and sleep disturbances have been identified as risk factors for depression (Kivela & Pahkala, 1988), but no research has addressed the relationship of sleep disruption as a predictor for pessimism as proposed in this

study. This relationship is especially important for older adults, as they will face more combined physical and psychological life events than any other age group.

### *Cynical Hostility*

Cynical hostility is defined as a stable behavior consisting of cynicism toward others, mistrust, harsh affect, argumentative responses, and defensiveness (Barefoot, Dodge, Peterson, Dahlstrom & Williams, 1989; Smith, 1992). Individuals with greater cynical hostility have been shown to be at risk for greater cardiovascular morbidity and mortality (Barefoot, Dahlstrom, & Williams, 1983; Boyle, Williams, Mark, Brummett, Siegler, Helms et al., 2004; Everson-Rose, Lewis, Karavolos, Matthews, Sutton-Tyrrell & Powell, 2006; Shekelle, Gale, Ostfeld, & Paul, 1983). Although little research has examined the effects of cynical hostility as a behavioral outcome of sleep disruption, Brisette and Cohen (2002) found that individuals with greater cynical hostility also reported greater sleep disturbances and greater negative affect than those without cynical hostility. However, the sample's age ranges were from 18-54 years only; no elderly subjects were included in this study.

Although there is some literature on the effect of cynical hostility on sleep disruption, there is no literature that assesses cynical hostility as a specific behavioral outcome of sleep disruption in older adults. However, because sleep disruption and cynical hostility are both related to cardiovascular morbidity and mortality, this study will explore the relationships of these three concepts. It is possible that sleep disruption predisposes aging adults to increased cynical hostility, which in turn could increase cardiovascular morbidity and mortality.

### Significance of the Study

In the following discussion, the terms sleep disruption and sleep loss, as well as sleep-related disorders and sleep disorders are used interchangeably. All these terms are also used interchangeably in the literature describing the morbidity, mortality, economic impact, health resource utilization, diagnosis, and treatment in elders. These topics are presented in more detail in the following sections.

#### *Morbidity and Mortality*

In the last decade, researchers have dispelled the notion that sleep disruption has no deleterious health consequences beyond daytime sleepiness. Sleep disorders occur more frequently with advancing age, as does the likelihood of comorbidities and chronic disease (Ersner et al., 1999). Sleep disruption has far-reaching effects on the cardiovascular, nervous, endocrine, and immune systems; sleep disruption has been associated with obesity, diabetes and impaired glucose tolerance, depression, anxiety, and other mood disturbances, psychiatric illness, Alzheimer's Disease, Parkinson's Disease, epilepsy, stroke, alcohol use, cardiovascular disease, and hypertension (IOM, 2006). Additionally, patients with insomnia or sleep insufficiency report lower health-related quality of life in the domains of physical distress, mental distress, pain, depressive symptoms, anxiety, and activity limitations (LeBlanc, Beaulieu-Bonneau, Merette, Savard, Ivers, & Morin, 2007; Strine & Chapman, 2005).

Sleep disruption is also associated with increased mortality risk according to population-based mortality studies. Subjects who sleep five consecutive hours or less have a 15% increase in all-cause mortality; additionally, progressively shorter or

longer sleep (above or below 7 consecutive hours) is associated with increased mortality (Heslop, Smith, Metcalfe, Macleod, & Hart, 2002; Patel, Ayas, Malhotra, White, Schernhammer, Speizer et al., 2004; Tamakoshi, Ohno, JACC Study Group, 2004). Kripke, Simons, Garfinkel and Hammond (1979) stated that persons sleeping less than five consecutive hours had a predicted mortality risk that was almost as great as those with histories of cardiovascular disease, diabetes, stroke, or hypertension. Mortality in older adults with common causes of death such as heart disease, suicide, cancer, or stroke is twice as high in older adults with sleep disorders compared with older adults who have adequate sleep (Ancoli-Israel & Cooke, 2005; Morgan, Healey, & Healey, 1989; Van Diest, 1990; Wingard & Berkman, 1983).

Older adults are naturally at greater risk for shorter sleep duration and less REM restorative sleep due to age-associated changes in sleep architecture. They are also at greater risk for pathological conditions that may affect sleep (Ancoli-Israel & Cooke, 2005; Bliwise, 2005). Older adults face natural and pathological effects of sleep disruption, combined with an increased mortality risk due to sustained shorter sleep periods. Healthcare professionals cannot overlook the impact of sleep disorders on morbidity and mortality in older adults.

#### *Economic Impact and Health Resource Utilization*

Although there are varying estimates of the economic impact of sleep disruption and sleep disorders, researchers agree that the economic impact is substantial. The Institute of Medicine (IOM) (2006) states that hundreds of billions of dollars are spent each year on direct and indirect costs of sleep disorders, but the “full economic impact of sleep loss and sleep disorders on individuals and society is

not known” (p.187). Because there is limited data on the impact of sleep disruption, it will be discussed within the context of two of the most commonly occurring sleep disorders in older adults, obstructive sleep apnea and insomnia (IOM, 2006).

Al-Ghanim, Comondore, Fleetham, Marra, and Ayas (2008) state that the economic impact of obstructive sleep apnea may exceed the financial burden of asthma and chronic obstructive pulmonary disease, and would be comparable to the yearly cost of diabetes, which was \$132 billion dollars in 2002 (American Diabetes Association, 2003). In two analyses of annual direct costs of insomnia, including nursing home patients, the costs of insomnia are estimated to be between \$1.79 billion and \$13.9 billion. When prescription and over-the-counter medications used to treat insomnia are included, and nursing home patients are excluded, estimated direct costs are between \$1.8 billion to \$3 billion annually, (Chilcott & Shapiro, 1996; Fullerton, 2006; Walsh & Englehardt, 1999). Indirect costs are estimated between \$77-\$92 billion, including medical comorbidities, increased hospitalization, alcohol abuse, workplace productivity, and motor vehicle and other accidents (Fullerton, 2006; Stoller, 1994).

Elderly patients with insomnia demonstrated a 60% increase in average health resource costs when compared with elders without insomnia. After the findings were adjusted for depression, elders with insomnia still demonstrated a 25-50% increase in healthcare costs (Fullerton, 2006; Simon & VonKorff, 1997).

*Sleep Disorders Remain Under-Diagnosed*

Despite the overwhelming evidence that sleep disorders result in increased morbidity, increased mortality, substantial economic burden, and increased use of health resources, millions of those with sleep disorders remain undiagnosed (Hossain & Shapiro, 2002; IOM, 2006; Young, Evans, Finn, & Palta, 1997). The general population, healthcare professionals and policy makers remain largely unaware of the public health burden of sleep loss and sleep disorders (IOM, 2006). Patients often fail to mention sleep-related problems because they feel that nothing can be done about the problem, or that healthcare providers will do nothing to evaluate the problem (Engstrom, Strohl, Rose, Lewandowski, & Stefanek, 1999). Two-thirds of adults have never been asked about their sleep habits by their primary physician (National Sleep Foundation, 2000). When physicians do ask, they are more likely to make a diagnosis of depression than insomnia when sleep complaints are present (Kripke, Garfinkel, Wingard, Klauber, & Marler, 2002).

In a survey of 45 geriatricians, Haponik (1992) found that sleep complaints are largely viewed as secondary to comorbidities or medications and that very few respondents acknowledged any formal training in sleep disorder diagnosis and treatment. Primary sleep disorders in elders are rarely diagnosed by physicians and few physicians obtain or refer patients for polysomnography to evaluate sleep complaints. Although non-pharmacologic methods were recognized, very few physicians provide any non-pharmacologic sleep hygiene methods in their practice (Haponik, 1992; Richardson & Doghramji, 2005).

The very nature of diagnosing sleep disruption and sleep disorders places the older adult at a disadvantage. Diagnosis of sleep disorders largely depends on subjective complaints of sleep disruption, and the older adult must recognize the sleep disruption as a problem. Many older adults tend to accept sleep disruption as a consequence of aging and adapt accordingly, not reporting problems unless they perceive them as serious. Additionally, older adults may report adequate sleep, even though the amount of quality sleep is substantially restricted (Bliwise, 2005; Hoffman, 2003; Jean-Louis, Kripke, & Ancoli-Israel, 2000).

#### *Sleep Disorders Are Treatable*

Sleep loss and sleep disorders in older adults are remedial and treatable conditions. Adequate assessment is crucial and a clinical sleep history must be obtained by the healthcare provider (Avidan, 2005; Hoffman, 2003). Objective measures such as polysomnography may be necessary to assess the older adult's sleep, or to identify a particular sleep disorder.

Various non-pharmacological measures exist for promoting sleep in the older adult. Sleep is often enhanced by implementation of simple sleep hygiene measures including, but not limited to, going to bed at the same time every night, removing disturbances from the bedroom, using the bedroom only for sleep, avoiding alcohol, smoking, and large meals before bedtime, and limiting daytime napping. Professional non-pharmacologic treatments include cognitive-behavioral therapy, relaxation therapy, cognitive therapy, stimulus-control therapy, and sleep restriction limits (Richardson & Doghramji, 2005).



Pharmacologic therapies are also available, but should be evaluated periodically. Many older adults take prescribed hypnotic medications, but will continue to take them even though their sleep complaints do not subside (Bliwise, 2005). Hypnotic medications may also have adverse effects in older adults resulting in increased risk of falls, fractures, effects on balance and equilibrium, and decreased cognitive function during the day (Allain, Bentue-Ferrer, Polard, Akwa, & Patat, 2005; Avidan, 2005; Bliwise, 2005; Conn & Madan, 2006; Martin & Ancoli-Israel, 2008).

The IOM Committee on Sleep Medicine and Research (2006) recommends a multidisciplinary three-pronged strategy for increasing the awareness, diagnosis and treatment of sleep loss and sleep disorders. First, the general public must be aware of sleep disorders, with program campaigns beginning as early as kindergarten, and continuing in community areas such as hospitals, local health departments, private industries, and entertainment media. Second, healthcare professionals must be educated through specific training programs, targeted curricula, and certification requisites. Finally, the IOM advocates for expanded surveillance and examination of the general population (IOM, 2006). Recognition of the prevalence and impact of sleep disorders is crucial for older adults and the population at large; the consequences of undiagnosed sleep disorders largely exceed the advantages of adequate treatment (IOM, 2006). Therefore, this study will capitalize on existing data from the HRS study to examine sleep disruption and behavioral outcomes.

### Assumptions

For the purpose of this study, the following assumptions were made:

1. The subjects were truthful in their responses to the HRS.
2. There are certain subjects in the general population with behavioral extremes that would prohibit them from participating in the study.
3. The subjects met the level of literacy required in the study.
4. The subjects were sufficiently physically and mentally healthy to complete the survey.
5. Subject responses were free from bias or coercion by investigators.
6. Each subject consented to participate in the study through an informed consent process.
7. The truncated instrumentation for concepts in the study is sufficiently sensitive for statistical analysis.

## CHAPTER 2

### REVIEW OF THE LITERATURE

This chapter explores concepts as found in the literature that are congruent with the theoretical model previously introduced in Chapter 1. Potential factors influencing sleep disruption are introduced, followed by sleep disruption, and finally potential outcomes of sleep disruption in the community dwelling older adult. The literature review is a comprehensive result of the examination of the PubMed, PsycINFO, CINAHL, and Nursing Academic Edition Databases.

#### Sleep Disruption in the Older Adult

Sleep disruption in older adults is widespread and multifactorial. Although many older adults and healthcare professionals accept that decreased sleep is a normal part of aging, older adults do not have a reduced need for sleep; rather, it is the ability to sleep that declines with aging (Ancoli-Israel, 2005). The decreased ability to sleep is related to a variety of factors including alterations in the timing and consolidation of sleep, medications, medical and psychiatric illnesses, and the increased risk of sleep disorders such as insomnia, OSA, RLS, and circadian rhythm disturbances (Ancoli-Israel, 2005; Avidan, 2005; Bliwise, 2005). The risk of sleep disorders increases with age, with insomnia affecting 20-40% of elderly at least a few nights per month (Ancoli-Israel & Cooke, 2005; Foley et al., 1995). The consequences of continuous disrupted sleep often manifest in declining cognition, confusion, slowed intellect, decreased psychomotor skills, and increased likelihood of injury. Any of these consequences may threaten quality of life, and may produce

physical, psychological, social, and economic problems for older adults and caregivers (Avidan, 2005).

#### *Age-Associated Changes in Sleep Architecture*

It has been well documented that older adults experience age-associated changes in sleep architecture as they age. Older adults experience *decreased total sleep time* (Brendel, Reynolds, Jennings, Hoch, Monk, Berman, et al., 1990; Brezinova, 1975; Burger, Stanson, Daniels, Sheedy, & Shepard, 1992; Buysse, Browman, Monk, Reynolds, Fasiczka, & Kupfer, 1992; Carrier, Land, Buysse, Kupfer, & Monk, 2001; Crowley, Trinder, Kim, Carrington, & Colrain, 2002; Frank, Roland, Sturis, Byrne, Refetoff, Polonsky, et al., 1995; Gaillard, 1978; Gaudreau, Carrier, & Montplaisir, 2001; Gillin, Duncan, Murphy, Post, Wehr, Goodwin, et al., 1981; Hoch, Dew, Reynolds, Monk, Buysse, Houck et al., 1994; Monk, Reynolds, Buysse, Hoch, Jarrett, Jennings, et al., 1991; Lauer, Riemann, Wiegand, & Berger, 1991; Monk, Reynolds, Machen, & Kupfer, 1992; Nicolas, Petit, Rompre, & Montplaisir, 2001; Ohayon, Carskadon, Guilleminault, & Vitiello, 2004; Schiavi, White, & Mandeli, 1992; Schiavi & Schreiner-Engel 1988; Van Cauter, Leproult, & Plat, 2000; Yoon, Kripke, Youngstedt, & Elliott, 2004), *decreased sleep efficiency* (Bixler, Kales, Jacoby, Soldatos, & Vela-Bueno, 1984; Brendel et al., 1990; Carrier et al., 2001; Crowley et al, 2002; Frank et al., 1995; Gaillard, 1978; Gaudreau et al., 2001; Gillin et al., 1981; Haimov & Lavie, 1997; Hayashi & Endo, 1982; Hoch et al., 1994; Hoch, Reynolds, Monk, Buysse, Yeager, Houck et al., 1990; Landolt, Dijk, Achermann, & Borbely, 1996; Lauer et al., 1991; Monk et al., 1992; Monk et al., 1991; Naifeh, Severinghaus, & Kamiya, 1987; Nicolas et al., 2001; Ohayon et

al., 2004; Parrino, Boselli, Spaggiari, Smerieri, & Terzano, 1998; Rao, Poland, Lutchmansingh, Ott, McCracken, & Lin, 1999; Schiavi et al., 1992; Schiavi & Schreiner-Engel, 1988; Yoon et al., 2003), *reduced slow-wave sleep (SWS)* (Brendel et al., 1990; Brezinova, 1975; Burger et al., 1992; Buysse et al., 1992; Carrier et al., 2001; Crowley et al., 2002; Ehlers & Kupfer, 1997; Frank et al., 1995; Gaudreau et al., 2001; Gillin et al., 1981; Haimov & Lavie, 1997; Hayashi et al., 1982; Lanholt et al., 1996; Lauer et al., 1991; Monk et al., 1992; Naifeh et al., 1987; Nicolas et al., 2001; Ohayon et al., 2004; Parrino et al., 1998; Van Cauter et al., 2000; Van Coevorden, Mockel, Laurent, Kerkhofs, L'Hermite-Baleriaux, Decoster, et al., 1991; Zepelin & McDonald, 1987) and *reduced percentage of rapid eye movement (REM) sleep* (Brendel et al., 1990; Brezinova, 1975; Buysse et al., 1992; Carrier et al., 2001; Crowley et al., 2002; Frank et al., 1995; Gaudreau et al., 2001; Gillin et al., 1981; Hayashi & Endo, 1982; Hoch et al., 1994; Monk et al., 1992; Monk et al., 1991; Naifeh et al., 1987; Ohayon et al., 2004; Parrino et al., 1998; Schiavi et al., 1988; Van Cauter et al., 2000; Van Coevorden et al., 1991; Zepelin & McDonald, 1987).

The most striking changes occurring in older adults are a reduction in slow-wave sleep (SWS), and an increase in Stages 1 and 2 of sleep. SWS comprises Stages 3 and 4 of the sleep cycle, commonly referred to as the first non-rapid eye movement cycle (Bliwise, 1993; Reynolds, Monk, Hoch, Jennings, Buysse, Houck, et al., 1991). Although the exact age in which SWS begins to decline is unknown, Ohayon et al. (2004) state that SWS and REM sleep changes are already seen in young adults (ages 20-28), continuing to middle-aged adults (ages 42-56), and that SWS decreases in a linear fashion of 2% per each decade of age, up to 60 years.

Sleep continues at a steady length from ages 60-90, with the exception of gradual decrease in sleep efficiency to about 70-80% of normal sleep efficiency (Ancoli-Israel, 2005; Bliwise, 1993; Ohayon, et al., 2004). It has been hypothesized that the delta power exhibited on electroencephalogram during SWS is an indicator of the restorative function of sleep (Ancoli-Israel, 2005; Jenni & Carskadon, 2005). If this hypothesis is true, then adults may face considerable decline in the restorative function of sleep by middle age, resulting in subsequent sleep disruption in older adults (Ancoli-Israel, 2005; Ohayon et al., 2004; Van- Cauter et al., 2000).

