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**The Role Of Nocturnal Cognitive Arousal In The Complaint Of Insomnia Among
Older Adults**

IRIS ALAPIN

A THESIS

in

**The Department
of
Psychology**

**Presented in Partial Fulfillment of the Requirements
For the Degree of Master of Arts at
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Montreal, Quebec, Canada**

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ABSTRACT

The Role Of Nocturnal Cognitive Arousal In The Complaint Of Insomnia Among Older Adults

Iris Alapin

Sleep disruptions and complaints of insomnia are prevalent among older adults. However, despite the physiological changes in sleep patterns that accompany aging, not all older adults complain of problematic sleep. Recent conceptualizations implicate cognitive hyperarousal in the etiology and maintenance of insomnia and suggest that negative cognitive activity acts as mediator between personality factors and negative affect on the one hand, and insomnia complaints and poor daytime functioning on the other.

The present study examined nocturnal sleep parameters, daytime functioning and psychological adjustment in relation to nocturnal cognitive activity and experienced sleep quality, both cross sectionally ($N=183$) and longitudinally ($N=91$), in four groups of older adults: good and poor sleepers with high and low cognitive arousal. In Phase 1, the objectives were to compare the characteristics of seniors who reported sleeping well and poorly and to evaluate the role of nocturnal cognitive arousal in the complaint of poor sleep. The goals of Phase 2 were to assess changes in sleep quality over a 2-year period and to identify factors of vulnerability and resilience to the development / maintenance of insomnia components among older adults. Results indicated that when sleep quality was controlled for, individuals with higher nocturnal cognitive arousal were less well psychologically adjusted and displayed more neurotic and worrying personality characteristics than individuals with low cognitive arousal. Over a 2-year period 78% of

participants maintained the same sleep status category. Of those who changed most improved. Overall, the findings of this investigation argue against the direct role of nocturnal cognitive arousal for onset and/or maintenance of insomnia among older adults. Rather, the data suggest that cognitive arousal is part of the psychological complex associated with the insomnia complaint.

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The Role Of Nocturnal Cognitive Arousal In The Complaint Of Insomnia Among Older Adults

Increases in sleep disturbances with age have been reported in cross-sectional studies of a variety of populations. Indeed, sleep disruptions may be inevitable as people age. However, not all older adults with problems falling asleep at night or nocturnal or early morning awakenings complain of problematic sleep. It is often assumed that sleep disorders develop as a consequence of increasing age in older adults. Yet, recent longitudinal studies suggest that insomnia may actually peak around 60 years of age, and in fact, in older poor sleepers, some studies have shown that sleep quality can even spontaneously improve over time. Psychological adjustment, cognitive arousal and negative thoughts also have been implicated in the etiology and maintenance of insomnia complaints. The goals of this research are twofold: (1) to examine nocturnal sleep parameters, daytime functioning and psychological adjustment in relation to nocturnal cognitive activity and experienced sleep quality and (2) to identify nocturnal, psychological, and personality variables associated with “vulnerability” and “resilience” for developing sleep complaints among older women and men over a two-year period. This research has implications for determining how poor sleep can be improved and how good sleep may be preserved in older individuals.

Sleep and Aging

Older individuals experience a variety of sleep and wakefulness changes that are all in the direction of impaired sleep (Morin, 1993). Indeed, numerous studies using physiological measurements including the electroencephalogram (EEG) have demonstrated age related changes in the continuity, duration and depth of sleep in older

adults. Compared to the sleep of younger individuals, the sleep of older adults is characterized by more frequent shifts from one stage to another and more frequent intra-sleep arousals (e.g., Bosseli, Parrino, Smerieri, & Terzano, 1998). Both of these events result in more broken sleep and are likely to be rated as poor in quality (cf., Morgan, in press). Short periods of EEG awakenings during sleep are normal at any age but tend to become more numerous and of longer duration in later life (e.g., Webb, 1982). In addition to the more conventionally recorded EEG arousals, transient arousals, consisting of 2 to 15 seconds of alpha activity, have also been observed in the sleeping EEG of elderly adults (Carskadon, Brown, & Dement, 1982). As noted by Morgan (in press), transient arousals have not been associated with behavioral awakening, however these episodes of alpha activity are positively related to daytime sleepiness.

As frequency and duration of wakefulness increase with age, the total sleep time and sleep efficiency (total sleep time/ total time spent in bed) of older individuals diminish. The most consistently replicated age related structural change within non rapid eye movement (NREM) sleep is the progressive reduction in EEG slow waves (associated with stages 3 and 4) and, for a significant proportion of individuals, the complete disappearance of stage 4 sleep (e.g., Nielson, Nordhus, & Kvale, 1998). Finally, with regards to depth of sleep, it appears that with advancing age, the quality and the quantity of deep sleep diminish. Indeed, older adults experience not only less slow wave sleep but also an increase in stage 1 and 2 sleep, which are, respectively, associated with light sleep and drowsiness. Hence, the structural sleep of elderly individuals tends to be lighter than that of younger adults.

Gender Differences

Collectively, documented changes in the structure of sleep are consistent with subjective reports of older individuals in community surveys (for a review, see Floyd, Medler, Ager, & Janisse, 2000). Interestingly, while EEG studies indicate that it is men who experience greater deterioration in sleep architecture, with less slow wave sleep and more stage 1 sleep, epidemiological studies tend to show that it is women who are more likely to report sleep deficiencies in old age (Foley, Monjan, Brown, Simonsick, Wallace, & Blazer, 1995; Morgan, Dallosso, Ebrahim, Arie, & Fentem, 1988; Rediehs, Reis, & Creason, 1990; Schechtman, Kutner, Wallace, Buchner, & Ory, 1997; Weyerer & Dilling, 1991). For instance, in a meta-analysis of 27 studies of sleep characteristics, differences were found between men and women over 58 such that women had longer sleep latencies than men and reported more frequent awakenings after sleep onset. However, no gender differences between older men and women were found in total nighttime sleep (Rediehs et al., 1990).

At present the reasons for the discrepancies between objective measurements and subjective reports of men and women are not clearly understood. Although it has been suggested that cultural influences or the willingness of women to discuss their symptoms and problems more readily than men may underlie these results (Morgan, in press). Possibly gender differences in sleep perception and the effects of sleep disruption on mood, make women more sensitive to sleep quality and sleep loss (Hoch, Buysse, Monk, & Reynolds, 1992). The present study is designed to explore these possibilities.

Definition of Insomnia

Poor Sleep Versus Insomnia

The failure to use a uniform definition of insomnia across studies and the almost universal lack of research attention to the distress component of insomnia has contributed to the confounding of poor sleep and the complaint of insomnia in older adults (Fichten, Libman, Bailes, & Alapin, in press). Most older adults, including those who call themselves good sleepers wake up at least once during the night (Libman, Creti, Amsel, Brender, & Fichten, 1997). Clearly, the experience of sleep disruption which is not accompanied by distress cannot be categorized as a complaint of insomnia. The three popular classification systems for sleep disorder: the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV: American Psychological Association, 1994), the International Classification of Sleep Disorders (ICSD; American Sleep Disorder Association, 1990) and the International Classification Of Diseases (ICD-10: World Health Organization, 1992), differ not only in the categories they use but also in the diagnostic criteria used to define insomnia (Edinger, Fins, Goetze, McMillan, Gersh, Krystal, & McCall, 1996). For example, while both the DSM-IV and the ICD-10 include a criterion of distress related to the sleep problem as a central feature of primary insomnia, the ICSD does not include this criterion.

The most popular research definition of insomnia involves 30 minutes of unwanted wake time at least 3 nights per week with problem duration of at least 6 months; the distress component is not usually included. Despite the physiological changes in sleep patterns that accompany aging, not all older individuals complain of impaired sleep (Dement, Miles, & Carskadon, 1982; Libman et al., 1997; Monjan, 1990).

As discussed by Morgan (in press), structural changes affect most aging individuals, yet only a fraction of older individuals complain of unsatisfactory sleep quality. It is therefore reasonable to conclude that increasing age per se is not sufficient for developing insomnia (Morgan, in press, p.11). Available evidence on older adults supports Morgan's (in press) conclusion. For example, while increases in sleep disturbance with age have been identified in non-elderly samples (Janson, Gislason, DeBacker, Plashke, Bjornsson, Hetta, Kristbjarnason, Vermaire, & Boman, 1995; Weyerer & Dilling, 1991), some investigations suggest that rather than accelerating after 65, insomnia problems seem to peak earlier - in the 50 to 60 age group (Mellinger, Balter, & Uhlenhuth, 1985). Similarly, epidemiological studies of older individuals have demonstrated that when health problems were controlled for in longitudinal studies, insomnia complaints generally showed no age related increases (Bliwise, King, Harris, & Haskell, 1992; Foley, Monjan, Brown, Simonsick, Wallace, & Blazer, 1995; Hoch, Dew, Reynolds, Monk, Buysse, Houck, Machen, & Kupfer, 1994; Monjan & Foley, 1995). In addition, cross-sectional and longitudinal studies which have examined well functioning older adults, demonstrated exceptionally low levels of sleep complaints (Morgan, Healey & Healey 1989). Similarly, other studies of sleep patterns in aging populations have found that when older individuals were divided into "young old" and "old old" categories, sleep quality did not decline with age (e.g., Frisoni, De Leo, Rozzini, Bernardini, Della Buono, & Trabucchi, 1993; Gislason, Reynisdottir, Kristbjarnarson, & Benediktsdottir, 1993; Hoch et al., 1994; Kronholm & Hyypa, 1985; Libman, Fichten, Weinstein, Tagalakis, Amsel, Brender, & Creti, 1998). When older subjects are divided into good and poor sleeper categories, some longitudinal studies have even suggested

that sleep quality can improve over time (Libman et al., 1998; Mellinger et al., 1985; Mendelson, 1995; Monjan & Foley, 1995; Morgan et al., 1989). Such findings indicate that insomnia does not necessarily develop as a consequence of increasing age, per se, in older adults. They also highlight the lack of differentiation in the literature of disrupted sleep and insomnia complaint.

Daytime Functioning.

Insomnia is defined not only in terms of nocturnal sleep / wake parameters such as total sleep time, total wake time, or sleep efficiency but also in terms of presumed daytime consequences of poor sleep (DSM-IV: American Psychological Association, 1994; ICSD: American Sleep Disorder Association, 1990; ICD-10: World Health Organization, 1992). People who complain of difficulties falling or remaining asleep during the night often complain of being more impaired in their functioning during the day. For example, they report feeling sleepy and tired during the day, unrefreshed upon awakening as well as having difficulties with memory and concentration (Alapin, Fichten, Bailes, & Libman, 1998; Chambers & Keller, 1993; Hauri & Fisher, 1986; Zammit, 1988).

In spite of the ubiquity of self reported complaints about daytime impairments in individuals with insomnia, studies have generally failed to find significant differences between people with insomnia and normal controls on behavioral measures of daytime performance and functioning (e.g., Alapin, 1996; Lichstein, Wilson, Noe, Aguillard, & Bellur, 1994; Riedel & Lichstein, in press). Moreover, correlations between self-reports of feeling sleepy and tired and behavioral measures of these constructs (for example, the Multiple Sleep Latency Test) are generally small and non significant (Johnson, Freeman,

Spinweber, & Gomez, 1991; Seidel, Ball, Cohen, Patterson, Yost, & Dement, 1984).

This lack of consistency between subjective and behavioral measures of daytime functioning has led some investigators to posit, “that the secondary symptoms reported by patients with insomnia are probably not related to sleep per se” (Bonnet & Arand, 1998, p.359). Self-reports of poor daytime functioning however are related to distress about insomnia and to poor scores on psychological adjustment measures (Chambers & Kim, 1993; Fichten, Creti, Amsel, Brender, Weinstein, & Libman, 1995; Fichten, Libman, Creti, Amsel, Tagalakis, & Brender, 1998). Chambers and Kim (1993) examined the role of state and trait anxiety in insomnia and daytime restedness over one week. Among both good and poor sleepers, there was a significant negative correlation between intrusive thoughts at bedtime and restedness on the following day. In fact, in this study, reports of intrusive thoughts and daytime restedness were significantly related even when total sleep time was controlled for in both groups.

Reports such as these have lead some researchers to conclude that the daytime fatigue and sleepiness commonly attributed to poor sleep or to sleep deprivation by patients with insomnia may be more strongly associated with psychological variables and personality characteristics (e.g., a general tendency to complain of somatic distress) than to nocturnal sleep quality (e.g., Chambers & Keller, 1993). Another possible explanation is that subjectively experienced daytime performance and behavioral aspects of these constructs may, in fact, not be controlled by the same physiological mechanisms.

Prevalence and Incidence of Insomnia

Psychophysiological changes associated with aging resemble the pattern seen in non-elderly people with insomnia (Engle-Friedman & Bootzin, 1981). Such changes

may predispose older individuals to perceive themselves as suffering from insomnia (Fichten et al., 1995). Notably, throughout the prevalence / incidence literature, the distinction between sleep disruption (poor sleep) and sleep complaint (insomnia) is unclear. Nevertheless, as adults age, difficulties in initiating and maintaining sleep become a frequent health concern. While 5 % of the general population complains of insomnia, this estimate rises to 30-60% in adults over the age of 60 (Ancoli-Israel & Roth, 1999; Chen & Foley, 1994; Mellinger et al., 1985; Morgan, in press). Estimates of occasional insomnia in the older population have been as high as 73% (Frisoni et al., 1993). While problems falling asleep tend to predominate among younger and middle-aged individuals, sleep maintenance and terminal insomnia (characterized by early morning awakenings) are the most frequently reported types of sleep complaints among older adults (Brabbins, Dewey, Copeland, Davidson, McWilliam, Saunders, Sharma, & Sullivan, 1993; Floyd et al., 2000; Foley et al., 1995).

Epidemiological studies have consistently shown that sleep dissatisfaction is more common among women than men (e.g., Ohayon, Caulet, & Guilleminault, 1997). As noted previously, whether this finding results from a fundamental difference in sleep perception of men and women or whether it reflects differences in the propensity to express complaints remains undetermined.

In contrast to the abundance of prevalence data available, information about the incidence of insomnia (i.e., the rate at which new cases occur) among older adults is more scarce (Morgan, in press). Thus, it is possible that the available statistics reflect the chronicity of sleep complaints rather than the rate at which new sleep difficulties develop. Additionally, a variety of other changes occur with age, and factors such as

deteriorating health, high rates of sleep apnea and restless legs syndrome / periodic limb movements in sleep, or the adverse effects of many prescription and over-the-counter drugs may be confounding the findings (e.g., Libman, Creti, Levy, Brender, & Fichten, 1997).

Estimates of the incidence of insomnia indicate a clear though somewhat modest increase of insomnia with age, with estimates of incidence rising from 5.7% among 18-25 year olds to 7.3% among individuals 65 years and over (e.g., Ford & Kamerow, 1989). Such findings suggest that insomnia present in later life does not necessarily originate in later life, and that many younger and middle-aged adults suffering from difficulties initiating or maintaining sleep may continue to report such difficulties in old age (Morgan, in press).