The other most notable factor in sleep architecture is the percent increase in Stage 1 and Stage 2 sleep. Stages 1 and 2 are usually characterized as “light” sleep, and the amount of time spent in these stages has been shown to increase by 8-15% in older subjects (Bliwise, 2005; Bliwise, 1993; Ohayon et al., 2004; Unruh, Redline, An, Buysse, Nieto, Yeh et al., 2008). Increased time in Stage 1 sleep is considered to be representative of fragmented, disrupted sleep. Additionally, the amount of brief arousals during sleep is notable in older adults, with as many as 18-27 arousal events per hour (Boselli, Parrino, Smelieri, & Terzano, 1998). This inability to maintain continuous sleep is frequent in aging adults, as well other aging mammalian species (Bliwise, 1993).

Although a wealth of data exist on the changes in sleep architecture in elders, many earlier studies involved small sample sizes of healthy adults, with little recognition to confounding factors such as sleep disorders, sleep pathology, or demographics (Bliwise, 2005; Ohayon et al., 2004). Only recently have these changes been carefully collected and analyzed through large population-based

studies that address the effects of comorbidities, sleep-disordered breathing (SDB), and demographic factors in describing sleep of aging adults (Bliwise 2005; Redline, Kirchner, Quan, Gottlieb, Kapur, & Newman, 2004).

The Sleep Heart Health Study (SHHS) is a multicenter population-based study that recruited subjects from eight existing cohort studies; the Atherosclerosis Risk in Communities Study, the Cardiovascular Health Study, the New York Hypertension Cohorts, the Tucson Epidemiologic Study of Airways and Obstructive Diseases, the Framingham Heart Study Offspring and Omni Cohorts, the Strong Heart Health Study, and the Tuscon Health and Environment Study (Quan, Howard, Iber, Kiley, Nieto, O'Connor, et al., 1997; Young, Shahar, Nieto, Redline, Newman, Gottlieb et al., 2002). The SHHS study design is such that subjects are recruited from these cohorts that already possess data on cardiovascular disease, risk factors, demographics, and comorbidities. The primary goal of the SHHS is to test the hypothesis that sleep-disordered breathing is associated with an increased risk of coronary heart disease events, stroke, longitudinal increase in blood pressure, and all-cause mortality (Quan et al., 1997). This design allows for longitudinal assessment of middle-aged and older adults, with over 11,000 subjects in the combined cohorts eligible for screening. Once samples are chosen, the SHHS employs subjective and objective measures for assessing sleep, such as sleep questionnaires, clinical examinations and in-home polysomnography (Nieto, Young, Lind, Shahar, Samet, & Redline, 2000; Quan et al., 1997; Unruh, 2008; Young et al., 2002).

One of the greatest advantages of the SHHS is the ability to determine associations between SDB and demographic, physical, psychosocial, and comorbidities of middle-aged and older adults. SHHS studies have concluded that subjects (N=6,132) with a higher severity of SDB have 1.3 times the elevation of systolic and diastolic blood pressure than those with lower values of SDB (Nieto et al., 2000). Young et al. (2002) found that subjects (N=5,615) with habitual snoring, loud snoring, numerous breathing pauses, male gender, high body mass index, and increased neck girth were 3-4 times more likely to have severe SDB; however, as age increased the strength of these associations decreased. Aging was also associated with decreased sleep time, decreased sleep efficiency, and increased brief arousals during sleep (Unruh et al., 2008). Further data from selected SHHS studies will be addressed in the sleep and gender, and sleep and race discussions.

### Sleep and Gender

Although there are age-associated changes that contribute to sleep disruption, perhaps the most striking differences in sleep architecture are between males and females. It has long been accepted that sleep disruption is greater in men, but more frequently reported by women (Bliwise 2005; Lavie, 2007; Ohayon et al. 2004; Pack, Dinges, Gehrman, Staley, Pack, & Maislin, 2006; Redline et al. 2004; Richardson & Doghjirami, 2005; Unruh et al., 2008; Young et al. 2002). Total sleep time is markedly longer for women, yet they report more awakenings, less total sleep time, longer time to fall asleep, and overall poorer sleep quality (Reyner & Horne, 1995). Due to the differences in self-reported sleep quality between men and



women, objective assessments with actigraphy or polysomnography have yielded the most definition data in sleep architecture and gender.

The most dramatic sleep architecture gender differences involve the amount of time spent in SWS. Redline et al. (2004) found that men spend considerable less time in SWS, more time in Stage 1 and Stage 2 sleep, and less time in REM sleep than women. Additionally, women showed no significant reduction in SWS, and had a 106% more time in SWS than men. About 10% of the subjects (N=864) had cardiovascular or lung disease, and over one-third had a history of hypertension (Bliwise, 2005; Redline et al., 2004.)

Findings of Redline et al. (2004) were confirmed by Unruh et al., (2008), who used SHHS data to examine the associations between subjective and objective reports of sleep quality in elder adults (N=5,407). Aging men had poorer sleep than aging women based on objective polysomnography examination. However, women (mean age =  $63.6 \pm 11.2$  years) subjectively reported more difficulty in falling asleep, waking at night, and waking too early. Men (mean age =  $63.5 \pm 10.7$  years) showed an increased percentage of time in Stage 1 and 2 sleep, and less time in SWS than elderly women. These findings are comparable with Ohayon et al. (2004), who in a meta-analysis of 65 sleep studies, reported a larger effect size in the association of reduced sleep efficiency and females, possibly due to self-report. The above findings have important implications as researchers should consider the obvious gender differences in sleep physiology.

## Sleep and Marital Status

### *Marital Status and Mortality*

Marital status has been reported as a significant risk factor for mortality in community-dwelling older adults (Ebrahim, Wannamethee, McCallum, Walker, & Shaper, 1995; Ikeda, Tso, Toyoshima, Fujino, Mizoue, Yoshimura et al., 2007; Kumlin, Latscha, Orth-Gomer, Dimberg, Lanioselee, Simon et al., 2001; Manzoli, Villari, Pirone, & Boccia, 2007). Older men are more likely to be married, and older women are more likely to live alone or with their family (Zunzunegui et al., 2003). In a recent meta-analysis of marital status and mortality in elderly subjects, Manzoli et al. (2007) found that subjects who were widowed, divorced or separated, or never married had higher relative risks of mortality than married subjects. Marriage was an independent predictor of survival, and married elders had a 9-15% reduced mortality risk compared to non-married elders (Manzoli et al. 2007).

In a longitudinal study of British middle-aged men ( $n = 7,735$ ) over 11 years, Ebrahim et al. (1995) found that widowed men had increased risks of non-cardiovascular mortality, and that divorced men were almost twice as likely to die from cardiovascular-related diseases and four times more likely to die of non-cardiovascular diseases. Another longitudinal study by Ikeda et al. (2007) examined marital status and mortality risk in 94,062 middle-aged and elderly Japanese subjects. Never-married men were three times as likely to die from cardiovascular disease, and twice as likely to die from respiratory disease or external causes. Never-married women were 1.5 times as likely to die from all- cause mortality. Divorced and widowed men also demonstrated increased mortality risk from cardiovascular,

external, and all-cause disease, although divorced and widowed women did not. When marital status and cardiovascular risk factors were studied, Kumlin et al. (2001) found no differences between widowed and divorced males compared with married males in the development of cardiovascular risk factors such as cholesterol and blood pressure (Kumlin et al. 2001).

#### *Marital Status and Sleep*

Very few studies address the effects of marital status on sleep excepting marital satisfaction studies that address the impact of sleep disorders on bed partner's sleep, and the influence of close relationships on quality sleep (Troxel, Robies, Hall, & Buysse, 2007). Nugent, McCrum, Patterson, Evans, and MacMahon (2001) found that middle-aged men who were divorced, separated, or widowed, were more likely to suffer excessive daytime sleepiness in a sample of Irish males ( $n = 2,364$ ). In a sample of younger and middle-aged subjects, single mothers ( $n = 160$ ) were almost twice as likely to report sleep problems (Baker, Mead, & Campbell, 2002). Kowalski and Bondmass (2008) found that widows reported sleep disturbances, and that reports did not decrease across a 5-year follow-up. This suggests that widowhood may be associated with long-term sleep disturbance (Kowalski & Bondmass, 2008).

Teculescu, Hannhart, Virion, Montaut-Verient, and Michaelley (2004) examined the relationships between marital status and sleep-disordered breathing in a sample of middle-aged French men ( $n = 499$ ). They found no differences between single men (including never married, divorced/separated, and widowed), and

married men in the prevalence of sleep-disordered breathing. However, single men comprised only 14% of the sample (Teculescu et al., 2004).

The literature on marital status and sleep outside of marital satisfaction studies is relatively sparse. Marital status has been studied in community-dwelling older adults regarding mortality risks. Population-based studies are needed in these areas to explore the effects of marital status on sleep disruption in community dwelling older adults.

### Sleep and Race/Ethnicity

Although numerous studies have validated the differences in sleep and gender, few studies have addressed race or ethnicity and sleep disruption (Ancoli-Israel, Klauber, Stepnowsky, Estline, Chinn, & Fell, 1995; Kutner et al., 2004). Studies have been limited as to the ethnicities included, and racial studies on sleep have yielded conflicting results.

The greatest amount of data on race/ethnicity and sleep disruption compares Black to White subjects. In two large studies involving subjects of the Established Populations for Epidemiologic Studies of the Elderly cohorts, Blacks reported fewer sleep complaints after controlling for gender, age, education, physical health, cognitive status, perceived health status and depression. However, at the 3-year follow-up of these subjects, Black women had a significantly higher incidence of insomnia, when compared to Whites and Black men (Blazer et al., 1995; Foley et al., 1995).

Two studies explored the effects of race on sleep in the Cardiovascular Health Study, with each study having over 4,000 subjects. Subjective sleep reports indicated

that Black males reported less nighttime awakenings than Black females or Whites (Newman, Enright, Manolio, Haponik, Wahl, & Cardiovascular Health Study Group, 1997; Whitney, Enright, Newman, Bonekat, Foley, & Quan, 1998;). However, in the same study, Whitney et al. (1998) also reported that elderly Black men had significantly higher reported daytime sleepiness (mean Epworth Sleepiness Scale = 7.13) than White men or Black or White women.

Rao, Poland, Lutchmansingh, Ott, McCracken, and Lin (1999) examined sleep architecture and ethnicity including 73 subjects representing four ethnic groups who underwent polysomnographic evaluation for two nights. Blacks had more Stage 1 and 2 sleep, and reduced Stage 4 sleep. However, limitations of this study included small sample size, and that the subjects were classified as having good physical and psychological health, and had no sleep disorders.

Recent data has indicated differences among ethnicities, other than Whites and Blacks. Using data from the SHHS (n = 2,685), Redline et al. (2004) found that Native Americans had more Stage 1 sleep than Whites or Blacks, a higher percentage of Stage 2 sleep, and less SWS sleep than Blacks, Whites, Hispanics, or Asian Americans. Blacks had a higher percentage of Stage 2 sleep compared with Whites and Hispanics, and had fewer night arousals than Whites. These findings are based on objective polysomnography, with the study sample including subjects ages 37-92 years (Redline et al., 2004).

Race has also been reported to interact with chronic illness in predicting sleep complaints. Chronic disease in these studies was defined as chronic renal disease receiving dialysis therapy (Kutner, Bliwise, Brogan, & Zhang, 2001; Kutner et al.,

2004). After non-renal health conditions, depressed mood, perceived health status, medications, and sociodemographics were controlled, Whites reported higher rates of sleep disturbance than Blacks. Both races shared a chronic illness, similar age, and treatment course when compared to an illness-free community sample (Kutner et al., 2004; Kutner et al., 2001).

There are external factors to consider when examining sleep disruption in Black populations. Kutner et al. (2004) acknowledge that social processes may play a role in the sleep of Black participants. Troxel, Matthews, Bromberger, and Sutton-Tyrell (2003) posit that previous studies have not addressed the overall stress burden in ethnic minorities and have not acknowledged the effects of persistent environmental stressors. At least half of Blacks in the US are at risk for substandard housing, lack of employment opportunities, lower wages and racial discrimination (Sigelman & Welch, 1991; Troxel et al., 2003). Troxel et al. (2003) also note that the literature on chronic stress and discrimination is largely dependent on the appearance of clinical disease. Older Blacks have been shown to report health complaints less than Whites; consequently, Black aging adults with sleep disruption may not report the problem (Kutner et al., 2004). Even if they do, it may be viewed as a result rather than an etiology of subsequent illness.

Studies on race/ethnicity and sleep are quite limited, and the majority focuses on sleep differences between Blacks and Whites only. There are very limited data on Hispanic, Asian-American, or Native American subjects. Data are also limited in elders. Further population-based studies with representative sample sizes of minorities are needed to explore this relationship.

## Sleep and Socioeconomic Status

SES is regarded as a crucial factor in the physical, mental, and psychosocial well-being of all individuals. This review considers the relationship between sleep disturbance and SES, within the context of income and education. SES factors such as income and education have been used to measure the relationships between SES and sleep disturbances and have been shown to be predictors of sleep disruption in older adults (Moore, Adler, Williams, & Jackson, 2002; Paine, Gander, Harris, & Reid, 2004). Both income and education are strongly related to health in the older adult (Veenstra, 2000).

Lower SES individuals report more insomnia and sleep disturbance (Ancoli-Israel & Roth, 1999; Chiu, Leung, Lam, Wing, Chung, Li, et al. 1999; Ford & Kamerow, 1989; Kim, Uchiyama, Okawa, Liu, & Ogihara, 2000; Lege, Guilleminault, Dreyfus, Delahaye, & Paillard, 2000; Li, Wing, Ho, & Fong, 2002; Ohayon & Hong, 2002; Ohayon, Caulet, & Guilleminault, 1997; Ohayon, 1996; Paine et al. 2004; Pallesen, Nordhus, Nielsen, 2001; Sutton, Moldofsky, & Badley, 2001). Van Cauter and Spiegel (1999) state that individuals of lower SES may face additional difficulties in obtaining restorative sleep due to poor environmental conditions, crowded or unsafe living situations, noise, temperature, and the resulting anxiety and stress that arise from these situations.

### *Income*

Household income is a significant predictor of insomnia and sleep quality (Friedman, Love, Rosenkranz, Urry, Davidson, Singer et al., 2007; Moore et al., 2002; Paine et al., 2004). Income also predicted increased risk of cardiovascular

disease in patients with OSA (Tarasiuk, Greenberg-Dotan, Simon, Tal, Oksenberg, & Reuveni, 2006). In older adults, chronic financial stress and income levels have been shown to significantly correlate with reduced sleep efficiency after controlling for confounding factors such as age, sex, and mental and physical health, upon polysomnographic evaluation (Friedman et al., 2007; Hall, Buysse, Nofzinger, Reynolds, Thompson, Mazumdar, et al. 2008;).

Two studies have explored the mediating role of sleep in associations of SES and health. Moore et al. (2002) state that although higher income was associated with better physical and mental health, the relationship was mediated by sleep quality, suggesting that sleep quality may be a link in translating SES into physical and mental health in older women. Van Cauter and Spiegel (1999) tested the hypothesis that the effects of low SES on health are mediated by decreases in sleep efficiency and sleep quality. Sleep loss was related to reduced glucose tolerance, increased evening cortisol levels, and heightened central nervous system sympathetic activity; thus, sleep loss increases allostatic load and possibly contributes to the development of chronic diseases such as diabetes, hypertension, and obesity that are more prevalent in individuals with lower SES (Van Cauter & Spiegel, 1999).

### *Education*

Level of education has been shown to affect the cognitive status, and psychosocial well-being of older adults (Veenstra, 2000; Wight, Aneshensel, Miller-Martinez, Botticello, Cummings, Karlamangia et al., 2006), and this effect is maintained when controlling for level of household income (Wight et al. 2006).



Level of education has also been shown to affect sleep (Friedman et al. 2007; Gellis, Lichstein, Scarinci, Durrence, Taylor, Bush et al. 2005; Moore et al., 2002; Paine et al., 2004; Tarasiuk et al., 2006). Higher education predicted higher income, better quality sleep, reduced psychological distress, and better physical health than those with less education; consequently, lower education reduced sleep efficiency in this sample of 710 community dwelling women (Moore et al., 2002).

Gellis et al. (2005) measured SES by three educational levels, individual, household, and community. Subjects with lower individual and household education were more likely to subjectively report insomnia. Individuals with very low educational levels, including those who dropped out of high school, reported greater difficulties due to their insomnia than those with higher levels of individual education (Gellis et al., 2005).

Although SES is related to sleep disturbance, few studies address older adults exclusively. Veenstra (2000) found that the relationship between SES and health was the strongest in his older subjects. Future research should continue to explore this relationship, as many older adults experience both lower SES and sleep disturbances.