In a recent longitudinal epidemiological study of 6,800 older adults, Foley, Monjan, Simonsick, Wallace, and Blazer (1999) found that 15% of individuals without insomnia at baseline developed symptoms over three years, suggesting a yearly incidence rate of 5% in this cohort of older persons. In addition, the authors found that approximately 15% of those with insomnia resolved their symptoms each year. Estimates of incidence and remission rates of insomnia in older individuals, such as those presented above, may provide a more accurate portrayal of the development and maintenance of sleeping difficulties in later life and seem to indicate that the aging process, per se, may be related to changes in sleep parameters but does not cause insomnia. One of the objectives of this research is to explore characteristics associated with the improvement as well as the deterioration of sleep and insomnia in older adults.

Etiology of Insomnia

Lifestyle and Sleep.

It is well documented that pain, medical and psychiatric illness, and drug side effects all affect sleep adversely in older adults (e.g., Foley et al., 1995; Morgan et al., 1988; Habte-Gabr, Wallace, Colsher, Hulbert, White, & Smith, 1991). In fact, medical problems, medications, irregular schedules permitted by retirement, napping, early bedtimes, long periods of time spent in bed, and unrealistic expectations about sleep needs, erroneous beliefs about how well same age peers sleep, as well as life stress and mood disturbances have all been cited as possible causes of insomnia in older adults (Morin, Kowatch, Barry, & Walton, 1993; Buysse, Browman, Monk, Reynolds, Fasiczka, & Kupfer, 1992; Prinz, Vitiello, Raskind, & Thorpy, 1990).

In terms of lifestyle practices however, there is a surprising lack of confirmatory data. Recent studies demonstrate that when daytime activities and lifestyle practices are examined, older individuals complaining of insomnia do not differ from non-complaining older individuals. Fichten and her colleagues (Fichten et al., 1995) found that poor sleepers were surprisingly optimistic about how their sleep compared to that of others their age. Poor sleepers did not differ from good sleepers in terms of schedule, such as their meal times or the time they went to bed and got up in the morning. Good sleepers napped as frequently as poor sleepers. Similarly, studies comparing coffee or alcohol consumption between good and poor sleepers during nocturnal awakenings indicate no significant differences between the groups (Adam, Tomeney, & Oswald, 1986; Gourash Bliwise, 1992; Libman et al., 1998; Morgan et al., 1989). Aspects of lifestyle, such as the diversity of activities engaged in during the day or the perceptions

about how fully one's time is occupied does not distinguish poor sleepers from good sleepers.

Similarly, exposure to stressful events was found to be comparable between the two groups (Fichten et al., 1995; Friedman, Brooks, Bliwise, Yesavage, & Wicks, 1995). In the Friedman et al. (1995) study, good and poor sleepers did not differ in terms of life stress; however, within the group of poor sleepers, those with higher life stress had greater difficulty falling asleep and more early morning awakening than did poor sleepers with lower life stresses. There was no association between life stress and any sleep measure for good sleepers.

Psychological Adjustment.

Diagnosable psychiatric conditions such as major depression and anxiety disorders are well known to be associated with insomnia (e.g., Ford & Kamerow, 1989; Henderson, Jorm, Scott, Mackinnon, Christensen & Korten, 1995; Kales, Caldwell, Preston, Healey, & Kales, 1976; Morgan & Clarke, 1997; Ohayon, Caulet, Philip, Guilleminault, & Priest, 1997; Fuller, Waters, Binks, & Anderson, 1997). Other psychological factors too have been found to be important. Indeed, the vast literature on personality and psychological adjustment in young and middle aged individuals with sleep problems (e.g., Dorsey & Bootzin, 1997; Fuller et al., 1997; Hirshkowitz, Hamilton, Rando, Bellamy, Williams, & Karacan, 1990; Lundh, Broman, & Hetta, 1995) and the growing literature on older adults (e.g., Brabbins et al., 1993; Fichten et al., 1995; Frisoni et al., 1993; Gourash Bliwise, 1992; Morin & Gramling, 1989) with insomnia have been remarkably consistent.

On measures of personality such as the MMPI, researchers have found that people with insomnia show higher numbers of elevated scales than controls. The most consistent elevations have been on the Depression, Hysteria, Hypochondriasis, and Psychastenia scales (e.g., Beutler, Thornsby, & Karacan, 1978; Freedman & Sattler, 1982; Kales, Caldwell, Soldatos, Bixler, & Kales, 1983; Mendelson et al., 1984). Other measures of psychological adjustment have assessed levels of depression, anxiety and worry among poor sleepers. All of these studies describe people with insomnia as being more anxious, depressed, and worried than people without insomnia (e.g., Fichten et al., 1995). People complaining of insomnia have also been shown to differ from normal sleepers on other personality parameters as well. They tend to have lower self-concepts and greater difficulty in their interpersonal relationships than do normal sleepers (Healey, Kales, Monroe, Bixler, Chamberlin, & Soldatos, 1981) and tend to be more predisposed to cognitive hyperarousal (Coren, 1988; Nicassio et al., 1988).

Overall, people suffering from insomnia have more problematic psychological profiles than their well sleeping counterparts and are characterized as being more depressed, anxious, neurotic and worrying individuals. The research literature rarely makes distinctions among poor sleepers a priori, however their results clearly suggest that poor sleepers are not a homogeneous group and that different subgroups may in fact present very different psychological profiles (Chambers & Keller, 1993; Fichten et al., 1995; Ohayon, Caulet, Priest, & Guilleminault, 1997; Zorick, Roth, Hartze, Piccione, & Stepanski, 1981).

In a recent study Fichten et al. (1995) distinguished categories of older poor sleepers on the basis of distress about their sleep. This resulted in two groups of poor

sleepers: highly distressed poor sleepers and minimally distressed poor sleepers. While both subgroups of poor sleeping older individuals presented similar poor sleep during the night, and reported significantly worse sleep than good sleepers, the low distress poor sleepers actually were more comparable to good sleepers on both state and trait measures of anxiety, indices of psychological maladjustment, and measures of good psychological adjustment. Both good sleepers and low distress poor sleepers differed significantly from the highly distressed poor sleepers on these measures. In addition, Fichten et al. (1995), found that highly distressed poor sleepers reported significantly greater amounts of sleepiness and fatigue during the day than did either good sleepers or low distress poor sleepers.

Similarly, Ohayon and his colleagues (Ohayon et al., 1997) categorized subjects according to the presence / absence of diagnosable impaired sleep as well as the presence / absence of sleep dissatisfaction. While the authors found that diagnosable impaired sleep, based on self-reports of sleep parameters, occurred in 36.2% of subjects, most of these people did not report sleep dissatisfaction. Moreover, subjects with both impaired sleep and sleep dissatisfaction manifested a higher prevalence of mental disorders as well as longer duration of insomnia symptoms than individuals with insomnia symptoms who were not dissatisfied with the quality of their sleep. Individuals with impaired sleep and sleep dissatisfaction were also more prone to taking sleep-promoting medications and reporting greater sleepiness during the day.

Findings such as these suggest that sleep dissatisfaction and distress as well as their correlates – anxiety and depression - may in fact be better indicators of insomnia complaints than nocturnal sleep quality alone. It should be noted that there is, at present,

little information on the nature of the relationship between the complaint of insomnia and sub-clinical levels of depression or anxiety. While it is known that clinical depression tends to produce insomnia symptoms, it is possible that low levels of depression and anxiety also induce sleep difficulties. Conversely, sleep impairments may bring about depressive or anxiety symptoms.

Hyperarousal and Insomnia

As noted earlier, poor sleepers tend to be more anxious and depressed than good sleepers; this is particularly the case for highly distressed or dissatisfied poor sleepers (Fichten et al., 1995; Ohayon et al., 1997c). This suggests that more or less nocturnal sleep or wake time does not sufficiently explain the severity of the sleep complaint. Among the possible mechanisms underlying insomnia, hyperarousal has been gaining ground. Two categories of hyperarousal are commonly described: pre-sleep cognitive arousal and physiological hyperarousal (cortical and autonomic).