### Social Integration

Continued social integration and social participation are crucial for the physical, mental, and psychosocial functioning of the older adult (Berkman, Glass, Brissette, & Seeman, 2000; Seeman, 2000; Zunzunegui et al., 2003). Participation in formal social organizations such as churches, clubs, and volunteer organizations seem to improve health in older adults (Young & Glasgow, 1998). Longitudinal studies of community-dwelling older adults have shown that individuals who have

poor social networks and are isolated have higher rates of cognitive decline and dementia (Bassuk, Glass, & Berkman, 1999; Fabrigoule, Letteneur, Dartigues, Zarrouk, Commenges, & Barber-Gateau, 1995; Fratiglioni, Wang, Ericson, Maytan, & Winbland, 2000; Seeman, Albert, Lusignolo, & Berkman, 2001).

Zunzunegui et al. (2003) conducted a longitudinal study over four years (N=964) to evaluate the effects of social networks, social integration, and social engagement on cognitive decline in community dwelling elders 65 and over in Spain. Poor social networks, less social participation, and social disengagement predicted cognitive decline over four years. Additionally, social integration predicted mortality. Men who had fewer visual exchanges with relatives or family members had increased mortality. Infrequent social participation, infrequent social engagement with friends and relatives predicted mortality in women (Zunzunegui et al., 2003).

Beland et al., (2005) confirmed the above findings in a 7-year longitudinal study (n = 1,272) that examined the trajectories of cognitive decline and social activities. Social integration was defined as belonging to a community association, attending religious services at least monthly, attending a community senior center at least monthly, and attending a public or outdoor meeting at least monthly. Social engagement and family ties were measured by contact with family and friends, and the frequency of contacts with children, extended family, and friends separately. Family relations and social engagement predicted cognitive decline. Contacts with friends lessened cognitive decline in women, but not men. There was also a significant difference in the rate of cognitive functioning between those with low

and high levels of social integration, with the strongest relationship occurring at older ages (Beland et al., 2005). These findings are consistent with Seidler, Bernhardt, Nienhaus, and Frolich (2003) who reported that social integration and social engagement seemed to be more crucial than social ties, and that a psychosocial network appears to be protective considering the causes of dementia.

Although social integration has been shown to predict cognitive decline in older adults, little literature has addressed the effects of sleep disruption on integration in social activities. Sleep disruption often results in subsequent daytime sleepiness, decreased alertness, cognitive decline, and mood disruption, all of which may contribute to decreased social integration, social isolation, and impaired ability to take pleasure in social relationships (Ancoli-Israel., 2005; Roth & Ancoli-Israel, 1999). Excessive daytime sleepiness can be devastating to both family and social relationships (Ancoli-Israel, 2005). Further research should continue to examine this relationship with population-based studies so that clinicians will consider that increased sleep disruption may be an obstacle in older adults who exhibit decreased social integration and subsequent cognitive decline.

#### Pessimism

Contrary to an optimistic outlook, pessimistic individuals possess general negative expectations about the likelihood of coping with stressful events. When faced with a stressor, pessimists are more likely to abandon their goals, remove effort, and become passive. Pessimists are more likely to face more serious physical or emotional effects of stressful situations than are optimists (Carver & Scheier, 1990; Raikonen et al., 1999).

### *Pessimism and Health*

There is very little literature that examines or measures pessimism separately from optimism. Pessimistic individuals have higher blood pressure. Grewen, Girdler, West, Bragdon, Costello, and Light (2000) found that the interaction of pessimistic attitudes and SES in post-menopausal women influences blood pressure. Post-menopausal women ( $n = 37$ , ages 39-64 years) with stable pessimistic attitudes and low SES had at least twice the rate of hypertension of women with less pessimism or higher SES. One-hundred percent of Black women classified as high pessimism/low SES were classified as hypertensive, compared with only 17% of Black women in the low pessimism group. Those women with high pessimism/low SES reported fewer stressful events, but also less social support, when compared with women in other groups (Grewen et al., 2000). In addition to higher blood pressure, pessimists also reported more common negative interpersonal interaction than those with lower pessimism scores, and less benefits from interpersonal interactions (Raikkonen et al., 1999).

### *Pessimism and Sleep*

There is very little literature that examines the relationships of pessimism and sleep disturbance. Pessimistic thoughts and sleep disturbances were both common in older adults with depression (Kivela & Pahkala, 1988). Aikens and Mendelson (1999) found that patients with OSA have greater pessimism than patients with primary snoring. Gabryelewicz, Styczynska, Pfeffer, Wasiak, Bareczak, Luczywek et al. (2004) found that both pessimism and sleep disturbance were prominent factors

in older adults with mild cognitive impairment, leading to major and minor depression.

## Optimism

### *Optimism and Health*

Optimism is defined as a longitudinal and cross-sectional cognitive, steady disposition, or temperament that believes an individual will invoke positive rather than negative feelings when experiencing or recounting life events, and will expect positive outcomes of future life events (Leung, Moneta, & McBride-Chang, 2005; Scheier & Carver, 1985). Optimism has been shown to be a predictor of self-reported health status in community dwelling older adults (Leung et al., 2005). Optimism has long been associated with better mental health and fewer depressive symptoms, but recent research has shown that optimism benefits physical health outcomes as well (Taylor et al., 2000). Being optimistic has been shown to safeguard against stroke and cardiovascular disease, affect blood pressure, hasten wound healing, and enhance resistance to infectious diseases (Cohen, Doyle, Turner, Alper, & Skoner, 2003; Ebrecht, Hextall, Kirtley, Taylor, Dyson, & Weinman, 2004; Haack & Mullington, 2005; Kubzansky, Sparrow, Vokonas, & Kawachi, 2001; Ostir, Markides, Peek, & Goodwin, 2001; Raikkonen, et al, 1999). Optimism has been associated with lower levels of pain and increased pain tolerance in those with painful medical conditions (Achat, Kawachi, Spiro, DeMolles, & Sparrow, 2000; Costello, Bragdon, Light, Sigurdsson, Bunting, Grewen, et al., 2002; Treharne, Kitas, Lyons, & Booth, 2005). Optimists recover more quickly from coronary bypass surgery, return to normal activities at a faster rate after discharge, and possess

greater postsurgical quality of life (Scheier, Matthew, Owens, Magovern, Lefebvre, Abbott, et al., 1989).

### *Optimism and Life Satisfaction*

Optimism is also a key component of life satisfaction. Optimism predicted coping mechanisms, good social relationships, better health promotion behaviors, adaptation, self-reported health, and life satisfaction (Boland & Cappeliez, 1997; Chang & Sanna, 2001; Chang, Maydeu, & D’Zurilla, 1997; Leung et al., 2005; Taylor et al., 2000; Scheier & Carver, 1992). Leung et al. (2005) found that although financial status mediated the relationship between optimism and life satisfaction, optimism was a key component of self-esteem, relationships, favorable views of financial situations, and subjective well-being in community dwelling older adults. These findings are particularly relevant as optimistic older adults may face more physical, social, and cognitive challenges, but they do not allow these challenges to negatively affect their self-image or regulation of self-affect (Archer, Adolfsson, & Karlsson, 2008; Leung et al., 2005).

### *Optimism and Sleep*

There is little literature regarding the impact of sleep on optimism. Haack and Mullington (2005) found that sustained sleep restriction may compromise optimistic and psychosocial attitudes. Optimism and sleep have been identified as correlates of anger symptoms, and both are shown to influence positive affect, and decrease depression (Archer et al., 2008; Carter & Acton, 2006; Thomas, 1991). Although optimism and sleep are often measured within the same studies, none have

assessed the ability of sleep disruption to predict optimistic outlook in community-dwelling elders.

Optimistic individuals view present and future events positively. Sleep disruption has been shown to affect optimistic outlook, but only in one study. Several studies use community dwelling older adults, but the predictive ability of sleep disruption on optimism has not been studied in this population. Because optimism has direct effects on cardiovascular disease, infectious disease, healing, and blood pressure, future research should clarify the relationship between sleep disruption and optimism in community-dwelling older adults.

#### Cynical Hostility

Cynical hostility as a concept is defined as a stable behavior consisting of cynicism toward others, mistrust, harsh affect, argumentative responses, and defensiveness (Barefoot et al., 1989; Smith 1992). The terms hostility and anger have often been used interchangeably in the literature, with few attempts to discriminate between the two constructs. Hostility has historically been viewed as a construct with attitudinal origins. Although the manifestation of anger is expected from one with this attitude, the angry affect appears to be the outcome of preceding hostile cognitions (Eckhardt, Norlander, & Deffenbacher, 2004).

The majority of the literature uses the Cook and Medley Hostility Inventory (HS) scale as the measure of hostility. The HS, developed in 1954, is a 50-item true/false questionnaire, and is a subset of the Minnesota Multiphasic Personality Inventory (MMPI). Although the HS is somewhat dated and there is much confusion

as to what the scale actually measures, it continues to be the most widely used measure of hostility today (Cook & Medley, 1954; Eckhardt et al., 2004).

### *Cardiovascular Disease and Mortality*

The overwhelming majority of cynical hostility literature is concerned with describing the effects of cynical hostility on cardiovascular disease, hypertension, and mortality. The seminal works exploring the effects of hostility on cardiovascular disease and mortality occurred in the 1980's. In a follow-up study of 255 physicians, Barefoot et al. (1983) administered the HS to medical students, and assessed their coronary heart disease (CHD) status 25 years later. Subjects with HS scores above the median were found to have an incidence of CHD events six times greater than those with HS scores below the median. Additionally, higher HS scores in deceased subjects predicted mortality from *all* causes, including cancer, accidents, suicide, gastrointestinal disorders, and other cardiovascular events. Mortality density for those with higher HS scores was 6.4 times greater than for those with lower HS scores (Barefoot et al., 1983).

The findings of Barefoot et al. (1983) were confirmed by Shekelle et al. (1983) in a 10-year follow-up study of 1,877 men who were members of the Western Electric Study, a prospective study of CHD in men aged 40-55 years. The men had no CHD events in the initial assessment period for the study. Higher scores on the HS were associated with 10-year and 20-year crude mortality rate from all causes of death combined. An increase of 23 points on the HS (the difference between the first and fifth quintiles) was associated with a 42% increase in the risk of death in the 20-year follow-up period (Shekelle et al., 1983). Results were similar for current



literature, as Boyle, Williams, Mark, Brummett, Siegler, Helms et al. (2004) found that hostility continues to be associated with worsened survival rates in CHD patients.

Although the literature confirms that hostility was strongly associated with occurrence of CHD events and mortality, the overwhelming majority of study subjects were men. There was virtually no discussion of gender, race, socioeconomic, or psychosocial factors that might predispose an individual to higher levels of hostility.

Recent research continues to look at the effects of hostility on CHD events in population-based studies, but also considers concomitant psychosocial characteristics in assessing risk. Knox, Adelman, Ellison, Arnett, Siegmund, Weidner et al. (2000) conducted a large cross-sectional analysis of men and women from the National Heart, Lung, and Blood Institute Family Heart Study (n = 4,643). Women with high hostility and low social support were significantly more likely to develop carotid lesions and coronary artery atherosclerosis, were 2.5 times as likely to have had a previous myocardial infarction, and men with the same characteristics were twice as likely to have a history of angina when compared with lower risk individuals, or those with higher social support levels (Knox et al., 2000; Knox, Siegmund, Weidner, Ellison, Adelman, & Paton, 1998).

Everson-Rose, Lewis, Karavolos, Matthews, Sutton-Tyrell, and Powell (2006) confirmed that greater hostility is associated with greater subclinical atherosclerosis in middle-aged Black and White women (N=589) using data from

the Study of Women's Health Across the Nation (SWAN) study. Hostility was found to be an independent predictor of CHD events in post-menopausal women ( $n = 792$ ) in the Heart and Estrogen/Progestin Replacement Study (HERS). Women within the highest quartile of hostility scores were twice as likely to have had a myocardial infarction (Chaput, Adams, Simon, Blumenthal, Vittinghoff, Lin et al., 2002).

#### *CHD Risk Factors*

Research has examined whether hostile individuals have a greater number of CHD risk factors. In a meta-analysis, Bunde and Suls (2006) evaluated the connection between hostility scores and CHD risk factors. HS scores were associated with lipid ratio, triglycerides, glucose, body mass index, insulin resistance, waist-to-hip ratio, smoking, alcohol consumption, and SES. Chaput et al. (2002) found higher hostility scores were associated with greater body mass index, and increased serum triglycerides, and they were inversely associated with high density lipoprotein cholesterol, self-rated general health, and education. Hostility was also associated with higher self-reports of health symptoms, but only after control for SES (Christensen, Lund, Damsgaard, Holstein, Ditlevsen, Diderichsen et al., 2004).

#### *Hypertension*

Cynical hostility has also been determined to have an association with increased blood pressure. Generally, individuals with higher hostility have displayed higher blood pressure readings than individuals with lower hostility scores (Christensen & Smith, 1993; Hardy & Smith, 1988; Holt-Lunstad, Smith, & Uchino,

2008; Jamner, Shapiro, Goldstein, & Hug, 1991; Kline, Fekete, & Sears, 2008; Linden, Chambers, Maurice, & Lenz, 1993; Shapiro, Goldstein, & Jamner, 1996; Spicer & Chamberlain 1996; Smith & Allred, 1989;). Individuals with higher hostility tend to display higher blood pressure readings during social interaction, interpersonal conflict, and stress when recalling a negative event (Christensen & Smith, 1993; Hardy & Smith, 1988; Kline et al., 2008; Smith & Allred, 1989).

Males with higher hostility had higher systolic or diastolic blood pressure readings or both; additionally, most studies that included only males involved undergraduate or graduate students (Christensen & Smith 1993; Jamner et al., 1991; Kline et al., 2008; Linden et al., 1993; Smith & Allred, 1989). Studies with males and females have shown males to have higher hostility, and that hostility is independently related to increased blood pressure and heart rate (Linden et al., 1993). However, Spicer and Chamberlain (1996) found that systolic and diastolic blood pressure was associated with higher HS scores only in women. Few studies have examined cynical hostility and blood pressure considering race. Shapiro et al. (1996) found that African American college students with higher cynical hostility scores had higher day and night systolic blood pressures compared with Caucasian subjects.

### *Sleep*

Only one study was located that evaluated the relationship between cynical hostility and sleep. Brisette and Cohen (2002) examined the effects of individual differences such as cynical hostility on affect and sleep following interpersonal conflict. Individuals higher in cynical hostility exhibited greater negative affect and

more sleep disturbance following interpersonal conflict. Although this study shows that hostility results in greater sleep disruption, the sample size was relatively small (N=47), and young (mean age = 34).

There has been little investigation into the effects of sleep disruption and cynical hostility. Though this research has identified that higher hostility is associated with sleep literature, no literature has examined whether sleep disruption contributes to a cynically hostile affect. Cynical hostility is associated with cardiovascular risk factors, increased blood pressure, cardiovascular disease, and increased mortality. Research on cynical hostility has been performed predominantly on male college students, and beyond follow-up studies, there is little literature that examines cynical hostility in other population groups, including community-dwelling older adults. Further research should examine this relationship, particularly with community-dwelling older adults who are naturally at risk for sleep disruption, hypertension, and cardiovascular disease.

### Conclusion

This review of literature has offered current information on factors affecting sleep disruption, sleep disruption in the older adult, and behavioral outcomes of sleep disruption. Older adults face numerous challenges to achieve adequate sleep. Sleep is understudied in regard to the behavioral outcomes of cynical hostility, optimism, pessimism, and social participation. Further research is needed on the role of sleep in determining specific behavioral outcomes.

## CHAPTER 3

### METHODS

This chapter presents the complete methodology of the HRS and is followed by the research plan to use HRS data for secondary analysis.

#### Health and Retirement Study

The Health and Retirement Study (HRS) is a longitudinal study conducted by The Institute for Social Research at the University of Michigan and funded by the National Institute on Aging (NIA) and the Social Security Administration. The HRS is designed to provide researchers with data needed to investigate the trajectories of economic, health, and family status in Americans aged 50 and older as they age, to provide an open atmosphere for theory/hypothesis testing, and to determine the parameters of dynamic behavioral models (HRS, 2007). The secondary purpose of the HRS is to provide a public access data base for researchers to conduct in depth analyses of embedded variables within a multidisciplinary framework.

#### *Research Design*

The HRS is a descriptive, longitudinal, national study of community dwelling older Americans. The initial sample included over 12,600 subjects in 7,600 households; the current HRS sample includes over 26,000 subjects in over 15,000 households (Willis, 2005).

### *Setting*

The HRS utilizes two settings to conduct baseline and follow-up interviews. Interview topics are reported across four domains; health, work and retirement, income and wealth, and family characteristics and intergenerational transfers. Upon entry into the study, the subject completes a baseline face-to-face interview in the subject's home. Follow-up interviews are then conducted every two years, and proxy surveys are conducted when elders cannot answer interviews personally, and after the death of the subject (Willis, 2005).

### *Sample Characteristics*

The HRS is a nationally representative random sample of subjects in the United States over the age of 51 (HRS, 2005). Subjects are screened after determining age eligibility, which is 51-61 years of age upon entry. The HRS also follows subjects into a nursing home setting if needed, but nursing home residents were not utilized in this study. The target sample is reached for each cohort by screening and recruiting until the target sample size for the cohort is reached (HRS, 2002).

The original HRS sample was recruited in 1992, with data collection of over 12,000 subjects, and is repeated every two years. A new cohort is added every six years. Subjects lost to follow-up by death/disability are replaced in the subsequent cohort to promote new sample growth. Secondarily, the spouses of age-eligible subjects are included in a shorter interview process, regardless of age. Spouse data are reported in the cohort of the age eligible primary subject. Inclusion criteria for subjects include a beginning age of 51-61 years, subjects who are cognitively intact,

and are willing to participate in the study. The HRS also allows for proxy interviews of cognitively impaired subjects when cognitive impairment occurs after the initial interview event. Exclusion criteria include participants under 18 years of age, pregnant women, or participants who are in prison or detention facilities (HRS, 2005).

The 2004 wave of the HRS contained 20,129 total respondents. The 2004 wave also included a new cohort called Early Baby Boomers (EBB), which includes 3,600 persons born 1948-1953, and their spouses (HRS, 2005). Data collection for the 2004 wave occurred from March 2004 until February 2005 (HRS, 2005). The response rate for the 2004 wave of the HRS was 88.9%. To date, the HRS data set contains five age-stratified subsamples determined by date of birth. Table 1 contains the sample characteristics of the 2004 wave of the HRS. Blacks and Hispanics are oversampled at a 2:1 ratio to Whites. The HRS also oversampled residents of Florida (Health & Retirement Study, 2005; Juster, 1995). Table 2 provides the core interview counts for the seven previous waves of the HRS.

Table 1. Sample Characteristics of the 2004 wave of the HRS (HRS, 2005)

Cohort	Birth	Subjects	Year Added
Original HRS Sample	1931-1941	2,885	1992
Asset and Health Dynamics among the Oldest Old (AHEAD)	1890-1923	2,858	1994
Children of the Depression (CODA)	1924-1930	7,224	1998
War Baby (WB)	1942-1947	2,806	1998
Early Baby Boomer (EBB)	1948-1953	2,257	2004

Table 2. HRS Core Interview Counts by Wave/Year of Data Collection 1992-2004 (HRS, 2007).

Birth Cohort	1992	1993/94	1995/96	1998	2000	2002	2004
1890-1923 (AHEAD)	201	7,572	6,415	5,356	4,452	3,559	2,858
1924-1930 (CODA)	1,014	1,607	1,511	3,753	3,437	3,166	2,885
1931-1941 (HRS)	9,814	8,923	8,543	8,244	7,785	7,537	7,224
1942-1947 (WB)	1,192	1,140	1,122	3,097	2,943	2,906	2,806
1948-1953 (EBB)	293	286	278	668	673	679	3,357
1954+	113	113	123	268	293	324	964
Unknown	2	1	0	0	0	0	35



### *Instruments*

In 2004, the HRS initiated the *Psychosocial Leave-Behind Questionnaire* (PLBQ). The PLBQ was used in a random sample of study subjects who were not in a nursing home after completion of the core interview. Subjects are instructed to complete the questionnaire and mail it back to the central location at the University of Michigan (Clarke, Fisher, House, Smith & Weir, 2007). The PLBQ was modeled after the psychosocial portions of the English Longitudinal Study on Aging (ELSA) in 2002.

The PLBQ has four goals: to assess the impact of psychosocial issues on health and functioning of the elderly, to enhance knowledge on the social disparities of health in the US, to provide data for secondary use by researchers in social science and epidemiological disciplines, and to assist in cross-cultural assessment of data from ELSA (Clarke et al., 2007). The PLBQ was administered to 4,000 randomly selected subjects in the 2004 wave. The response rate for the PLBQ was 76.8% in the original sample (Clarke et al., 2007).

The PLBQ consists of two questionnaires, the *Participant Questionnaire on Work and Health One* and the *Participant Lifestyle Questionnaire*. The Participant Lifestyle Questionnaire explores the psychosocial issues of aging and is administered randomly to all age cohorts of the HRS (Clarke et al., 2007). This questionnaire contains items on sleep sensitive behaviors such as cynical hostility, optimism, pessimism, and social integration utilized for this study.

*Protection of Human Subjects*

Study participant's names, addresses, and contact information are kept in secure files by the HRS. Survey information is released for researcher use after an extensive, rigorous process to remove all identifying information and approval of the researcher by the HRS Data Release Protocol Committee (NIA, 2002).

Data are available to the research community for secondary analysis over a secure website. Researchers are required to register for data access and downloads, and agree to make no attempt to identify participants. Appendix B provides information concerning unique identifiers. The HRS website also requires that publications be registered with the HRS for inclusion in an online bibliography. The HRS maintains IRB approval from the University in Michigan. Appendix A provides IRB approval and informed consent for the HRS; Appendix C provides current IRB approval for this study.

Phone interviews were conducted for every cohort, except the new cohort added in 2004, for which a face-to-face interview was conducted. Study subjects also completed the PLBQ at home after the initial core interview that was mailed to the Institute for Social Research at the University of Michigan (Clarke et al., 2007).

HRS subjects are invited to be informed of study findings. Study participants have their own participant page on the HRS website, participant newsletters, explanatory study brochures and links to other important agencies for older adults such as the Social Security Administration and the American Association of Retired Persons. Study participants may discontinue participation in the study at any time

(HRS, 2007). Participants are paid an average of \$40 for completing the survey (Willis, 2005).

### Methodology for Dissertation

The second portion of this chapter refers to the current study using HRS data to explore the impact of sleep disruption on behavioral outcomes in community dwelling older adults.

#### *Research Design*

A predictive, cross-sectional design was used for the current secondary analysis. Data were collected from the HRS subjects who completed the HRS, and the *PLBQ* from the 2004 data collection period.

#### *Sample Characteristics*

This study employs only a portion of those subjects completing the 2004 wave of the HRS ( $n = 1,439$ ) who also completed the *PLBQ* in 2004. The sample reflects only primary subjects; no proxy or spouse interviews were included in the sample. Table 3 displays the sample population by age cohort.

Table 3. *PLBQ* Sample Population by Age Cohort ( $n = 1, 439$ )

Cohort	Birth	Subjects
Asset and Health Dynamics of the Oldest Old (AHEAD)	1890-1923	93
Children of the Depression (CODA)	1924-1930	201
Original HRS Sample	1931-1941	736
War-Baby (WB)	1942-1947	197
Early Baby Boomer (EBB)	1948-1953	212
Total		1,439

### *Data Access and Procedures*

Codebooks, guides and data files from the 2004 wave of the HRS were downloaded via secure HRS website after registration requirements were met. Data downloads were kept on a password protected computer. HRS datasets used include the following: Section PR (preload respondent), Section A (respondent), Section B (demographics), Section C (physical health), Section Q (assets and income), and Section LB (leave-behind questionnaires) (HRS, 2004). Data from these core interview sections (PR through Q) were extracted and merged with those completing the PLBQ ( $n = 1,439$ ).

### *RAND Capital Corporation Data*

For the purposes of this study, the RAND Capital Corporation (RAND) dataset was utilized. The RAND data offers cleaned and processed data from the HRS in an attempt to make the data more manageable to researchers. RAND data includes imputation procedures and provides sample data weights taken directly from the HRS Tracker File and describes these procedures in detail. RAND offers a separate codebook for their variables. Both HRS and RAND codebooks were compared to ensure the correct variables were downloaded for the study. RAND data is available via the HRS website (St. Clair, Blake, Bugliari, Chien, Hayde, Hurd, et al., 2008).

Cases with incomplete data were included in the analysis. Cases were eliminated based on the following criteria: one missing item on the sleep disruption score (SDS), more than two missing items on the Cook and Medley hostility scale

(HS), one missing item on the Life Orientation Test Revised (LOT-R) for optimism, one missing item on the LOT-R for pessimism, and three or more missing items on the Social Integration scale. These criteria were determined by PLBQ guidelines for missing data (Clarke et al., 2007).

### *Definitions of Terms*

#### *Independent variables.*

In this study, individual demographic factors of age, gender, race, marital status, sleep disruption, comorbidities, income and education were used as independent variables. Age was defined as age in years at the end of the interview period. Participants indicated male or female gender. Race consisted of the following classifications: White/Caucasian, Black/African American, Other, don't know, refused, and blank/inapplicable. A separate question was used to answer whether the subject was considered Hispanic or Latino. Marital status included classifications of married, divorced, single, widowed, never married, not married, other, refused and blank/inapplicable. Responses were also categorized by actual or proxy respondents, and the type of proxy respondent (family or financial). Although proxy responses were used if the primary subject could not answer the survey, only data from primary subjects will be used for this secondary analysis (HRS, 2004).

Comorbidities were calculated by RAND into a comorbidity index. The comorbidity index was comprised of the following eight disease states: high blood pressure, diabetes, cancer, lung disease, heart disease, stroke, psychiatric problems, and arthritis. Participants were asked to indicate which of these disease states they

had ever had. These were then summed by RAND to provide an index of comorbidities (St. Clair et al., 2008).

Socioeconomic status is conceptualized as the participant's educational level, and income. Educational level is a scale variable, and was determined by the participant's response to numerical years of education. (HRS, 2004).

For income measures, primary subjects were asked to indicate their total assets and income in a dollar amount for numerous categories of income. Categories of income include work, self-employment, wages and salary, professional practice or trade, tips, bonuses, or commissions, second job, unemployment, worker's compensation, social security income, welfare, veteran's benefits, military benefits, real estate, rent from real estate, business or farm, pensions, retirement, savings bonds, certificates of deposit, or treasury bills, and individual retirement accounts (HRS, 2004). These categories were summed into one variable by RAND to provide a total dollar amount of assets and income for the subject.

Sleep disruption was operationalized for this study as the Sleep Disruption Score (SDS). The SDS contains the summed scores of the four sleep questions on the HRS. Item content includes difficulty falling asleep, waking during the night and not being able to return to sleep, trouble waking too early and not being able to return to sleep, and feeling really rested when waking in the morning. Subjects rate their sleep disruption using five anchors with point values as follows: most of the time = 3, sometimes = 2, rarely or never = 1, don't know = 0 or refused = 0. The SDS

consisted of recoded and summed scores, such that higher scores indicate greater sleep disruption for this study (HRS, 2004).

*Dependent variables.*

This study uses the independent variables above to examine their effects on behavioral outcomes. Social integration, pessimism, optimism, and cynical hostility are the behavioral outcomes of interest in this study. Appendices D through G provide the composition of each dependent variable's measurements.

*Social integration.*

The HRS Social Integration variable consists of one item that indicates the social interaction of the respondent. The HRS measures social integration in one question by asking respondents how often they attended meeting or social programs other than religious activities. Responses are recorded in Likert format as follows: 1 = never, 2 = less than once a month, 3 = about once a month, 4 = 2-3 times per month, 5 = once a week, and 6 = more than once a week. Appendix F provides the social integration scale. The social integration variable was adopted from ELSA (Clarke et al., 2007).

*Optimism/Pessimism.*

The PLBQ measures optimism/pessimism by using a portion of the LOT-R. The LOT-R was developed and revised by Dr. Charles Carver at the University of Miami, and Dr. Michael Scheier, and Dr. Michael Bridges at Carnegie Mellon University. The instrument is brief and has been used in a variety of research on behavioral and health outcomes of optimism and pessimism (Carver, 2007). The instrument is intended for research purposes

and is not a clinical measure. There are no cut-off values, as optimism/pessimism is conceptualized as a continuous behavioral dimension (Carver, 2007).

The LOT-R is derived from the model of behavioral self-regulation, which originates from Expectancy Value theory in psychology. The underlying assumption of this theory is that individuals stay engaged in attempts to defeat adversity to reach their goals as long as their expectations for success are positive (Scheier, Carver & Bridges, 1994).

In the PLBQ, six items of the 10 LOT-R items (three for optimism and three for pessimism) are included. The LOT-R permitted responses in a Likert format as follows: 1=strongly disagree, 2=somewhat disagree, 3=slightly disagree, 4=slightly agree, 5=somewhat agree, and 6=strongly agree. An optimism and pessimism score is calculated by adding the scores among each category of three items. Scores are considered “missing” if one response is missing from each category. Reliability estimates for the LOT-R in the PLBQ were  $\alpha = 0.80$  for optimism and  $\alpha = 0.77$  for pessimism (Clarke et al., 2007). Items for the LOT-R scale are listed in Appendix E.

#### *Cynical hostility.*

The PLBQ uses five items to measure cynical hostility that were drawn from the Cook and Medley Hostility (HS) Scale (Cook & Medley, 1954). The HS scale was developed by empiric observations, and remains the most widely used measure of hostility today (Eckhardt et al., 2004). The HS scale for this study is a 5-item true/false questionnaire that is usually administered as a



subscale of the Minnesota Multiphasic Personality Inventory. Cynical hostility in the PLBQ is scored in a 6-point Likert scale as follows: 1=strongly disagree, 2=somewhat disagree, 3=slightly disagree, 4=slightly agree, 5=somewhat agree, and 6=strongly agree. The index is entered as a missing value if there are more than two out of five missing items on the survey. An index of cynical hostility was created by averaging the scores from each subject over all the items. The cynical hostility measure of the PLBQ achieved moderately strong reliability (0.79) in the HRS (Clarke, et al., 2007). Appendix D provides the items for the cynical hostility scale.

#### *Protection of Human Subjects*

The HRS maintains ongoing IRB approval by the University of Michigan. The current study received approval by the University of Alabama at Birmingham Institutional Review Board. See Appendix E for current IRB approval for this study. Data were obtained after registering on the HRS website. The researcher met requirements for registration, and agreed to make no attempt to identify participants in the study. For the purposes of this study, data are linked by unique identifier to match the HRS data to participants who completed the Participant Lifestyle Questionnaire in the 2004 wave of the HRS.

#### *Data Analysis*

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) Version 15.0. Descriptive statistics (frequencies, means and standard deviations) were calculated for all independent and dependent variables. The researcher also tested the statistical assumptions and adequacy of regression models

prior to testing hypotheses that required regression analysis. The significance level for all statistical analyses in this study was set as an alpha of .05. Internal consistencies of the SDS, HS, and LOT-R were assessed using Cronbach's alpha coefficients.

### *Statistical Plan*

#### *Research question 1.*

1. Will sleep disruption predict cynical hostility, optimism, pessimism, and social integration in community-dwelling elderly in the HRS, when sociodemographic factors are controlled?

**Hypothesis 1a:** Sleep disruption will be an independent predictor of increased cynical hostility when age, gender, race, marital status and SES are controlled among community-dwelling aging adults in the HRS.

**Hypothesis 1b:** Sleep disruption will be an independent predictor of increased pessimism when age, gender, race, marital status, and SES are controlled among community-dwelling aging adults in the HRS.

**Hypothesis 1c:** Sleep disruption will be an independent predictor of decreased optimism when age, gender, race, marital status, and SES are controlled among community-dwelling aging adults in the HRS.

**Hypothesis 1d:** Sleep disruption will be an independent predictor of decreased social integration when age, gender, race, marital status, and SES are controlled among community-dwelling aging adults in the HRS.

Multiple regression analysis was utilized to answer research question 1 and each related hypothesis, with an alpha of .05. Sociodemographic factors of age,

gender, race, marital status, and SES (education and income) served as covariates for assessing the effect of sleep disruption on cynical hostility, optimism, pessimism, and social integration, respectively.

*Research question 2.*

2. What is the relationship between sociodemographic factors and sleep disruption?

**Hypothesis 2a:** Sleep disruption will be more frequently reported among community-dwelling aging adults ages 85 and above in the HRS.

**Hypothesis 2b:** Sleep disruption will be more frequently reported by women than men.

**Hypothesis 2c:** Married participants will report less sleep disruption than those who are divorced or widowed.

**Hypothesis 2d:** Black participants will have no greater or less sleep disruption than White subjects.

**Hypothesis 2e:** Education is the most influential surrogate for SES of sleep disruption in community-dwelling aging adults.

For research question 2, a Kruskal-Wallis ANOVA was used to answer hypothesis 2a. T-tests were used to answer hypotheses 2b-d. A forced entry progressive adjustment regression analysis was used to answer hypothesis 2e. All statistical analyses were evaluated at an alpha of .05.

*Statistical assumptions.*

Statistical assumptions for multiple regression analyses were assessed. Each regression model was evaluated for the assumptions of independence, linearity, homoscedasticity, and normality (Kleinbaum, Kupper, Muller, & Nizam, 1998).

*Imputations and Weights*

One or more imputed values were used in calculation of the composite income variable for a majority of respondents (52.5%) in this data set. Imputations were calculated at the household level; hence, all income measures reflect household, and not individual income levels (HRS, 2004). RAND protocols include the methods for calculating imputations of income data from the HRS. The following is a description of the imputation procedure:

“We impute exact amounts for all cases with (reported or imputed) bracket information. The procedure is different for cases in closed vs. open-ended brackets. For closed brackets, we use a “nearest neighbor” approach; for open-ended brackets, a Tobit-based approach. The following discusses the two approaches in turn. In the nearest neighbor approach for closed brackets, we first estimate a linear regression model based on the sample of households who report an exact continuous value. The explanatory covariates are discussed below. The distribution of asset and income amounts tends to be roughly log-normal, so we would like to apply a logarithmic transformation to the outcome (asset, income) variable. However, some outcomes, such as business income, may be negative. The frequency with which this occurs is very low—too low to allow for a fully flexible model specification. Instead, we therefore apply the inverse hyperbolic sine transformation. Next, we computed predicted values for all cases, both with and without exact amounts. For each missing observation in closed brackets, we impute the actual value from the sample of households who report an exact amount that is closest in predicted value.” (St. Clair et al., 2008, p.30-31).