Self-reported cognitive arousal

The important role of cognitions in the insomnia complaint has been underscored by several investigators (Borkovec, Lane, & Van Oot, 1981; Fichten & Libman, 1991; Coyle & Watts, 1991; Kuisk, Bertelson, & Walsh, 1989; Lichstein & Rosenthal, 1980; Morin et al., 1993). Indeed, the data concerning the impact of self-reported cognitive arousal on sleep disruption is more consistent than that reported for somatic arousal on the Nicassio, Mendlowitz, Fussell and Petras (1985) pre-sleep arousal scale, which measures the intensity of cognitive and somatic symptoms of arousal prior to falling asleep. Both subscales discriminated people with insomnia from normal sleepers and

both were associated with longer sleep onset latencies (SOL), although the cognitive arousal scale was more strongly associated with SOL than with the somatic subscale.

Similarly, Lichstein and Rosenthal (1980) asked a sample of people with sleep disruptions to judge the primacy of cognitive symptoms, somatic symptoms, both or neither in their sleep problem. While more than half of their sample (54%) reported cognitive arousal as a primary factor in their sleep problem, only 5.4% indicated that somatic arousal had an important role in their disrupted sleep. Fichten et al. (1995) also found that cognitive aspects and negative thoughts during periods of sleeplessness were more closely related to sleep variables than were somatic aspects.

Two types of data demonstrate the role of cognitive arousal: studies identifying psychological factors associated with poor sleep and recent work that is more specific to cognitive arousal and its role in insomnia treatments (e.g., Creti, 1996). Elevated psychopathology among insomnia sufferers suggests that insomnia may be a symptom of anxious, depressed and disordered thought patterns that operate at bedtime. Cognitive activity prior to sleep, particularly when it involves anxious and negative thoughts, has been hypothesized to contribute directly to the etiology and to the maintenance of sleep onset problems (Borkovec, 1979; Lichstein & Rosenthal, 1980; Youkilis & Bootzin, 1981). White and Nicassio (1990) proposed that cognitions serve as a mediating factor between stress and sleep. Studies assessing cognitive arousal using questionnaires have consistently found cognitive arousal to be a characteristic of poor sleepers rather than good sleepers. Poor sleepers describe themselves as having more difficulty relaxing, and as being more tense, anxious, preoccupied, worried and depressed (Chambers & Kim, 1993; Fichten et al., 1995; Kales, Kales, Bixler, Soldatos, Cadieux, Kashurba, & Vela-

Bueno, 1984). Young sleep onset insomnia sufferers report overall greater cognitive activity at night than good sleepers (Coates, Killen, Silverman, George, Marchini, Hamilton, & Thoresen, 1983). One study examined the content and the valence of thoughts during nocturnal awake times in good sleepers and high distress and low distress poor sleepers (Fichten et al., 1995). Results indicated that negative thought frequency was closely related to poor sleep, distress about insomnia, and poor psychological adjustment.

Hall, Buysse, Dew, Prigerson, Kupfer, and Reynolds (1997) tested the hypothesis that cognitive arousal may be one of the underlying causes of sleep disruption in depression. Intrusive thoughts were examined in individuals over the age of 65 suffering from bereavement. The results indicated a significantly greater frequency of intrusive thoughts was associated with longer sleep latency in this sample. Intrusive thoughts were also related to delta sleep ratios, gender, time since loss, depression severity and subjective sleep quality. Such findings suggest a mediating role for thoughts in the experience of insomnia and support the hypothesis that thoughts, particularly negative thoughts, play a central role in the insomnia experience of older adults (c.f., Fichten et al., in press).

Similarly, Fuller et al. (1997) obtained polysomnographic measures of individuals from non-clinical populations scoring in the top 20th percentile on the Spielberger State and Trait Anxiety Scale and the Penn State Worry Questionnaire, with no other psychiatric syndromes. The results indicated that individuals with high anxiety and worry scores experienced poorer sleep as assessed by PSG measures than non-anxious individuals. They exhibited longer sleep latencies, less deep sleep and increased

amounts of non rapid eye movement (NREM) sleep. These results suggest a common pathway between sleep problems and psychological maladjustment (Fuller et al., 1997).

Whether depression, anxiety and personality factors cause cognitive arousal which is then manifested as negative, worrying thoughts which interfere with sleep quality or whether it is sleep disruptions that predispose older individuals to experience increased cognitive activity and worry during periods of nocturnal wakefulness cannot be determined by existing correlational studies.

The frequency of thoughts, predominantly negative, during periods of nocturnal awakenings among those with insomnia suggests that interference with cognitive activity, either by decreasing the frequency of negative cognitions or by focusing attention away from these intrusive thoughts, would be appropriate in the treatment of insomnia. The sleep literature tends to support cognitive interventions. Indeed, the addition of cognitive aspects to behavioral interventions, by changing maladaptive beliefs and attitudes about sleep, has been shown to have beneficial effects on the complaint of insomnia (e.g., Morin et al., 1993). Some sleep researchers have even argued that a common mediating mechanism, the disruption of cognitive activity, accounts for the demonstrated effectiveness of different types of cognitive-behavioral interventions in the treatment of sleep problems (Borkovec, 1982; Lichstein & Fisher, 1985). It is noteworthy, that a physiological predisposition for certain personality characteristics has been suggested and high frequency EEG activity has been linked to cognitive hyperarousal during the sleep onset period (Perlis, Giles, Buysse, Tu, & Kupfer, 1997).

Physiological Hyperarousal

While the powerful impact of thinking on behavior has been amply demonstrated in the cognitive therapy literature, to date, studies on insomnia and cognitive arousal do not permit determination of the direction of causality between poor sleep and negative thinking. One possibility is that the root cause of both insomnia and poor psychological adjustment is physiological hyperarousal (Bonnet & Arand, 1997; 1998; Perlis et al., 1997). Indeed, physiological hyperarousal has not only been invoked as an explanation of poor sleep but has also been associated with difficulties related to psychological maladjustment, negative affect and thoughts, to personality factors, as well as self reported daytime impairments and biases in time estimation (e.g., Bonnet & Arand, 1998).

Autonomic Arousal.

Several studies have suggested that individuals with insomnia tend to display higher autonomic arousal at night than people without insomnia (Adam et al., 1986; Bonnet & Arand, 1995, 1997, 1998; Freedman & Sattler, 1982; Monroe, 1967; Vgontzas, Tsigos, Bixler, Stratakis, Zachman, Kales, Velo-Bueno, & Chrousos, 1998). Some researchers actually hypothesize that individuals with insomnia also have elevated arousal during the day (for a review, see Riedel & Lichstein, in press). Measures of automatic arousal include self-reports, behavioral and physiological indicators, such as higher body temperature, elevated skin resistance, increased heart and respiratory rate, increased peripheral vasoconstriction, and higher electro-myographic amplitudes. For example, Bonnet and Arand (1996, 1997) compared the physiological activity, indexed by whole body metabolic rate, of patients suffering from sleep state misperception

(reported poor sleep not corroborated by physiological indices) and individuals suffering from psychophysiological insomnia to controls displaying no sleep disruption matched for age, gender, and weight. The results indicated that the metabolic rates of patients with both types of insomnia were significantly higher than those of subjects reporting no sleep problems, supporting the position that people with insomnia are indeed characterized by increased physiological arousal. More recently, Bonnet and Arand (1998) assessed subjects with insomnia after particularly poor nights on psychological and physiological indices. It was hypothesized that if daytime symptoms of insomnia were secondary to EEG sleep quality, the laboratory produced insomnia would make the secondary symptoms worse. On the other hand, if hyperarousal caused both poor sleep and the secondary symptoms in patients with insomnia, the induced supplementary sleep deprivation would not affect or could actually improve the secondary symptoms related to hyperarousal. Despite the large reduction in total sleep, patients with insomnia did not display significantly increased sleepiness on the Multiple Sleep Latency Test (Carskadon, Dement, Mitler, Roth, Westbrook, & Keenan, 1986) and did not report significant decreases in their sleep quality (Bonnet & Arand, 1998). The authors concluded that the symptoms patients attribute to poor sleep are in fact not due to their poor night's sleep but rather possibly resulted from physiological hyperarousal.

Cortical Arousal.

Other sleep researchers have implicated hyper-activation of the cortex in the etiology of insomnia. Studies investigating cortical arousal have also found pattern of hyperarousal in people with insomnia. Mérica and Gaillard (1992), for example, recorded changes in EEG during the sleep onset period (SOP) of 12 people with

psychophysiological insomnia and 23 normal sleepers. The SOP of people with insomnia were marked by periods of rapid changes, as well as rates of delta activity and total activity ratios which differed from the patterns found in normal sleepers. Insomnia sufferers had greater EEG activity during SOP that continued throughout the first minutes of Stage 2 sleep. They also experienced increases in beta activity and lower delta activity than did normal sleepers.

Other studies, too, have found differences between normal sleepers and people with insomnia on cortical activity during nocturnal sleep. Lamarche and Ogilvy (1997), for example, compared the electro-physiological patterns of activity of people with psychophysiological insomnia, secondary insomnia (secondary to a psychiatric condition), and normal sleep. Individuals suffering from psychophysiological insomnia displayed less alpha sleep during the first part of the SOP and did not show the typical drop in alpha sleep across SOP which is characteristic of normal sleep. They also displayed fewer delta waves in the last quartile of SOP and displayed higher beta during periods of wakefulness than both normal sleepers and people with psychiatric insomnia. Interestingly, while the sleep onset periods of individuals with psychiatric insomnia and with normal sleep were relatively similar, these were clearly different from the SOP of people with psychophysiological insomnia. It should be noted that the delta differences found among those with psychophysiological insomnia and the absence of a drop in alpha sleep during the sleep onset period have also been found in depressed patients (Lamarche & Ogilvy, 1997).

In this study, individuals with psychophysiological insomnia also had relatively reduced alpha activity and increased beta activity during nocturnal awake times.

Similarly, the beta activity was higher in these individuals than in the other two groups. According to the authors, the cortical arousal reflected by higher beta activity in psychophysiological insomniacs may reflect their difficulties with sleep onset and delayed perceptions of sleep (Lamarche & Ogilvy, 1997). Thus, differences in power measures in psychophysiological insomnia are consistent with the hypothesis of heightened cortical arousal.

Recent studies have implicated cortical hyperarousal as the psychophysiological mechanism underlying intrusive cognitive activity at sleep onset (e.g., Hall, Buysse, Nowell, Nofzinger, Houck, Reynolds, & Kupfer, 2000; Perlis et al., 1997). Hall et al. (2000), for example, evaluated symptoms of stress and depression in conjunction with subjective sleep complaints and quantitative measures of sleep in individuals with chronic insomnia. In this study, hyperarousal during sleep was defined as decreases in delta power and elevations in alpha and beta power through out non-REM sleep, symptoms of stress were defined as the tendency to experience stress related intrusive thoughts and the interaction between intrusion tendency and the number of recent stressful events (“subjective stress burden”). The results showed that a stronger tendency to experience stress related thoughts was associated with greater sleep complaints and a trend towards greater beta power and increases in “subjective stress burden” were associated with decreases in delta power. In addition, Hall and her colleagues (2000) found that elevations in subclinical levels of depression were associated with elevations in alpha activity. Such findings suggest that cortical hyperarousal during sleep contributes to the experience of disturbed sleep and that heightened cortical arousal level

in patients with insomnia may reflect heightened wakelike information and sensory processing (Hall et al., 2000, p.229).

Physiological Hyperarousal and Cognitive Arousal in Poor Sleep.

Physiological hyperarousal has not only been proposed as an explanation of poor sleep but also of difficulties related to personality and psychological adjustment (negative affect, self reports of daytime impairments) (Bonnet & Arand, 1998).

Physiological hyperarousal and cognitive arousal as explanations of poor sleep are not necessarily incompatible. Indeed, autonomic hyperarousal could be viewed as the physiological basis for certain personality characteristics, psychological adjustment parameters, as well as perceived impairment of daytime functioning. This physiological process could also account for both delayed sleep onset at night as well as during the schedule daytime naps (as observe on the Multiple Sleep Test Latency). While cortical arousal could be seen as the physiological substrate of negative nocturnal cognitive activity which interferes with night-time sleep, such hyperarousal, alone, cannot sufficiently explain insomnia. Indeed, as suggested by several researchers (Chambers & Keller, 1993; Zorick et al., 1981), and recently demonstrated by Fichten et al. (1995) and Ohayon and his colleagues (1997), there are substantial numbers of persons who sleep poorly yet do not report sleep distress or dissatisfaction, and do not exhibit the problematic personality profiles and psychological adjustment commonly reported in studies on insomnia. These affective, personality style differences among poor sleepers can more easily be viewed as the behavioral correlates of physiological (autonomic) hyperarousal.

Cognitive arousal may be the mediating factor between physiological hyperarousal and poor sleep. Thus, physiological over-activity is completely consistent with the view that excessive negative thinking mediates various aspects of the insomnia complaint, including sleep related distress or dissatisfaction with one's sleep. To recap, self reported poor sleepers display more neurotic, anxious, and depressed profiles than non-poor sleepers. Similarly, they exhibit more pre-sleep cognitive, autonomic and cortical hyperarousal than individuals who do not complain of sleep problems. In parallel, individuals with more anxious and/or depressed characteristics tend to report poorer sleep than well-adjusted individuals. Less well-adjusted individuals also experience differences on polysomnographic measures during nocturnal sleep. Does negative affect, personality, and cognitive or physiological hyperarousal cause poor sleep? While much research has confirmed the relationship between these variables, only a few studies have attempted to identify the direction of causality between them. In fact, most of the findings have been cross-sectional and correlational in nature, and hence, have not provided an answer to this question. Phase 2 of the present investigation explores this issue.

Cognitive Models of Insomnia

The role of dysfunctional beliefs and attitudes in the development and maintenance of insomnia has recently been integrated into the conceptualization and clinical management of late-life insomnia (e.g., Fichten, Libman, Bailes, Alapin, in press; Morin, in press). Morin (in press), for example, describes acute insomnia episodes among older adults as often resulting from reaction to stressful events such as retirement, bereavement or medical illness. He explains that in situational or short-term insomnia,

sleep quality often normalizes once the stressor has dissipated or the individual has adapted to it. In many cases, however, insomnia can develop a chronic course. According to Morin (in press), the individual's responses to his or her initial sleep impairments, in particular his or her thoughts and behaviors, determine in large part whether or not the sleep difficulties will persist or will cease. Indeed, Morin postulates that when insomnia becomes chronic, most people will develop maladaptive sleep behaviors such as daytime napping or excessive time in bed, and will manifest a series of dysfunctional cognitions (e.g., worries about sleep, ruminations about the consequences of sleep loss). Although Morin (in press) categorizes these behavioral and cognitive responses as being fairly normal initially, he postulates that they can often become maladaptive over time and feed on the vicious cycle of insomnia.

While this conceptualization cogently describes how insomnia can develop and persist in certain older adults, it fails to address the developmental changes in sleep quality which characterize late-life and are probably associated to a certain degree with the etiology of insomnia in aging individuals. Moreover, the model stipulates that negative thoughts and/or maladaptive behaviors are central in determining whether sleep difficulties will persist or stop. It does not however specify the characteristics distinguishing individuals who will continue to entertain maladaptive cognitions from those who will cease.

Fichten et al. (in press) address these issues in their Cognitive Model of Insomnia. Indeed, while Fichten et al.'s (in press) model also implicates cognitive factors such as cognitive hyperarousal and distressing and intrusive thoughts in the etiology and maintenance of insomnia, it posits that negative cognitive activity and high

levels of tension during periods of wakefulness contribute to poor sleep experiences. They may also act as mediators between personality factors and negative affect, on the one hand, insomnia complaints and self-reported poor daytime functioning on the other.