Sampling weights are available for demographic variables in the RAND data, and are taken directly from the HRS Tracker File (RAND corporation,

personal communication, March, 27, 2009). Sampling weights were not utilized for this analysis due to limitations of available statistical software.

## CHAPTER 4

### FINDINGS

This chapter presents a description of the sample and findings from the analysis of the data. The first section provides a description of the sample, including age, gender, race, marital status, educational level, income, and comorbidities. The second section describes the reliability of the instruments. The third section shows findings from the analysis of data relevant to the research questions.

#### Description of the Sample

After removing proxy responses, spousal data, and incomplete cases, 1,439 participants completed the PLBQ. Table 4 displays demographics for the total study sample. The average age for the sample was 66.48, with a range of 50-91 years. Participants were predominantly White (91.5%) and married (96%). Income for participants ranged from zero to over 2 million US dollars. Tables 5-10 display demographics for gender, race, marital status, education, comorbidities, and income level by total sample and age cohort. The cohort of older aging adults (age 80+) tended to have more male subjects, less education, less income, and more comorbidities. Younger aging adults (50+) comprised an increase in female subjects, more racial diversity, more education, higher income levels, and less comorbidities. Marital status remained above 94% in total sample, as well as in age cohorts.

Table 4. Sample Demographics (N = 1,439)

Demographics	Frequency	%	Mean	Median	SD
Age	1,439	100	66.48	66	8.42
Gender					
Male	756	52.5			
Female	683	47.5			
Race					
White	1317	91.5			
Black	75	5.2			
Hispanic	99	6.9			
Other	47	3.3			
Marital Status					
Married	1387	96.4			
Separated	4	0.3			
Divorced	23	1.6			
Widowed	10	0.7			
NM	7	0.5			
Education			12.68	12	2.84
0-12	821	57			
13+	606	43			
Comorbidities			2	2	1.21
1	455	31.6			
2	464	32.2			
3	286	19.9			
4	162	11.3			
5	52	3.6			
6	16	1.1			
7	4	0.3			
Income			\$68,644	\$45,240	\$104,298

Table 5. Gender – Total Sample and Age Cohort

	% Male	% Female
TOTAL	52.5	47.5
AHEAD	67.7	32.3
CODA	59.2	40.8
HRS	50.4	49.6
WB	43.7	56.3
EBB	55.2	44.8

Table 6. Race – Total Sample and Age Cohort

	% White	% Black	% Hispanic	% Other
TOTAL	91.5	5.2	6.9	3.3
AHEAD	97.8	1.1	3.2	1.1
CODA	93.0	0.5	2.5	2.0
HRS	91.7	6.1	8.6	2.5
WB	91.4	6.1	8.6	2.5
EBB	86.8	5.2	13.7	8.0

Table 7. Marital Status – Total Sample and Age Cohort

	% Married	% Separated	% Divorced	% Widowed	% Never Married
TOTAL	96.4	0.3	1.6	0.7	0.5
AHEAD	96.8	0	0	3.2	0
CODA	97.5	0	2	0.5	0
HRS	96.5	0.4	1.1	0.8	0.4
WB	94.4	0	3	0	1.5
EBB	96.7	0.5	2.4	0	0.5

*Note:* Definition of Cohorts by year of birth are as follows:

AHEAD – 1923 or earlier

CODA – 1924 – 1930

HRS – 1931 – 1941

WB – 1942 – 1947

EBB – 1948 - 1953



Table 8. Education – Total Sample and Age Cohort

	% 0-12yrs.	% 13+yrs
TOTAL	57.0	43.0
AHEAD	66.7	33.3
CODA	53.5	46.5
HRS	60.4	39.6
WB	58.9	41.1
EBB	43.6	56.4

Table 9. Comorbidities – Total Sample and Age Cohort.

	Mean	Median
TOTAL	2.0	2.0
AHEAD	2.6	3.0
CODA	2.4	2.0
HRS	2.5	2.0
WB	2.0	2.0
EBB	1.8	1.0

Table 10. Mean and Median Income Level – Total Sample and Age Cohort.

	Mean	Median
TOTAL	\$68, 644	\$45, 240
AHEAD	\$41, 324	\$35, 728
CODA	\$55, 691	\$34, 398
HRS	\$66, 472	\$44, 501
WB	\$78, 835	\$57, 000
EBB	\$90, 981	\$66, 782

*Note:* Definition of Cohorts by year of birth are as follows:

AHEAD –1923 or earlier

CODA – 1924 – 1930

HRS – 1931 – 1941

WB – 1942 – 1947

EBB – 1948 - 1953

### Instrument Reliabilities

Reliabilities for each instrument were computed using the Cronbach's alpha coefficient. Table 11 reports reliability coefficients, means, and standard deviations for each instrument utilized in the study. For the purposes of this study, a Cronbach's alpha of .7 was considered acceptable reliability.

Table 11. Cronbach's Alpha Coefficients, Means, Standard Deviations, and Variances for Study Instruments (n=1,439)

Instrument	Alpha	Mean	Standard Deviation
Sleep Disruption Score	.775	9.41	2.354
Optimism	.717	6.75	2.725
Pessimism	.826	13.30	3.892
Cynical Hostility	.842	19.94	6.020
Social Integration		2.61	1.659

### Findings Related to Research Questions

In the following section, each research question is identified, and the results are presented. For all research questions using multiple regression, a forced entry progressive adjustment method was used to enter sociodemographic variables first into the regression model (Model 1), followed by sleep disruption (Model 2). Thus, each regression analysis consisted of two models. For research question 1, multiple regression methods were used to investigate each of the four hypotheses. For research question 2, a Kruskal-Wallis ANOVA was utilized to answer hypothesis 2a. Descriptive statistics and t-tests were used to answer hypotheses 2b-d. Multiple regression analysis was utilized to answer hypothesis 2e. Prior to testing each hypothesis using multiple regressions, methods for testing conformance to statistical

assumptions and for detecting outliers and problems with multicollinearity were employed. All statistical analyses were performed using SPSS version 15.0.

Studentized residuals, DFFITS, and DFBETAS were the diagnostic statistics used for identifying outlying and influential observations in the regression models. Outliers identified in the data for this study were not discarded because there were no known data coding errors or obvious instrument error. Furthermore, each of the outliers demonstrated near perfect positive or negative scores for the particular scale (e.g., a participant was very optimistic, and answered strongly agree to all questions), which would be plausible considering the behavioral outcomes under study. Additionally, each regression model was evaluated for multicollinearity through examinations of variance inflation factors (VIFs), and the condition index (CI). Critical values used to indicate potential problems were derived from Kleinbaum et al. (1998), and were a variance inflation factor of  $>10$ , and a condition index of  $>30$ , with proportions of variation  $>0.8$  between two or more predictor variables. None of the models examined met these criteria for clear evidence of multicollinearity.

### *Research Question 1*

Will sleep disruption be an independent predictor of social integration, optimism, pessimism, and cynical hostility among community dwelling aging adults in the HRS when sociodemographic factors are controlled?

#### *Hypothesis 1a.*

Sleep disruption will be an independent predictor of social integration when age, gender, marital status, race, income, and education are controlled among

community-dwelling aging adults in the HRS. In Model 1, sociodemographic factors predicted social integration as a set ( $F=14.977$ ,  $p<.001$ ) and individually, with the exception of marital status and comorbidities. Sociodemographic variables together explained 7.0% of the variance in social integration.

In Model 2, sleep disruption was a significant predictor of social integration (Total Model,  $F= 13.708$ ,  $p<.0001$ ) after controlling for sociodemographic variables, and the model explained 7.3% of the variance, a change in R-square of .3%. Table 12 displays descriptive statistics for scale variables of social integration, age, comorbidities, education, income, and sleep disruption. Table 13 provides standardized and unstandardized  $\beta$ , standard errors, t-scores, and p values for social integration.

Table 12. Descriptive Statistics for Social Integration Regression Models ( $n=1,405$ )

	Mean	SD
Social Integration	2.61	1.66
Age	66.47	8.41
Comorbidities	2.28	1.20
Education	12.71	2.84
Sleep Disruption	9.41	2.33
Income	\$69, 105	\$105,199

Table 13. Social Integration Regression Models

	Model 1				Model 2			
	<sup>a</sup> $\beta$	<sup>b</sup> $\beta$	<i>SE</i>	<i>t</i>	<sup>a</sup> $\beta$	<sup>b</sup> $\beta$	<i>SE</i>	<i>t</i>
R-Square (%)	7.0				7.3			
Female	.190	.057	.086	2.198**	.204	.061	.086	2.358**
Age	.020	.101	.005	3.825*	.020	.100	.005	3.781*
White	.283	.069	.107	2.638**	.278	.068	.107	2.599**
Married	-.009	-.002	.120	-.078	-.001	.000	.120	-.008
Comorbidities	-.072	-.052	.037	-1.953	-.059	-.043	.037	-1.583
Education	.129	.220	.016	8.123*	.125	.215	.016	7.897*
Income	.001	.056	.000	2.090**	.001	.054	.000	2.035**
Sleep Disruption					.040	.057	.019	2.135*

\* $p < .0001$ , \*\* $p < .05$ <sup>a</sup> Unstandardized  $\beta$  coefficients<sup>b</sup> Standardized  $\beta$  coefficients*Hypothesis 1b.*

Sleep disruption will be an independent predictor of pessimism when age, gender, race, marital status, comorbidities, education, and income are controlled among community-dwelling aging adults in the HRS. In Model 1, sociodemographic variables did predict pessimism as a set ( $F=41.877$ ,  $p < .0001$ ) and individually, with the exception of age, and they explained 17.2% of the variance in pessimism. In Model 2, after controlling for demographic variables, sleep disruption independently predicted pessimism (Total Model,  $F=39.025$ ,  $p < .0001$ ), and the model explained 18.1% of the variance. As in Model 1, age was not an independent predictor in Model 2, and income was also not significant when sleep disruption was added to the model. Table 14 displays descriptive statistics for scale variables of pessimism, age, comorbidities, education, income, and sleep disruption. Table 15

provides standardized and unstandardized  $\beta$ , standard errors, t-scores, and p values for pessimism.

Table 14. Descriptive Statistics for Pessimism Regression Models (n = 1,424)

	Mean	SD
Pessimism	13.31	3.89
Age	66.45	8.39
Comorbidities	2.27	1.21
Education	12.70	2.82
Sleep Disruption	9.39	2.35
Income	\$69, 120	\$104,717

Table 15. Pessimism Regression Models

	Model 1				Model 2			
	<sup>a</sup> $\beta$	<sup>b</sup> $\beta$	SE	t	<sup>a</sup> $\beta$	<sup>b</sup> $\beta$	SE	t
R-Square %	17.2				18.1			
Female	.577	.074	.189	3.045*	.634	.081	.189	3.352*
Age	.017	.037	.012	1.488	.015	.033	.011	1.339
White	-.468	-.048	.236	-1.981**	-.480	-.050	.235	-2.043**
Married	-.693	-.064	.264	-2.627*	-.658	-.061	.263	-2.506**
Comorbidities	-.492	-.153	.080	-6.133*	-.442	-.138	.081	-5.473*
Education	.448	.325	.035	12.810*	.433	.314	.035	12.389*
Income	.002	.051	.001	2.020**	.002	.048	.001	1.924
Sleep Disruption					.164	.099	.041	3.995*

\*p<.0001, \*\*p<.05

<sup>a</sup> Unstandardized  $\beta$  coefficients

<sup>b</sup> Standardized  $\beta$  coefficients

### *Hypothesis 1c.*

Sleep disruption will be an independent predictor of optimism when gender, age, race, marital status, comorbidities, education, and income are controlled among community-dwelling aging adults in the HRS. In Model 1, sociodemographic variables predicted optimism as a set ( $F=10.522$ ,  $p<.0001$ ), and explained 5.0% of the variance. Race, marital status, and education were not significant independent

predictors of optimism in Model 1. In Model 2, sleep disruption was an independent predictor of optimism, when sociodemographic variables were controlled (Total Model,  $F=12.238$ ,  $p<.0001$ ). Model 2 explained 6.6% of the variance in optimism. Race, marital status, and education remained non-significant of optimism in Model 2. Table 16 displays descriptive statistics for scale variables of optimism, age, comorbidities, education, income, and sleep disruption. Table 17 provides unstandardized  $\beta$ , standard errors, t-scores, and p values for optimism.

Table 16. Descriptive Statistics for Optimism Regression Models (n = 1, 407)

	Mean	SD
Optimism	6.8	2.7
Age	66.4	8.4
Comorbidities	2.3	1.2
Education	12.7	2.8
Sleep Disruption	9.4	2.3
Income	\$69,264	\$105,204

Table 17. Optimism Regression Models

	Model 1				Model 2			
	<sup>a</sup> $\beta$	<sup>b</sup> $\beta$	SE	t	<sup>a</sup> $\beta$	<sup>b</sup> $\beta$	SE	t
R-Square %	5				6.6			
Female	-.418	-.077	.143	-2.918**	-.469	-.086	.142	-3.291**
Age	-.032	-.099	.009	-3.697*	-.031	-.094	.009	-3.537*
White	-.293	-.044	.177	-1.655	-.287	-.043	.176	-1.630
Married	.067	.009	.202	.329	.041	.005	.201	.207
Comorbidities	.397	.176	.061	6.538*	.351	.156	.061	5.757*
Education	-.036	-.038	.026	-1.381	-.024	-.025	.026	-.902
Income	-.002	-.068	.001	-2.525**	-.002	-.065	.001	-2.408**
Sleep Disruption					-.151	-.129	.031	-4.876*

\* $p<.0001$ , \*\* $p<.05$

<sup>a</sup> Unstandardized  $\beta$  coefficients

<sup>b</sup> Standardized  $\beta$  coefficients

*Hypothesis 1d.*

Sleep disruption will be an independent predictor of cynical hostility when gender, age, race, marital status, comorbidities, education, and income are controlled among community-dwelling aging adults in the HRS. In Model 1, sociodemographic variables predicted cynical hostility as a set ( $F=36.766$ ,  $p<.0001$ ), and explained 15.3% of the variance. Income is only sociodemographic variable that does not predict cynical hostility. In Model 2, sleep disruption was an independent predictor of cynical hostility when sociodemographics were controlled (Total Model,  $F=34.339$ ,  $p<.0001$ ). Model 2 explains 16.1% of the variance in cynical hostility. With the addition of sleep disruption in Model 2, marital status and income were non-significant sociodemographic predictor variables. Table 18 displays descriptive statistics for scale variables of cynical hostility, age, comorbidities, education, income, and sleep disruption. Table 19 provides standardized and unstandardized  $\beta$ , standard errors, t-scores, and p values for cynical hostility.

Table 18. Descriptive Statistics for Cynical Hostility Regression Models ( $n= 1, 436$ )

	Mean	SD
Cynical Hostility	19.70	6.12
Age	66.47	8.41
Comorbidities	2.27	1.21
Education	12.68	2.84
Sleep Disruption	9.39	2.34
Income	\$68, 755	\$104,377



Table 19. Cynical Hostility Regression Models

	Model 1				Model 2			
	<sup>a</sup> $\beta$	<sup>b</sup> $\beta$	SE	t	<sup>a</sup> $\beta$	<sup>b</sup> $\beta$	SE	t
R-Square %	15.3				16.1			
Female	1.864	.152	.300	6.218*	1.950	.160	.299	6.519*
Age	.060	.082	.018	3.280**	.057	.079	.018	3.164**
White	-1.423	-.096	.366	-3.887*	-1.449	-.098	.365	-3.976*
Married	-.856	-.050	.419	-2.043**	-.801	-.047	.417	-1.920
Comorbidities	-.506	-.100	.127	-3.980*	-.429	-.085	.128	-3.350*
Education	.645	.300	.055	11.733*	.624	.290	.055	11.353*
Income	.002	.032	.001	1.256	.002	.029	.001	1.156
Sleep Disruption					.250	.096	.065	3.854*

\* $p < .0001$ , \*\* $p < .05$

<sup>a</sup> Unstandardized  $\beta$  coefficients

<sup>b</sup> Standardized  $\beta$  coefficients

### Research Question 2

What is the relationship between sociodemographic factors and sleep disruption?

#### Hypothesis 2a.

Sleep disruption will be more frequently reported among the oldest-old elders (AHEAD cohort) in the HRS. The AHEAD cohort represents the oldest-old of the HRS subsamples, with ages ranging from 80-91. Criteria for sleep disruption included answering at least “sometimes”, or “most of the time” for the four sleep disruption items. Table 20 lists frequencies of sleep disruption for the AHEAD cohort.