Unlike Morin's (in press) conceptualization, this model begins with the recognition that nocturnal awakenings will occur in most older adults. It then proposes that negative cognition, such as concerns over the day's events and worries about miscellaneous matters, including the consequences of not getting enough sleep, is associated with other maladaptive nocturnal behaviors (e.g., tossing and turning), emotions and distortions in their time estimation that, in turn, both magnify the sleep complaint and contribute to negative cognitive experiences that interfere with falling asleep or returning to sleep.

Studies reported by Fichten et al. (in press) provide support for the descriptive and the heuristic aspects of their Cognitive Model of Insomnia and also provide some support for the mediational role of negative thoughts in insomnia-related distress. For example, the data show that perceived severity of the sleep problem and negative thoughts both make significant and independent contributions to the variability in distress about poor sleep. Indeed, the data indicate that aversive cognitions, including negative thoughts, a poor balance between positive and negative thinking, and high levels of mental "tension" are strongly associated both to poor sleep and to distress about one's sleep problem. These cognitive aspects were more closely related to the various components of the insomnia components than any of the state or trait measures of anxiety and adjustment explored in their study, suggesting a specific mediational role for negative thinking during nocturnal awake times (Fichten et al., in press).

It should be noted that the causal role attributed to cognitive activity in the development or maintenance of insomnia in both conceptualizations merits further attention; indeed, much of the support for these models has, to date, been correlational in nature.

Longitudinal Studies

A few recent longitudinal studies have attempted to address the causality question indirectly (Libman et al., 1998; Morgan et al., 1989; Rodin, McAvay, & Timko, 1988). For example, Morgan et al., (1989) attempted to identify factors influencing the persistent complaint of insomnia in older adults at a two-year follow up. The results indicated that elevated neuroticism, diminished health as well as (somewhat puzzlingly) daytime tea consumption were associated with a persistent complaint of poor sleep 2 years later. The authors concluded that personality factors exert a pervasive influence on subjective sleep quality among older adults. Also of interest is the fact that some previously poor sleepers improved over the two years, although the authors did not systematically investigate the predictors of improved sleep.

Rodin et al. (1988) also tried to clarify the relationship between sleep and depression in adults over the age of 62. The goal was to determine whether clinical depression predicted self-reports of sleep difficulties even when health factors were controlled for over a 3-year period. The authors found a consistent positive relationship between frequency of depressed mood and severity of sleep symptoms 3 years later, such as early morning awakening and not feeling refreshed in the morning. The probability of reporting moderate and severe levels of sleep disruptions increased with the number of previous interviews where the subjects reported depressed affect. The authors found that

at 8 month and 2 year follow up, depression was related to more reports of sleep problems including, increased sleep latencies, diminished sleep efficiency and more early morning awakenings. This positive association between sleep quality and depression remained even when age, gender, and health were controlled for. These results are consistent with the cognitive model of insomnia in aging proposed by Fichten et al. (in press).

Mendelson (1995) carried out a long-term follow up of patients diagnosed with psychophysiological insomnia and sleep state misperception. Patients were given structured interviews at 40 months and 64 months after initial assessment. Most continued to report sleep disturbances, although there was a general improvement of symptoms. The number of awakenings during the night diminished, total sleep time increased, and days feeling sleepy and unrefreshed also diminished. There was a trend toward less global complaint of sleep. At the follow-ups, 70.4 % endorsed the global statement of trouble sleeping at 40 months and 88.2 % did so at 64 months (quantitative sleep parameters improved, subjective, perceived complaint increased).

In a recent study Libman et al. (1998) evaluated changes in sleep quality in “younger” and “older” older adults over a two-year period, and attempted to identify predictors of “vulnerability” and “resilience” for developing significant sleep complaints. At both of the testing times the percentage of individuals in the three sleep status categories was similar: 40% were good sleepers, 40% were poor and 20% were medium quality sleepers. At the end of the 2-year period, 66% of participants were unchanged. Of those who changed, approximately ½ improved and ½ deteriorated. Consistent with the cognitive hyperarousal hypothesis, improvement was related to better daytime

psychological adjustment, for example less neuroticism, as well as to lower levels of negative, anxious thoughts during the pre-sleep period. It is interesting to note that in this investigation there was no evidence for age-related increases in sleep complaints. None of the variables examined predicted deterioration of sleep among good sleepers. Possibly the stringent criteria used to classify sleepers as “good sleepers” may have resulted in a group of individuals who were particularly well adjusted. The consequent homogeneity of the good sleepers, in contrast to the poor sleepers, who could vary in terms of distress levels, may have made it difficult if not impossible to identify risk factors for developing insomnia. Perhaps, it is good sleepers who are distressed (dissatisfied) and have high cognitive arousal during periods of sleeplessness who are vulnerable to future problems. The methodology of this investigation precluded examination of this possibility.

Results of these longitudinal studies are still correlational in nature and cannot imply causation. However, they do suggest that making changes in negative, anxious thoughts during the pre-sleep period, and addressing the concomitant psychological maladjustment displayed by many individuals with poor sleep, may be useful therapeutic avenues. The results of these studies also highlight the importance of conducting longitudinal investigations. Indeed, as discussed by Libman et al. (1998), it is only by following the same individuals over time that research can shed light on the process of change in sleep patterns and identify etiological and maintenance factors associated with good and poor sleep patterns.

Summary

Psychological maladjustment and poor sleep are related. Individuals who are not well adjusted psychologically tend to report greater sleep problems. Similarly, individuals reporting trouble falling asleep or maintaining sleep during the night tend to display more negative affect and obtain higher scores on scales of anxiety, worry, negative thinking and depression than do better sleepers. Moreover, studies have shown that both psychological maladjustment and complaints of insomnia or poor sleep are associated with specific sleep parameters and CNS hyperarousal (e.g., longer sleep latency, less deep sleep, absence of a drop in alpha activity during sleep onset). A common denominator between poor sleep and poor psychological adjustment and, perhaps, the mediator between poor psychological adjustment, poor sleep and physiological arousal may be cognitive arousal in the form of negative self talk and an anxious and worrying personality style (Fichten & Libman, 1991; Fichten et al., 1995).

The Present Investigation

The two key questions addressed in Phase 1 of the present investigation are the following. (1) What are the characteristics of older adults who report sleeping well and poorly? (2) Among older adults who sleep poorly during the night, a significant proportion are neither distressed about their sleep, nor impaired during their day as a result of it. What distinguishes these individuals from other poor sleeping individuals who are distressed and impaired in their daily functions?

Individuals are prone to having more sleep disruption with increasing age. Yet, not all older individuals report or complain of impaired sleep. Of interest in the present investigation is the role of cognitive arousal during nocturnal wake times and its

correlates in the report of poor sleep and the complaint of insomnia in older adults. To do this, four groups of older adults who differ in sleep quality and in nocturnal cognitive arousal were selected: poor sleepers with high cognitive arousal (PSHA), poor sleepers with low cognitive arousal (PSLA), and good sleepers with high (GSHA) and low (GSLA) cognitive arousal. They were examined both cross-sectionally (Phase 1) and longitudinally (Phase 2).

Phase 2 also attempted to identify predictors of vulnerability and resilience for developing sleep complaints in older good and poor sleepers over a two-year period. Comparisons were performed separately for men and women to determine whether predictors of sleep complaints are similar for both sexes.

Hypotheses

Phase 1

Hypothesis 1. Individuals with high nocturnal cognitive arousal are expected to report poorer sleep quality than individuals with low cognitive arousal, regardless of sleep status. Thus, even among those participants who report good sleep, higher levels of cognitive arousal during nocturnal wakefulness are expected to contribute to lengthening sleep onset.