To compare sleep disruption in the AHEAD cohort with other cohorts, a one-way ANOVA was initially planned. However, the assumption of homogeneity of variance was not met (Levene=3.137,  $p=.014$ ), and there were markedly unequal sample sizes across groups. A Kruskal-Wallis ANOVA was used to evaluate the

differences in sleep disruption among age cohorts. There were no differences across cohorts for sleep disruption ( $\chi^2=1.234$ ,  $p=.872$ ). A median test revealed similar results ( $\chi^2= 5.093$ ,  $p= .278$ ). Sleep disruption did not differ significantly across age cohorts.

Table 20. Sleep Disruption in the AHEAD Cohort (n=1,439)

Sleep Disruption Items	%
Trouble Falling Asleep	40
Trouble Waking During the Night	59
Trouble Waking Too Early	44
Feels Rested Upon Waking	55

*Hypothesis 2b.*

Sleep disruption will be more frequently reported by women. Women reported greater frequency of sleep disruption for all sleep variables. A t-test revealed a significant difference between males and females for the sleep disruption score ( $t=3.270$ ,  $p=.001$ ). Table 21 lists frequencies for sleep disruption items by gender. Males (58%) and females (68%) most frequently reported trouble waking during the night. However, the largest difference was with trouble falling asleep (males - 34%, females - 49%).

Table 21. Sleep Disruption and Gender (n=1,439)

Sleep Disruption Items	Male %	Female %
Trouble Falling Asleep	34	49
Trouble Waking During Night	58	68
Trouble Waking Too Early	42	44
Feels Rested Upon Waking	43	45

*Hypothesis 2c.*

Married subjects will report less sleep disruption than those who are divorced or widowed. The majority of the sample is married (n=1,388, 96.8%), so the

categories of divorced and widowed were collapsed into one category. A t-test revealed a significant difference between married and divorced/widowed participants, and married participants had a higher mean score for sleep disruption ( $t = 2.161$ ,  $p=.03$ , mean SDS 9.41). Table 22 reports frequencies in sleep disruption between married, widowed, and divorced subjects. Frequencies in the table indicate the respondent answered at least “sometimes” or “most of the time” to sleep disruption items.

Table 22. Sleep Disruption and Marital Status (n=1,425)

Sleep Disruption Items	Married (n=1,388) %	Divorced (n=27) %	Widowed (n=10) %
Trouble Falling Asleep	86.5	70	80
Trouble Waking During the Night	70	67	60
Trouble Waking Too Early	86	81	80
Feels Rested Upon Waking	86	81.4	80

*Hypothesis 2d.*

Black subjects will have no greater or less sleep disruption than White subjects. The majority of the sample was White (n=1,317, 91.5%), and 5.2% (n=75) was Black. Table 23 reports the frequencies of sleep disruption in White and Black participants. Frequencies reported are responses in which the participant answered at least “sometimes” or “most of the time” for sleep disruption items. A t-test reported no differences between Whites and Blacks ( $t=.812$ ,  $p=.417$ ); however, both Whites and Blacks reported substantial sleep disruption in this sample.

Table 23. Sleep Disruption and Race (n=1,439)

Sleep Disruption Items	White (n=1,317) %	Black (n=75) %
Trouble Falling Asleep	86.6	76
Trouble Waking During the Night	69.4	77
Trouble Waking Too Early	81.3	86
Feels Rested Upon Waking	84	80

*Hypothesis 2e.*

Education was the most influential surrogate for SES of sleep disruption in community-dwelling aging adults in the HRS. The model was evaluated using regression diagnostics that have been discussed previously. A forced entry method was used with income entered first, followed by education. The model was significant in predicting sleep disruption ( $F=15.309$ ,  $p<.0001$ ), and explained 2.1% of the variance. Income did not predict sleep disruption ( $t=1.297$ ,  $p=.195$ ). Education significantly predicted sleep disruption and was more strongly correlated with sleep disruption ( $r=.141$ ,  $p<.001$ ). Table 24 provides standardized and unstandardized  $\beta$ , standard error, t-scores, and p values for sleep disruption.

Table 24. Sleep Disruption, Education, and Income Regression Model (n = 1,436)

	Model 1			
	<sup>a</sup> $\beta$	<sup>b</sup> $\beta$	SE	t
R-Square %	2.1			
Constant	7.952		.282	28.237*
Income	.645	.035	.000	1.297
Education	.109	.133	.022	4.931*

\* $p<.0001$ <sup>a</sup> Unstandardized  $\beta$  coefficients<sup>b</sup> Standardized  $\beta$  coefficients

### Summary of Research Findings

The data analysis of 1,439 participants of the HRS yielded the following results:

1. Older aging adults tended to have more male subjects, less education, less income, and more comorbidities. Younger aging adults demonstrated an increase in female subjects, more racial diversity, more education, higher income levels, and less comorbidities.
2. Sleep disruption was an independent predictor of social integration when sociodemographics of gender, age, race, marital status, comorbidities, education, and income were controlled. Sleep disruption explained an additional 0.3% of the variance in social integration ( $R^2 = 7.3\%$ ).
3. Sleep disruption was an independent predictor of pessimism when sociodemographics of gender, age, race, marital status, comorbidities, education, and income were controlled. Sleep disruption explained an additional 0.9% of the variance in pessimism ( $R^2 = 18.1\%$ ).
4. Sleep disruption was an independent predictor of optimism when sociodemographics of gender, age, race, marital status, comorbidities, education, and income were controlled. Sleep disruption explained an additional 1.6% of the variance in optimism ( $R^2 = 6.1\%$ ).
5. Sleep disruption was an independent predictor of cynical hostility when sociodemographics of gender, age, race, marital status, comorbidities, education, and income were controlled. Sleep disruption explained an additional 0.8% of the variance in cynical hostility ( $R^2 = 16.1\%$ ).

6. There was no difference in sleep disruption across age cohorts.
7. Females reported sleep disruption more often than males. Sixty-eight percent of females reported trouble waking during the night, and 49% of women reported difficulty falling asleep.
8. Married participants had more sleep disruption compared to divorced/widowed participants. A substantial number of participants had at least some sleep disruption.
9. There were no differences in sleep disruption between White and Black participants. A considerable number of White and Black participants had at least some sleep disruption.
10. Education is the most influential surrogate for SES in predicting sleep disruption.

## CHAPTER 5

### DISCUSSION

This chapter presents a discussion of the findings of the study. Conclusions, implications and recommendations for future research will also be presented.

#### *Research Question 1*

##### *Hypothesis 1a: Sleep and social integration.*

The hypothesis that sleep disruption negatively impacts social integration was not supported. Elderly, White females with higher education and income had higher social integration than other groups. Higher education was the strongest predictor of social integration, but sleep disruption appeared to attenuate this effect. This finding is similar to Moore et al. (2002) who found that aging adults who are well-educated have higher incomes, less psychological distress, and better physical health. Additionally, it may be that aging adults with higher education/income levels have greater access to social activities, as well as the ability to travel distances for social functions.

A counterintuitive finding was that higher sleep disruption was also associated with higher social integration in this model. This finding is in contrast to those of Ancoli-Israel (2005) and Roth and Ancoli-Israel (1999) who reported that poor sleep affects alertness and cognition, and that excessive daytime sleepiness may impact social integration, and the ability to participate in social activities. For this sample, the mean SDS was 9.41, indicating a high degree of self-reported sleep

difficulties. It may be that these difficulties did not prevent participation in social activities, although they may have impacted other aspects of daily living.

Additionally, the measurement of social integration consisted of one subjective question regarding the frequency of attendance in social events, excluding religious services. It may be that one question is not sufficient to measure this concept; additionally, aging adults may perceive social integration activities as more than participation in clubs and organizations, as the instrument suggests. These are areas that should be explored further.

It is important to note that the final model explained only a small amount of the variance in social integration. Perhaps the oldest-old participants have difficulty attending social functions due to physical limitations, lack of transportation, or even lack of events in their neighborhood. It is also difficult to determine what amount of social integration is deemed “adequate” by the individual. Whereas some aging adults attend social activities frequently, others may be satisfied with attending a social event monthly. Attendance in religious services was not measured by this variable. Aging adults frequently attend religious services, and it is possible that religious services meet their social needs. Although adequate social integration may vary based on the individual, social integration remains a crucial component of elder health, and there is limited data on the effects of sleep disruption on social integration.

*Hypothesis 1b: Sleep and pessimism.*

This study is among the first to examine the independent relationship between pessimism and sleep. The hypothesis that sleep disruption was an



independent predictor of pessimism was supported. Older Black females who were divorced or widowed had higher pessimism than other groups in this sample. Sleep disruption enhanced the effect of being divorced or widowed when added to the model.

Somewhat unexpectedly, higher education was also associated with higher pessimism, and was the strongest predictor. Higher income was also associated with increased pessimism; however, sleep disruption appeared to attenuate this relationship, and higher income became non-significant when sleep disruption was added to the model. The fact that lower comorbidities were associated with higher pessimism was also unexpected.

The final model explained 18.1% of variance in pessimism, but there remain several factors to consider. First, only 5.2% ( $n = 75$ ) of the sample was Black and only 35 participants in the sample were Black females. Additionally, only 3% ( $n = 37$ ) were divorced or widowed in this sample. Therefore, the above results should be interpreted with caution.

Pessimism was examined to determine its independent relationship with sleep disruption. Previous research has established sleep disruption and pessimism as risk factors for depression (Kivela and Pakkala, 1988). The model did not address depression, and depression may be a substantial confounder in examining this relationship. Reducing sleep disruption may reduce pessimistic thoughts, slowing the onset of depression, cognitive decline, physical decline, or all of these.

Another factor that must be considered is the effect of psychosocial stressors on pessimism. Family relationships, previous emotional trauma, and life satisfaction

are but a few of the psychosocial stressors that may contribute to a pessimistic outlook. This study did not address these factors, but psychosocial stressors must be managed by every aging adult. The unexpected findings of lower comorbidities and higher education influences on pessimism will be discussed later in the chapter.

*Hypothesis 1c: Sleep and optimism.*

The hypothesis that sleep disruption was an independent predictor of decreased optimism was supported. Younger, married Black males with less education and income had the lowest levels of optimism in the model. Higher comorbidities were the strongest predictors of decreased optimism, and this effect was attenuated by the addition of sleep disruption to the model. This finding supports conclusions by Haack and Mullington (2005) that sleep disruption may compromise an optimistic outlook. Blacks are at risk for lower education and income levels, and sleep disruption appears to mediate these effects.

Although sleep disruption and sociodemographic variables do predict optimism, the final model only explained 6.6% of the variance in optimism. Optimistic aging adults are likely to face more physical, social, and cognitive challenges, but an optimistic outlook maintains their self-image and regulation of self-affect, leading to positive physical and psychosocial health outcomes (Archer et al., 2008; Leung et al., 2005; Taylor et al., 2000). Sleep disruption may compromise an optimistic outlook in younger Black males who are already at risk for decreased optimism due to less income and education and higher comorbidities at a younger age. However, in this sample, only 5.2% ( $n = 75$ ) were Black and an even smaller number were Black males ( $n = 40$ ) so these results should be interpreted with

caution. There are also many physical and psychosocial factors that could affect optimism that were not addressed in this study.

*Hypothesis 1d: Sleep and cynical hostility.*

In this study, the hypothesis that sleep disruption independently predicted cynical hostility was supported. These findings are somewhat similar to Brissette and Cohen (2002) who found cynically hostile individuals exhibit greater sleep disturbance. However, this study is among the first to address the predictive effects of sleep disruption on cynical hostility. Older, Black, divorced or widowed females with less comorbidities and higher education had higher cynical hostility levels. Higher education was the strongest predictor of cynical hostility, and sleep disruption influenced this relationship when added to the model.

These findings are very important, considering the large body of research that links increased hostility to poor cardiovascular outcomes for both men and women. Sleep disruption is a risk factor for cardiovascular disease as well (Javaheri, 2005; Verrier & Mittleman, 2005). It is possible that sleep disruption has an additive effect on cynical hostility, leading to greater incidence of cardiovascular disease and even poorer health outcomes. Individuals with increased cynical hostility have an all-cause mortality rate that is six times greater than individuals with lower hostility (Barefoot et al., 1983). Perhaps aging adult females with greater sleep disruption and greater cynical hostility have substantially higher mortality rates when compared with aging females who do not.

Although the model explained 16.1% of the variance, there are several other factors that may contribute to increased cynical hostility. Anger is not addressed in

this study, but it is an important factor to consider in addressing hostility. The difference between anger and hostility is widely debated and often blurred, due to the fact that neither has a precise conceptual definition (Eckhardt et al., 2004). It is generally accepted that an angry affect is the outward result of inherent hostile cognitions (Eckhardt et al., 2004). It is possible that sleep disruption may predict anger as well.

As in the previous analyses, it is important to note the small number of Black women ( $n = 35$ ), and the small number of divorced or widowed participants ( $n = 37$ ) in this sample ( $n = 1,439$ ). Therefore, these results must be interpreted with caution.

*Effect of education and comorbidities.*

In the previous models, there were several unexpected findings regarding the influences of comorbidities and education. Higher education was a predictor of both increased pessimism and increased cynical hostility, and higher comorbidities were predictive of increased optimism. Lower comorbidities were predictive of both increased pessimism and increased cynical hostility. Although these findings are counterintuitive, there are several factors to consider in this sample.

This was a very well-educated sample. Only 20% of the entire sample had less than a high school education. It may be that in this predominantly White, married sample of aging adults, years of education was a proxy measure for some other characteristic that impacted study outcomes. Sleep disruption also appeared to attenuate these effects. These findings warrant further research for examination of the effects of education on behavioral outcomes, as well as the relationship of educational level and sleep disruption.

The effects of comorbidities were also unexpected. However, these findings were in models where Blacks, and divorced and widowed participants were underrepresented in the sample. The comorbidity index may also have contributed to these findings as it only records 8 disease states. There are many other comorbidities that can be serious and debilitating that are not represented in this index. The questionnaire also is based on having ever had the disease, and may not be a sufficient measure for current comorbidity status (e.g., the participant had controlled hypertension on medication, so they did not report hypertension). Additionally, many aging adults may not wish to report health conditions, particularly psychiatric illnesses.

Preliminary examination of data by cohorts suggests some differences across cohorts on associations between outcome variables and years of education and number of comorbidities. For example, number of comorbidities was not associated with cynical hostility in the HRS or EBB cohorts. Also, higher education was not a predictor of cynical hostility in the EBB cohort. Further subgroup analyses are planned to examine these relationships in more detail.

This sample was unusual in that it had a higher proportion of males than females (52.5% vs. 47.5%), and was overwhelmingly White, married, and highly educated. These demographics are not typical of the general population that falls into these aging cohorts. It is possible that weighting the data may result in different findings. Weighted analyses are planned for further examination of the HRS data.

## *Research Question 2*

### *Hypothesis 2a: Sleep and aging.*

The hypothesis that sleep disruption would be more frequently reported among the oldest-old adults was not supported. There was no difference between sleep disruption in the oldest-old (AHEAD) cohort, when compared with younger cohorts in the HRS. This finding is contradictory with previous findings in that older aging adults should have reduced ability to sleep (Ancoli-Israel, 2005). Fifty-nine percent of oldest-old complained of difficulty waking during the night and 55% do not feel rested after waking. The AHEAD cohort also possessed the smallest number of subjects in any cohort (n=93). The AHEAD cohort contained twice as many males, the smallest number of Black subjects, lower educational levels, more comorbidities, and the smallest median income when compared with the other cohorts (see Tables 5-10). Although there are no differences in sleep disruption, the AHEAD cohort has distinctly different characteristics that may warrant further study.

### *Hypothesis 2b: Sleep and gender.*

The hypothesis that sleep disruption will be more frequently reported by women than men was supported in this sample. This sample was fairly divided between men and women (53% vs. 47%, respectively). Women reported greater numbers of sleep disruption, and had a greater mean SDS than men. The findings are consistent with literature stating that women are likely to report sleep disruption more often than men (Bliwise 2005; Lavie, 2007; Ohayon et al. 2004; Pack, Dinges, Gehrman, Staley, Pack, & Maislin, 2006; Redline et al. 2004; Richardson &

Doghjirami, 2005; Unruh et al., 2008; Young et al. 2002). More than two out of three women reported trouble waking at night, and at least 40% of women reported some difficulty with waking during the night, waking too early, and not feeling rested after sleep. This is consistent with Redline et al., (2004), Reyner and Horne (1995), and Unruh et al., (2008) who reported similar findings. Although it is recognized that men actually have greater sleep disruption upon objective monitoring, this study did not examine sleep disruption objectively.

*Hypothesis 2c: Sleep and marital status.*

The hypothesis that married participants will report less sleep disruption than those who are divorced or widowed was not supported in this sample. Married participants actually had greater sleep disruption in this sample, although all groups reported substantial sleep disruption. Over 70% of married subjects reported at least some sleep disruption across all four sleep variables. Divorced and widowed participants had fewer awakenings during the night, but findings were comparable to married participants in difficulty falling asleep, waking too early and not feeling rested after sleep. The findings do support that widowed participants have increased sleep disruption, but this finding is not in the context of comparing marital status (Kowalski and Bondmass, 2008). These findings should be interpreted with caution, because of the very small percentage of aging adults who were divorced or widowed (3%) in this study.

*Hypothesis 2d: Sleep and race.*

The hypothesis that Black participants will have no greater or less sleep disruption than White participants was supported. Both Whites and Blacks reported

substantial sleep disruption across the four sleep variables, but there were no differences between groups. This finding does not support data stating Black participants have less sleep disruption than White participants (Blazer et al., 1995; Foley et al., 1995; Newman et al., 1997; Rao et al., 1999; Redline et al., 2004; Whitney et al., 1998). It is unclear whether there is any biologic basis for these differences or whether instead they reflect differences in social or environmental circumstances. However, the findings of this study must be interpreted with caution, as Blacks were underrepresented in this sample.

*Hypothesis 2e: Sleep and SES.*

The hypothesis that education is the most influential surrogate for SES of sleep disruption was supported. Higher education was the strongest surrogate of SES in three models, and the strongest predictor of all sociodemographic variables for social integration, pessimism, and hostility. In all three models, sleep disruption appeared to influence the effects of education. This finding is similar to those of Gellis et al., (2005), Moore et al., (2002), and Paine et al. (2002) who stated that education predicted higher quality sleep and less insomnia. In this sample, income was not an independent predictor of sleep disruption. Higher Education was not a significant predictor of optimism, and sleep disruption did not enhance the effects of income.

### Conclusions

These findings from this study emphasize the effects of sleep disruption on behavioral outcomes in community-dwelling aging adults. Based on the study findings, the following inferences were identified:



1. Sleep disruption was an independent predictor of social integration in community-dwelling aging adults in the HRS.
2. Sleep disruption was an independent predictor of pessimism in community-dwelling aging adults in the HRS.
3. Sleep disruption was an independent predictor of optimism in community-dwelling aging adults in the HRS.
4. Sleep disruption was an independent predictor of cynical hostility in community-dwelling aging adults in the HRS.
5. Oldest-old aging adults have no greater or less sleep disruption than younger aging adults.
6. Women reported greater sleep disruption than men, and men and women reported the most difficulty with waking at night.
7. Married subjects had greater sleep disruption than divorced or widowed aging adults. However, married, divorced, and widowed aging adults reported at least some sleep disruption.
8. Blacks had no greater or less sleep disruption than White aging adults.  
Both Black and White aging adults reported at least some sleep disruption.
9. Education was the most influential surrogate for SES on sleep disruption in community-dwelling aging adults in the HRS. Education was the strongest predictor of social integration, pessimism, and cynical hostility. Sleep disruption influenced the effects of education on these behavioral outcomes.

### Limitations

There are several limitations for this study. They are as follows:

1. This study was a secondary analysis of existing data from the PLBQ and the HRS. Consequently, the researcher's ability to measure and analyze the data is based on fixed instrumentation and fixed sample representation.
2. There was an unequal sample size across cohorts. Sample sizes for each cohort ranged from 93 (AHEAD) to 736 (HRS) participants and possessed unequal variances, necessitating the use of non-parametric methods for analysis.
3. Blacks, divorced, and widowed subjects were under-represented in the sample. Perhaps these aggregates were at greater risk for attrition, or had a greater number of proxy responses. The number of Blacks sharply declined in the PLBQ. However, Black populations were oversampled and application of sampling weights would have accounted for under-representation.
4. The PLBQ and HRS are both subjective, self-report interviews. The interpretation of sleep quality is based on subjective perception, and not objective monitoring.
5. It is possible that behaviors were affected by physical or psychosocial events that occurred prior to the interview, resulting in biased subjective perception of the behavioral outcomes. This bias could be positive or negative.

6. The frequency of sleep disruption in this sample could have been overestimated. Responses to sleep disruption items were coded as sleep disruption if the respondent answered at least “sometimes” or “most of the time.”
7. There is the possibility of response bias and fatigue. Aging adults may feel the need to answer a question a certain way, and not necessarily give the most truthful response. Additionally, the interview process last about 90 minutes, and aging adults may be prone to fatigue during the interview process.
8. The comorbidity index consists of 8 comorbidities, and is not an exhaustive list. Aging adults may possess more comorbidities that also affect sleep disruption and behavioral outcomes that were not assessed for this study.
9. There are numerous physical and psychosocial factors that could have affected these outcomes that were not addressed in this study.
10. The sampling weights were not used for this study. Consequently, the results are not generalizable beyond this sample.
11. The results would have been enhanced by the use of a statistical module with complex sampling techniques. It is possible that standard errors were underestimated.

## Implications

The results of this study have numerous implications for nursing research, education, and practice.

### *Implications for Nursing Research*

The effects of sleep disruption on behavioral outcomes should continue to be studied by nurse researchers with population-based data sets. Very little literature addresses the effects of sleep disruption on social integration, pessimism, optimism, or cynical hostility. Consequently, the relationships between sleep disruption and behavioral outcomes are unclear. Nurses are in a unique position to examine sleep disruption and its behavioral outcomes within a nursing framework that addresses research and clinical implications for evidence-based practice. There are numerous behavioral outcomes that are available for study within the HRS and other large data sets.

### *Implications for Nursing Practice*

This study offers several implications for nursing practice. Nurses should assess the aging adult within the context of sleep. This is especially important for community health and long-term care nurses, who share a long-term relationship with their patients. Nurses should be attuned to changes in behavior, and should conduct a thorough assessment of the patient's sleep quality. If depression and cognitive decline can be slowed by achieving quality sleep, then it is imperative that nurses recognize the signs of sleep disruption, document them accordingly, and arrange for further evaluation and treatment.

### *Implications for Nursing Education*

Although this study has implications for nursing education, the larger problem is that sleep education is mostly absent in nursing curricula. Lee, Landis, Chasens, Dowling, Merritt, Parker et al., (2004) report that there is no established sleep curriculum in baccalaureate or graduate nursing education. Educators should view sleep disruption as a health problem, affecting biological, psychological, and psychosocial health. Educators should integrate sleep into undergraduate and graduate education through psychiatric rotations, clinical experiences, class lecture, and observations of diagnostic sleep assessment (Lee et al., 2004). Sleep disruption has far-reaching effects for the community at large and sleep education should be present at every level of nursing.

### *Directions for Future Research*

Further research should examine the effects of sleep disruption on social integration, with special emphasis on areas of social integration such as religious services, and family relationships that were not addressed in this study. Because both sleep disruption and pessimism affect responses to physical and psychosocial stressors, future research should investigate the independent effects of sleep disruption on pessimism. Pessimism and sleep disruption may have mediating or moderating effects on each other, thus decreasing the ability to cope with physical or psychosocial stressors. There is also a need for more studies on the effects of sleep disruption on optimism. Optimism is a key component of health status, and healing. Research should examine whether sleep disruption threatens an optimistic outlook in both short and long-term physical and psychosocial conditions.

Future research should examine whether sleep disruption increases the risk of cynical hostility, thereby increasing the risk of cardiovascular disease. Very little literature explores this relationship, and even less that explores the relationship between sleep disruption and cynical hostility.

Future studies must continue to explore the differences between genders, and the reasons as to why females report sleep disruption more often than males. Studies must also provide representative samples of Blacks and other ethnicities, divorced, and widowed aging adults, so that adequate conclusions may be drawn regarding sleep disruption in these populations. If these aggregates are at risk for attrition, then researchers should establish the risk factors for attrition and make every effort to ensure continued participation in the study.

Given the differences in education and income across cohorts, future studies should expound upon the relationships of SES and sleep disruption. Education was the strongest predictor of social integration, pessimism, and cynical hostility. Younger aging adults had higher incomes than older aging adults. Perhaps this is because younger aging adults could still be working. It is possible that SES is more influential based on the age and work status of the aging adult, or that SES is more predictive of behavioral outcomes based on current work status. Additionally, occupation is a surrogate of SES that was not addressed in this study. Perhaps aging adults with certain occupations or certain shifts are at risk for greater sleep disruption.

Although this study has established that sleep disruption influences behavioral outcomes, researchers must also consider which behaviors or personality traits

influence good sleep. Personality traits have been shown to influence good sleep, but studies have predominantly focused on negative behaviors and their influence on sleep disruption (Espie, 2002). Recently, studies have shifted to examining positive personality traits that influence well-being, health, and good sleep. In particular, Wood, Joseph, Lloyd, and Atkins (2009) found that gratitude is related to quality sleep. The effects of positive personality traits on sleep is a new and rich area that warrants further investigation.

### Recommendations

Researchers should encourage continued use of the HRS, PLBQ and other large data sets to provide a generalizable appraisal of sleep disruption in the aging adult population. The HRS offers unique opportunities for both cross-sectional and longitudinal studies of sleep disruption. The inclusion of spouses and proxy data might offer valuable insight as to the perception of sleep disruption in the aging adult, and ensure a more representative sample of minority and older participants. Sleep disruption may also differ for those participants who are in nursing homes when compared with those who are community-dwelling. Finally, the HRS allows for the examination of sleep disruption and mortality through longitudinal data collections. Subjective interviews until death, and proxy interviews after the death of the subject could offer valuable insight into the effects of sleep disruption and mortality. Future research should apply sampling weights to generalize the findings to the US aging population, and to compare weighted versus unweighted findings.

### Summary

Sleep disruption has significant effects on social integration, pessimism, optimism, and cynical hostility in community-dwelling aging adults. The importance of sleep disruption in the aging adult is crucial to both physical and psychosocial well-being. Aging adults will face physical and psychosocial difficulties as they age. Ensuring adequate sleep can provide the aging adult with an optimistic outlook to the problems they will encounter. Nurses are in an important position to recognize sleep disruption and provide the necessary assessment and referrals for this treatable condition.



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# APPENDIX A

## HEALTH AND RETIREMENT STUDY IRB INFORMATION AND INFORMED CONSENT 9/20/90 – 12/31/05

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### Health and Retirement Study

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### Institutional Review Board Information Health and Retirement Study

UM Health Sciences IRB Protocol H03-0002774-M8  
Approved through 10/13/05

Principal Investigator: Willis, Robert J.  
Sponsor: NIA U01 AG09740  
Dates: 9/20/90 – 12/31/05  
Website: <http://hrsonline.isr.umich.edu/>

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### I Description

The Health and Retirement Study (HRS) is intended to provide data for researchers, policy analysts, and program planners who are making major policy decisions that affect retirement, health insurance, saving and economic well-being. An important motivation for the HRS is concern about the implications of the aging American population in terms of health and economic well-being during the latter part of life, and the economic well-being of those supporting older family members through family transfers or through public programs such as Social Security, Medicare and Medicaid. Data from the HRS will supply the necessary longitudinal data for researchers to begin to describe the trajectories of the economic, health and family status of Americans over age 50 and to test theories and estimate the parameters of dynamic behavioral models. By providing data in several domains typically studied by separate disciplines, the HRS facilitates interdisciplinary research and encourages the creation of crosscutting conceptual frameworks.

In 1990, the National Institute on Aging awarded F. Thomas Juster of the University of Michigan Institute for Social Research a five-year cooperative agreement to plan and undertake a study that would contain the most promising source of data on retirement for the foreseeable future. The planning process included an unprecedented amount of interdisciplinary input from experts across the country. Throughout the design process, nine planning committees met to discuss the most important issues that could be

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addressed in this longitudinal study. Many of those committees continue to influence study design and quality. Study Directorship was transferred to Robert J. Willis of the University of Michigan in 1996.

The mission of the HRS, therefore, is to design, collect, and distribute high-quality data to the research community. It began with two separate studies: the original HRS cohort born 1931-41 first interviewed in 1992 (at 51-61 years of age), and the AHEAD cohort born before 1923 first interviewed in 1993 (ages 70 and above). Spouses were included regardless of age. After two follow-ups of HRS (1994, 1996), and one of AHEAD (1995), the studies were merged in 1998 and combined with new respondents born 1924-30 and 1942-47, to become a complete panel of the population over age 50, with over 21,000 participants. A new cohort of early boomers born 1948-53 was added in 2004, with plans to enroll a new 6-year birth cohort each grant cycle. All cohorts were drawn as nationally representative samples, with those based on the 1992 screen containing oversamples of African-Americans and Hispanic Americans.

The biennial interview (primarily by telephone) covers a wide range of content areas including detailed income and wealth; work, retirement, and work history; health care utilization, insurance coverage, and out-of-pocket spending; relations with other family members including monetary transfers and detailed data on time spent giving or receiving care; and self-reports of major health conditions with some additional detail when present.

### Core Study Design:

- National panel study
- Initial sample of over 12,600 persons in 7,600 households; current sample of 26,000+ persons in 15,000+ households
- Oversamples (100%) of Hispanics, Blacks, and Florida residents
- Baseline: in-home, face-to-face in 1992 for the 1931-41 birth cohort (and their spouses, if married, regardless of age); in 1998 for 1924-30 (CODA: Children of the Depression Age) and 1942-47 (War Babies) birth cohorts; in 2004 for 1948-53 for Early Boomers.
- Incorporation of study of Asset and Health Dynamics Among the Oldest Old (AHEAD – pre-1924 birth cohort) in 1998, with combined survey instrument and field data collection
- Follow-ups by telephone every second year, with proxy interviews after death

### Questionnaire Topics:

- Health and cognitive conditions and status
- Retirement plans and perspectives
- Attitudes, preferences, expectations, and subjective probabilities
- Family structure and transfers
- Employment status and job history
- Job demands and requirements
- Disability
- Demographic background
- Housing
- Income and net worth
- Health insurance and pension plans
- Experimental modules

### Links with Administrative Data:

- Employer Pension Study (1993, 1999, 2005 - *planned*)
- National Death Index
- Social Security Administration earnings and benefits data; W-2 self-employment data
- Medicare files (through 2000)
- Medicaid files (*planned*)
- Minimum Data Set (*planned*)

The HRS collects additional data via competitive supplements, off-year surveys, and is exploring potential uses of the Internet. Current mail surveys will provide data on diabetes and consumption and time use. Another supplement is funded to examine and try to evaluate the dementia status of a subset of HRS older respondents. This study is referred to as the Aging, Demographics and Memory Study (ADAMS), and we partner with Duke University for data collection.

#### Off Year Mail Surveys:

##### Off Year Mail Out:

In 2001, we conducted a mail-out of self-administered questionnaires to a subsample of approximately 10,000 panel households of the Health and Retirement Study. This mail survey, dubbed OYMO (Off Year Mail Out) covered three topics: 1) lifetime "investments" made by a sample of panel households in the education of each of their children; 2) the level and pattern of consumption of sampled households; and 3) selected aspects of activities by a sample of respondents, including their participation in various types of productive activities and their social interactions with relatives and friends. A sample of 5000 households was sent questionnaires on the human capital investments, which led to a moniker of HUMS, HUMan capital Mail Survey. A second sample of 5000 households was sent questionnaires on consumption and time use, or CAMS (Consumption and Activities Mail Survey). Within households containing two respondents, one of them was randomly selected. Along with collecting new data streams, we used the OYMO assess the usefulness of this data collection procedure using several criteria, including the response rate to the procedure; the level of effort required to obtain the cooperation of the sample members; the effect, either positive or negative, of the off-year data collections on the level of cooperation of the sample members to requests for the regular biennial interviews in subsequent years; and the quality of the data obtained using the self-administered questionnaires, as reflected by criteria such as the extent to which the respondents differ from the non-respondents on known characteristics, and the proportion of incomplete or incorrectly completed questionnaires.

Based on the success of OYMO, we re-surveyed CAMS participants again by mail to update data on consumption levels and patterns in 2003. We expect to continue this off-year mail survey of consumption biennially, with the possible expansion of sample and/or additional content.

On mail surveys, consent is inferred by completion and return of questionnaires. Identifying information is separated from returned materials as soon as we have logged receipt of the materials. These data are linked to other data by means of a unique identifier within the HRS dataset.

##### Diabetes Mail Survey

This supplemental study aims to provide the research community with valuable new data on diabetes management, glycemic control, and its long-term causes and consequences. A sample drawn from the HRS was asked to complete a supplemental survey questionnaire and a blood test for glycosylated hemoglobin administered through the mail. The result is a unique combination of a clinical measure of average glucose levels, cross-section data on diabetes self-management, and retrospective and prospective data on family, health, and economic outcomes from the core HRS survey.

The laboratory conducting the blood tests for glycosylated hemoglobin is FlexSite Diagnostics. Their test is labelled A1c at Home. The FDA has approved it in 1997 (#K971919), and the laboratory methods have been certified as traceable to the reference DCCT method, which is the current gold standard for measuring glycosylated hemoglobin. Test kits carry an individual identification number assigned by FlexSite and are sent in bulk to the University of Michigan. The test kits are included in a mailing from Michigan to the respondents, along with the appropriate mailout questionnaire, consent form, and cover letter. At the time of mailing, the FlexSite ID number is logged in next to the record of the respondent to



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whom it is sent. Respondents who choose to participate in the blood test use an enclosed sterile lancet to lightly prick a finger and place a drop of blood on the special filter paper included in the kit. Samples are then sealed in a plastic bag marked with the current date, and placed in a pre-addressed mailer to be sent directly to FlexSite without any identifying information. FlexSite performs the tests and returns an electronic file to Michigan containing the FlexSite ID, the test results, and the dates of administration and testing. The blood samples deteriorate over time and in response to excessive heat. FlexSite maintains that results are highly reliable with ten days or less elapsed time between drawing the sample and conducting the test. The dates will be made available to researchers to establish their own criteria or to study the effects of elapsed time.