Hypothesis 2. Previous studies have shown that self-reports of daytime impairments in people with insomnia were more closely related to psychological measures than to nocturnal indices of sleep quality (Alapin, 1996; Alapin, Fichten, Bailes, & Libman, 1998; Fichten et al., 1995). Therefore, it is expected that individuals with high cognitive arousal, regardless of sleep quality, will be more impaired in their daytime functioning than individuals with low cognitive arousal. Thus, individuals with

high arousal are expected to report being more tired and sleepy during the day than individuals with low cognitive arousal.

Hypothesis 3. Individuals reporting greater cognitive arousal during periods of sleeplessness are expected to be more psychologically maladjusted (i.e., have higher scores on measures of depression and anxiety, lower satisfaction with life) and have more neurotic and worrying personality characteristics than individuals with low cognitive arousal, even when sleep quality is controlled for.

Because poor sleepers spend more time awake during the night than good sleepers (Fichten et al., 1995), the two poor sleeper groups will experience more thoughts than good sleepers. but those poor sleepers who have higher levels of cognitive arousal during the night are expected to be more impaired than the three other groups. Thus, individuals reporting poor sleep as well as high arousal are expected to have the worst outcomes, followed by individuals reporting higher levels of arousal without sleep disruptions, who in turn are expected to fare better than poor sleepers with low arousal and individuals with better sleep and low arousal.

Phase 2

Hypothesis 4. It is expected that high levels of cognitive arousal will pose a significant risk for developing or maintaining sleep difficulties. In other words, highly aroused good sleepers at the initial assessment are expected to be at greater risk for developing sleep problems 2 years later than good sleepers with low cognitive arousal. Conversely, individuals reporting low levels of cognitive arousal during nocturnal awake times are expected to maintain good sleep or to improve their sleep quality at the 2 year follow up compared to their highly aroused counterparts. Improvement and deterioration

are assessed not only by change in sleep status (e.g., good sleepers becoming poor sleepers) but also with measures of reported insomnia frequency, daytime fatigue, and sleep-related distress.

Implications

The findings of this investigation will be relevant both for the conceptualization of the insomnia experience in older adults and for the treatment of older adults reporting sleep problems. On the theoretical side, such a longitudinal study of individuals with and without insomnia categorized along a dimension of nocturnal cognitive arousal, although also correlational, might help clarify the relationship between sleep, psychological function and cognitive activity. The practical implication is that if, as predicted and as proposed by others (e.g., Fichten & Libman, 1991; Fichten et al., 1995; Morin, in press), cognitive arousal contributes to the onset and / or the maintenance of poor sleep in older adults, then focusing on problematic nocturnal thoughts may be effective in modifying cognitive activity and negative affect which prevent sleep in older adults: this possibility can be explored in future investigations. The findings may also shed light on the role of psychological maladjustment in heightened cognitive arousal during nocturnal wake times and in reports of poor sleep in older adults. If low levels of depression or anxiety, for example, contribute to cognitive arousal during periods of sleeplessness and to the onset and / or maintenance of sleep problems in this population, the treatment of sub-clinical levels of depression and anxiety may be a complementary way of preventing the deterioration of sleep quality in individuals who report sleeping relatively well, and of treating individuals who complain of poor sleep.

METHOD

Participants

One hundred eighty three older community dwelling individuals, (60 men and 123 women; mean age = 69.57 years, range = 55-87 years) participated in Phase 1 (i.e., the cross-sectional component of this investigation). They were volunteers who had taken part in a larger ongoing study conducted by the Sleep and Aging Project of the Jewish General Hospital in Montreal Quebec (Creti, 1996; Fichten et al., 1995; Libman et al., 1998).

Both Good and Poor Sleepers were recruited through media publicity consisting of press releases and notices in community clinics or residences for older adults. Participants were also recruited through presentations to seniors' groups. These participants were given a brief talk on stress management by a member of the research team followed by a brief introduction on the Sleep And Aging Study. These briefs talks (15-20 minutes) provided very general information on concepts of stress in daily life that older individuals may experience and general concepts of coping. We deliberately made no mention about sleep in these discussions so as not to influence responses on the battery of questionnaires completed by these participants. Only 20% of participants in Phase 1 were recruited by means of presentations to seniors' groups. Group members were asked to complete a series of questionnaires including the Background Information Form, the Sleep Questionnaire and the Stanford Sleepiness Scale. Potential participants were told that they were free to respond or not to any of the questions.

Four hundred three people responded to the invitation to participate in a study examining sleep characteristics in good and poor sleepers. Participants who completed

the questionnaires (20 minutes) were told about additional phases of the Sleep and Aging investigation and were invited to participate. Individuals who wanted more information and were interested in the study were invited to contact the research team. All individuals who inquired about the study, whether they had learned about the project through group presentations or publicity were given information about the goals of the study of the Sleep and Aging Project as well as what would be required of them should they choose to participate.

Those interested in participating were screened first by telephone using the Telephone Screening Interview and subsequently in person using the Structured Sleep History Interview. The subject selection criteria were as follows:

- a) age 55 and over;
- b) ability to read and write English well enough to complete the questionnaire measures
- c) prescription sleep medications, if taken, were currently taken no more than 3 times weekly [this criterion is consistent with sample selection in published studies on psychological intervention for insomnia and allows for the selection of a reasonably “typical” sample of older adults with insomnia (Lichstein & Fisher, 1985)];
- d) psychological status: currently not receiving psychiatric or psychological care, and no evidence of psychopathology and / or clinical depression. A single item asking whether participants had sought help from a mental health care practitioner, such as a psychologist, a psychiatrist or a social worker within the past 12 months, was used to assess individuals’ psychological status.
- e) physical status: absence of major illness or drug use directly associated with sleep disturbance (cf. Lacks, 1987; Nicassio & Buchanan, 1981);

- f) no evidence of physiologically based sleep disturbance such as sleep apnea, or restless leg syndrome / periodic limb movements during sleep (RLS / PLMD) (APA, 1994; ASDA, 1990) and
- g) no evidence of parasomnias or sleep phase disorders (e.g., phase delays, phase advance, or deregulation of circadian cycle).

On the basis of this initial screening 95 people were excluded because they failed to meet at least 1 of the selection criteria. When prospective participants did not meet the selection criteria of this study, subjects were invited to meet one of the senior investigators, a psychologist in the team and options for therapy were discussed. Depending on the problem(s) uncovered, these individuals were referred elsewhere for further assessments and / or for treatment. Individuals suspected of having another sleep disorder were referred to a sleep laboratory.

An additional 91 declined to participate in the investigation after they were provided with more details concerning the purpose and requirements of the project. The majority of these individuals did not specify the reasons for declining. Of those who did, most cited time constraints. Twenty-two additional individuals could not be reached at the beginning of the study and 6 were excluded during testing because they were unable to complete the battery of questionnaires. Thus of the 403 individuals who responded to the subject recruitment procedure, 189 individuals participated in the initial study of sleep and aging. Of the 189 individuals who participated in the larger study, 6 additional individuals were excluded from the present analyses because they did not complete Nicassio et al.'s (1985) Pre-Sleep Arousal Scale and, hence, could not be categorized as highly or minimally cognitively aroused during nocturnal awake times.

Grouping participants into 4 sleep status groups

Poor Sleepers were those who met the ASDA (1990) criteria for the diagnosis of a DIMS (Difficulty Initiating or Maintaining Sleep) (i.e., 30 minutes of undesired awake time at least 3 times per week, problem duration at last 6 months). Good Sleepers were individuals who failed to meet the criteria for diagnosis of psychophysiological insomnia.

A cut off point determined by median split was used to classify participants as "High" or "Low" in terms of nocturnal cognitive arousal. Low Arousal corresponded to a score lower than 13 on Cognitive Arousal subscale of the Pre-Sleep Arousal Scale and High Arousal corresponded to a score of 13 or more.