### Dementia Supplement (ADAMS)

This supplement to the HRS study conducts a field assessment of a sample of about 930 HRS panel members aged 75 years and over to clinically assess their dementia status and dementia severity. The field name of this study is "Aging, Demographics, and Memory Study (ADAMS)". In combination with multiple waves of HRS data on cognitive performance, functional status, medical history, and socio-economic measures, a probability function of dementia will be estimated for participants of this study. Based on this estimation algorithm, a predicted probability of dementia will be assigned to all participants in the parent HRS study. The addition of this imputed dementia status to the ongoing panel will provide unique resource for studies of the costs of dementia to the individual, and his or her family. A secondary goal of the supplement is to make available to the research community data from this study's clinical assessments, as well as the linked data from prior waves of HRS and, prospectively, from the future waves of HRS, and ultimately, coded information from the death certificate and from a knowledgeable proxy for deceased panel members.

The University of Michigan is collaborating with Duke University, via subcontract to Duke. The UM obtains agreement from a selected HRS study participant and his or her proxy to release their names and addresses along with a block of available time to the Duke University project coordinator, so that he or she may contact the subject and his/her proxy for the in-home dementia assessment protocol. Duke University collaborators conduct the clinical assessments. IRB approval has been gained at each Duke and UM.

## **II IRB-Specific Information**

### **Subject Population:**

The HRS subject population is a randomly selected national sample of 23,000 persons born in 1947 or earlier and their spouses. In 2005, HRS added a sample of approximately 3,600 persons born between 1948 and 1953, and their spouses. HRS subject population does not include participants under the age of 18, some participants may be cognitively impaired and in these cases a proxy informant is sought, does not follow subjects into prison or detention facilities, and does not intentionally consist of pregnant women. The HRS subject population consists of the following demographic groups:

Inclusion Enrollment Report (Pre-2004)				
Ethnic Category	Females	Males	SEX Unknown or Not Reported	Total
Hispanic or Latino**	1196	875		2071
Not Hispanic or Latino	13842	10459		24301
Unknown	267	266		533
<b>Ethnic Category: Total of All Subjects*</b>	<b>15305</b>	<b>11600</b>		<b>26905</b>
Racial Categories				
American Indian	229	162		391
Asian/Other Pacific Islander	116	83		199
Black	2388	1518		3906
White	12072	9376		21448
Others (Note:HRS Doesn't allow > one race)	189	161		350
Unknown	311	300		611
<b>Racial Category: Total of All Subjects</b>	<b>15305</b>	<b>11600</b>		<b>26905</b>
Racial Categories within Hispanics				
American Indian	76	46		122
Asian/Other Pacific Islander	1	5		6
Black	33	17		50
White	893	661		1554
Others (Note:HRS Doesn't allow >one race)	151	114		265
Unknown	42	32		74
<b>Racial Categories: Total Hispanics</b>	<b>1196</b>	<b>875</b>		<b>2071</b>

**Confidentiality Measures:**

Names, addresses, and contact information are maintained in a separate control file for future contact purposes. This identifying information is necessary to maintain due to the longitudinal nature of the study. This information is only provided to Survey Research Center staff and our collaborators when it is necessary to perform their duties with respect to the Health and Retirement Study – e.g., interviewing, sample reconciliation, mailing of respondent reports, etc. Other access is not permitted as this information is strictly controlled within the Survey Research Center. These data are stored electronically on a secure network server and only authorized personnel can access them. In addition, all ISR personnel and affiliates must sign an ISR Pledge of Confidentiality, which explicitly prohibits disclosure of study participants.

Before release, HRS data files are subject to a three-stage iterative process to ensure data confidentiality. In the first stage, before raw data files are created, a disposition list is created of variables to be removed or masked for confidentiality. In the second stage, the remaining variables are tested for any possible identifying content. If problems are found, stage 1 is corrected and repeated. When testing is complete, the data files are subject to final review and approval by the HRS Data Protocol committee.

The HRS distributes its data to the public via a secure website maintained on the premises of ISR. Registration is required of all users who wish to download the data files. After online registration is completed, individual passwords are sent via email, allowing the user to logon to the data distribution area of the website to download data.

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With respect to linked data or data deemed to be too sensitive in nature or in conjunction with other survey information, these data are considered restricted and are released only by a rigorous application procedure outlined on our website: <http://hrsonline.isr.umich.edu/rda/>

And, lastly, the HRS holds a Federal Certificate of Confidentiality granted by the National Institute of Mental Health, which gives HRS a shield against being forced to disclose study participants in a court of law.

### Risks:

The HRS is a non-invasive social science protocol. The main risk to respondents is possible re-identification. Our stringent procedures are outlined above. Please note that the ADAMS supplement does request that a buccal swab be provided for genotyping, and also collects other health measures, such as (a) medical history, medications, history of cognitive changes, and family history; (b) the administration of the neuropsychological test battery; (c) a brief physical examination which includes measurements of blood pressure and heart rate, and self-reported height and weight; (d) a standardized neurological examination; and (e) a 5-7 minute standardized video tape segment to cover portions of the mental status and neurological examinations.

### Consent Statements:

HRS: Most of the interviews will be conducted by telephone. Consistent with on-going HRS practice (telephone and some personal interviews) all respondents are read a confidentiality statement when first contacted, and give oral or implied consent by agreeing to do the interview. The confidentiality statement is as follows:

*"This interview is completely voluntary. If we should come to any question that you don't want to answer, just let me know and I will go on to the next question. The answers you give will be kept confidential."*

*A Department of Health and Human Services Certificate of Confidentiality covers this research in order to help ensure your privacy. This certificate can help protect the investigators from being forced to release any research information that identifies you.*

*We must report credible evidence of serious harm or abuse to any person to the authorities, but we will not ask you any questions about such topics."*

### Request for Social Security Administration Linkage

Written consent is required of the respondent to obtain Social Security Administration data. A copy of the previous wave's permission statements is attached. The 2004 authorizations were developed with Social Security Administration. After reading the preamble below, participants are presented (if in person) or mailed (if telephone interview) the form for review and signature.

*W306 One of the most important parts of our study is to understand the financial situations of people in their retirement years. This is an important and challenging part of our research, and in order to obtain complete data for this research, we are requesting the social security numbers of our respondents and asking them to complete a form.*

The following statements are read to respondents prior to obtaining their Medicare and Employer information. Provision of information in response is considered consent.

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### Request for Medicare and Medicaid Identification and Linkages

#### R117.MEDICARE NUMBER RECORDED?

*R117. We would like to understand how people's medical history affects their financial status, and how use of health care may change as people age. To do that, we need to obtain information about health care costs and diagnoses for statistical purposes. The best place to get this information without taking up a lot more of your time is in the Medicare files. Could you give me your Medicare number for this purpose?*

*(Under the Privacy Act of 1974, providing your number is a voluntary decision. The benefits you may be receiving under this program will not be affected in any way by your decision.)*

#### R118.MEDICAID NUMBER RECORDED?

*R118. We would like to understand how people's medical history affects their financial status, and how use of health care may change as people age. To do that, we need to obtain information about health care costs and diagnoses for statistical purposes. The best place to get this information without taking up a lot more of your time is in the (Medicaid/STATE NAME FOR MEDICAID) files.*

*Could you give me your Medicaid number for this purpose?*

*(Under the Privacy Act of 1974, providing your number is (also) a voluntary decision. The benefits you may be receiving under this program will not be affected in any way by your decision.)*

### Request for Employer Identification and Contact Information

*G19d READ TO ALL RESPONDENTS: We would like to obtain complete information about fringe benefits for employees like you. In order to do this, we need the full name and address of your employer.*

- *For whom do you work [now/ on your main job]?*
- *What is the (company's/organization's) name?*
- *What is the address of the place where you work [I will need the mailing address, city, state, and zip code.]?*

**Mail Surveys:** Consent is inferred by completion and return of questionnaires. Each package mailed to a sample household will contain a cover letter describing the purpose of the study and the voluntary nature of participation.

**ADAMS:** Before the University of Michigan releases names and addresses of selected HRS respondents, verbal informed consent agreeing to be contacted by the Duke team is obtained from the subject and, when indicated from the HRS interview (need for proxy interview), from a next-of-kin by the Survey Research Center's interviewer. Upon arrival of the Duke traveling team at the respondent's home, written informed consent is obtained typically from the respondent and the informant. If the consent is to be truly informed, this portion of the protocol can easily take 10-20 minutes to complete. In situations where significant cognitive impairment is suspected, a separate signature is sought to document permission to forward a summary of findings to the respondent's personal physician.

In the SRC effort, we only ask the respondents if we can pass on their contact information to our Duke University collaborators. We are not collecting any data, and we do not read them a consent statement during this phase. In fact, we emphasize that we are not asking for their participation in the study--only asking for consent to give contact information to Duke University. We do however retain all rights to the data, including the stored genetic samples.

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### Respondent Payments:

The HRS typically will provide respondents with a \$40 payment for their participation. For the OYMO data collections, respondent payments are \$20. This payment is provided at the initial re-contact for longitudinal sample members, and after completion of the interview for newly enrolled participants.

Because of the increased demand on participants for the ADAMS project, we currently provide payment of \$50 to participants and \$25 to caregivers of participants. As we view a similarly increased demand on the Diabetes supplement participants due to the self-administered finger-prick, these participants will be paid \$40 for their participation, as contrasted with the OYMO mail survey participation payment. In 2004, we are conducting a feasibility experiment on the collection of retirement documents – for which an additional payment is made.

### III Co-Investigators and Affiliations

#### HRS:

Robert J. Willis, University of Michigan  
David R. Weir, University of Michigan  
F. Thomas Juster, University of Michigan  
Alan Gustman, Dartmouth College  
John Henretta, University of Florida  
Daniel Hill, University of Michigan  
Michael Hurd, RAND  
Olivia S. Mitchell, University of Pennsylvania  
Mary Beth Ofstedal, University of Michigan  
Willard Rodgers, University of Michigan  
Beth J. Soldo, University of Pennsylvania  
Thomas Steinmeier, Texas Tech University

#### CAMS/HUMS Off-Year Mail Surveys:

Robert J. Willis, University of Michigan  
John Henretta, University of Florida  
Michael Hurd, RAND  
F. Thomas Juster, University of Michigan  
Willard Rodgers, University of Michigan  
Beth J. Soldo, University of Pennsylvania

#### DIABETES Mail Survey:

Robert J. Willis, University of Michigan  
David R. Weir, University of Michigan  
Rodney Hayward, University of Michigan  
Caroline Blaum, University of Michigan  
Jeffrey Halter, University of Michigan  
Michele Heisler, University of Michigan  
Ken Langa, University of Michigan  
David Meltzer, University of Chicago  
Robert Wallace, University of Iowa

#### ADAMS:

Robert J. Willis, University of Michigan  
Steve Heeringa, University of Michigan  
Michael Hurd, RAND  
Brenda Plassman, Duke University (Duke PI)  
Willard Rodgers, University of Michigan  
Robert Wallace, University of Iowa  
David R. Weir, University of Michigan

### IV Attachments to this document

HRS Social Security record linkage permission forms

## APPENDIX B

MEMORANDUM CONCERNING UNIQUE IDENTIFIERS FROM THE  
HEALTH AND RETIREMENT STUDY**MEMORANDUM**

TO: Institutional Review Boards/Human Subjects Review Committee  
FROM: David R. Weir, Principal Investigator, Health and Retirement Study  
RE: Health and Retirement Study Public Use Datasets

The Health and Retirement Study (HRS) is an ongoing longitudinal survey of Americans over the age of 50, sponsored by the National Institute on Aging (U01 AG009740) with support from the Social Security Administration. HRS makes available to researchers both unrestricted datasets, available to all researchers, and restricted datasets, available only under agreement to researchers who meet rigorous conditions.

***No individual identifiers or links to individual identifiers are provided to researchers under any conditions.*** Moreover, unrestricted datasets from the HRS have been sufficiently purged of secondary identifying information that they pose no significant threat to respondent anonymity. These files are public-use and are distributed via download from our website. We assert that in most cases the HRS public use files qualify as anonymized datasets and that secondary data analysis using these files may qualify for exempt IRB status, under [45 CFR 46.101\(b\)](#).

The entire Health and Retirement Study is under current IRB approval by the relevant committees at the University of Michigan and the National Institute on Aging, the primary sponsor of HRS.

If you have further questions, please feel free to contact:

Cathy Liebowitz  
Survey Research Center  
426 Thompson, Room 3050  
Ann Arbor, Michigan 48104-2321

phone: 734-763-4180  
fax: 734-647-1186  
email: [catlieb@umich.edu](mailto:catlieb@umich.edu)

## APPENDIX C

## CURRENT IRB APPROVAL UAB



Form 4: IRB Approval Form  
Identification and Certification of Research  
Projects Involving Human Subjects

UAB's Institutional Review Boards for Human Use (IRBs) have an approved Federalwide Assurance with the Office for Human Research Protections (OHRP). The UAB IRBs are also in compliance with 21 CFR Parts 50 and 56 and ICH GCP Guidelines. The Assurance became effective on November 24, 2003 and expires on October 26, 2010. The Assurance number is FWA00005960.

Principal Investigator: WILLIAMS, LAURA B

Co-Investigator(s):

Protocol Number: X071016011

Protocol Title: *Factors Associated with Sleep Disruption and Sleep Disorders Among Community Dwelling Elderly in the Health and Retirement Survey*

The IRB reviewed and approved the above named project on 11-11-08. The review was conducted in accordance with UAB's Assurance of Compliance approved by the Department of Health and Human Services. This Project will be subject to Annual continuing review as provided in that Assurance.

This project received EXPEDITED review.

IRB Approval Date: 11-11-08

Date IRB Approval Issued: 11-11-08

HIPAA Waiver Approved?: N/A

Marilyn Doss, M.A.

Vice Chair of the Institutional Review  
Board for Human Use (IRB)

Investigators please note:

The IRB approved consent form used in the study must contain the IRB approval date and expiration date.

IRB approval is given for one year unless otherwise noted. For projects subject to annual review research activities may not continue past the one year anniversary of the IRB approval date.

Any modifications in the study methodology, protocol and/or consent form must be submitted for review and approval to the IRB prior to implementation.

Adverse Events and/or unanticipated risks to subjects or others at UAB or other participating institutions must be reported promptly to the IRB.

470 Administration Building  
701 20th Street South  
205.934.3789  
Fax 205.934.1301  
irb@uab.edu

The University of  
Alabama at Birmingham  
Mailing Address:  
AB 470  
1530 3RD AVE S  
BIRMINGHAM AL 35294-0104

## APPENDIX D

## CYNICAL HOSTILITY SCALE

Items: 5 items (Q19a-Q19e)

*(Please say how much you agree or disagree with the following statements:)*

Q19a Most people inwardly dislike putting themselves out to help other people

Q19b Most people will use somewhat unfair means to gain profit or an advantage rather than lose it.

Q19c No one cares much what happens to you.

Q19d I think most people would lie in order to get ahead.

Q19e I commonly wonder what hidden reasons another person may have for doing something nice for me.

Coding: 1=Strongly disagree, 2=Somewhat disagree, 3=Slightly disagree,  
4=Slightly agree, 5=Somewhat agree, 6=Strongly agree

Scaling: Create an index of cynical hostility by averaging the scores across all items. Set the final score to missing if there are more than three items with missing values.

Psychometrics: Alpha = .79



## APPENDIX E

## OPTIMISM AND PESSIMISM (LOT-R SCALE)

<u>Items:</u>	6 items (Q19f-Q19k)
<i>(Please say how much you agree or disagree with the following statements:)</i>	
Q19f	If something can go wrong for me it will.
Q19g	I'm always optimistic about my future.
Q19h	In uncertain times, I usually expect the best.
Q19i	Overall, I expect more good things to happen to me than bad.
Q19j	I hardly ever expect things to go my way.
Q19k	I rarely count on good things happening to me.
<u>Coding:</u>	1=Strongly disagree, 2=Somewhat disagree, 3=Slightly disagree, 4=Slightly agree, 5=Somewhat agree, 6=Strongly agree
<u>Scaling:</u>	Create an index of optimism by averaging the scores across items Q19g, Q19h, and Q19i. Set the optimism score to missing if there is more than one item with missing values.  Create an index of pessimism by averaging the scores across items Q19f, Q19j, and Q19k. Set the pessimism score to missing if there is more than one item with missing values.
<u>Psychometrics:</u>	Optimism      Alpha = .80

## APPENDIX F

## SOCIAL INTEGRATION SCALE

**Q. 2 Social Integration*****Q. 2 (2004)***

This question captures the degree of embeddedness in social networks (clubs, groups, etc.) in terms of the frequency of social interaction within this network.

Items: 1 item (Q02)

*(Not including attendance at religious services, how often do you attend meetings or programs of groups, clubs, or organizations that you belong to?)*

Coding: 1=More than once a week, 2=Once a week, 3=2 or 3 times a month, 4=About once a month, 5=Less than once a month, 6=Never. (Note that unless you recode the scale, higher values will correspond to less social integration.)