Among the 183 individuals, there were 54 Low Arousal Good Sleepers, 23 High Arousal Good Sleepers, 34 Low Arousal Poor Sleepers, and 72 High Arousal Poor Sleepers. The Chi Square test indicates that Poor Sleep and high Cognitive Arousal were significantly related, $\chi^2=25.87$, $p<.001$. To examine similarities and differences between these four groups on demographic characteristics, a series of 2-way analyses of variance comparisons (2 Sleep Status (GS/PS) * 2 Arousal (High/Low)) were performed. Because none of the comparisons were statistically significant, Table 1 provides demographic information for the whole Phase 1 sample. The sample consisted of 123 females and 60 males whose average age was 69.57 years (range: 55-85). They were predominantly married and living with a spouse. Although socio-economic background varied, most participants were well educated, not currently employed, had an income equal or greater to \$30,000 in the early 1990s, and were reasonably satisfied with their income.

As seen in Table 2, Poor Sleepers had experienced insomnia for a mean of 15.40 (SD=14.37) years, suggesting that they were experiencing a chronic, rather than an acute sleep problem; there was no significant difference between Low Arousal and High Arousal Poor Sleepers on this variable. It can be seen in Table 2 that most Poor Sleepers in this investigation experienced difficulties maintaining sleep versus initiating sleep.

Measures

I. Demographic and Socio-Economic Factors

Telephone Screening Interview. The first individual contact with potential participants consisted of a standardized telephone interview, which included an introduction to the investigation and the research project (Creti, 1996). Selection criteria were evaluated by asking potential participants their age and language, the presence of serious medical or personal problems, whether these affected their sleep, current medical and psychological consultations and medication use.

Background Information Form. This is a modified version of a short questionnaire used in previous studies on aging (e.g., Libman, Fichten, Creti, Weinstein, Amsel, & Brender, 1989). It has 9 items and provides information on socioeconomic, personal, and demographic variables such as age, sex, and highest level of education, marital status, and adequacy of income.

Table 1

Demographic Characteristics

Variables		
Age (years)	Mean	69.57
	SD	6.75
Gender	Male	60
	Female	123
Marital status	Married / common law	51.30%
	Currently single ^a	47.60%
Living arrangements	Alone	41.40%
	With spouse / partner	49.70%
	Other arrangements	8.80%
Education	Elementary	6.10%
	HS / CEGEP / trade	54.70%
	University	39.20%
Employment	Full time / part time	24.00%
	Unemployed / retired	76.00%
Income	<= \$10, 000	3.60%
	\$10, 000 - \$30, 000	40.60%
	> \$30, 000	55.80%
Income adequacy ^b	Mean	5.51
	SD	1.69
Life events	Mean	.49
	SD	.72
Total medications	Means	1.28
	SD	1.31

^a Includes: never married, divorced, widowed, separated

^b This variable has a 9-point scale with the following labels: 1=inadequate, 5=adequate, 9=more than adequate.

Table 2

Sleep Characteristics

Variables		Total
Duration of insomnia	Mean (years)	15.40
	SD	14.41
	Range	.50-60
Type of insomnia problem	Onset	14
	Maintenance	49
	Mixed	42
Sleep medication	Mean (nights / week)	.50
	SD	.89
	Range	0-3

II. Sleep Measures

Structured Sleep History Interview. A modified version of the clinical instrument developed by Lacks (1987) was used. Most questions require a yes or no response, with prompts in case of difficulty. The measure provides information on exclusion criteria such as sleep apnea, parasomnias, sleep phase disorders, medication use, hypnotic and sedative use, and physical and psychological disorders. Operational definitions for specific variables are noted in the measure.

Sleep Questionnaire. This brief questionnaire inquires about typical sleep experiences and is scored on an item-by-item basis. It was designed for a larger study on sleep and aging. The data show that scores based on this measure have acceptable psychometric properties for research use: test-retest correlations indicate reasonable temporal stability (r ranges from .58 to .92 for test retest intervals between 2 weeks and 15 months) and the pattern of correlations among variables shows logical highly significant relationships (Fichten et al., 1995). Data on 156 community dwelling older adults show reasonably high correlations between corresponding scores on this questionnaire and on 7 days of self-monitoring on a daily sleep diary (total sleep time: $r = .83$; total wake time: $r = .72$; sleep efficiency: $r = .77$) (Fichten et al., 1997).

Of interest in this investigation are the following scores derived from the measure:

- Duration of insomnia problem (years)
- Presence or absence of a diagnosable difficulty of initiating or maintaining sleep (DIMS): Sleep Onset Insomnia, Sleep Maintenance Insomnia
- Frequency of sleep medication use (nights/week)
- Sleep Onset Latency (SOL) (hours)
- Wake After Sleep Onset (WASO) (hours)

- Total Sleep Time (TST) (hours)
- Sleep Efficiency (SE)(%) – defined as nocturnal Total Sleep Time / Total Time in Bed
- Frequency of self reported insomnia (1 = very rarely, 10 = very often)
- Distress associated with an insomnia problem (1 = not at all, 10 = very much)
- Frequency of daytime fatigue attributed to sleep problem (days per week)

Stanford Sleepiness Scale (Hoddes, Zarcone, Smythe, Phillips, & Dement, 1973).

This frequently used measure of daytime sleepiness/alertness consists of a 7-point Guttman scaled item where responses range from 1 (feeling active and vital, alert, wide awake) to 7 (lost struggle to remain awake). This scale was modified to allow respondents to select the one option which best describes how sleepy they feel on most days. The scale's authors report that alternate forms reliability yielded an agreement of 88%. Concurrent validity data provided by the scale's authors show that the measure is reasonably highly correlated with vigilance ($r = .68$) and memory ($r = .47$) scores. Also, scores were shown to be sensitive to sleep loss effects.

III. Psychological Adjustment: State Measures

Pre-Sleep Arousal Scale (Nicassio et al., 1985). Sixteen items using a 5-point rating scale assess pre-sleep states. Two scores which assess somatic and cognitive aspects of arousal are derived from this measure: Somatic and Cognitive Arousal (“a tight tense feeling in your muscles,” “thoughts keep running through your head,” respectively). Higher scores on this measure indicate greater arousal. Nicassio et al. (1985) showed good psychometric properties for this scale. Subscales were shown to be internally consistent and stable over time. Reported Cronbach alphas for subscales

ranged from .68 to .88 and test-retest correlations with a 3-week interval ranged from .72 (Cognitive subscale) to .76 (Somatic subscale). Mean scores of people with insomnia were significantly higher than those of normal sleepers on scores for both subscales. Population norms of insomniacs and non-insomniacs are respectively $M=15.12$ ($SD=5.3$) and $M=11.34$ ($SD=3.4$) (White, 1983). Notably, norms for older populations are unavailable (White, 1983). For the purposes of this investigation, the measure was modified to reflect all nocturnal awake time arousals, not only pre-sleep arousal (i.e., arousal during wake times both after sleep onset as well as during sleep onset). A cut-off point determined by median split was used to classify participants as “High” and “Low” Arousal individuals. Participants with scores equal to or greater than 13 were categorized as “High Arousal” individuals and those whose scores on this subscale were below 13 were classified as “Low Arousal” individuals.

Self-Efficacy Scale (Sleep) (Hoddes et al., 1973). This 9-item scale evaluates individuals’ beliefs about their ability to influence their own sleep related motivation and behavior. Higher scores indicate stronger sleep self-efficacy expectations. Stronger sleep efficacy expectations after behavioral treatment for insomnia constitute evidence for the scale’s validity (Cook & Lacks, 1984; Lacks, 1988).

Anxious Self Statement Questionnaire (ASSQ, Kendall & Hollon, 1989). This 32 item self-report measure evaluates cognitions in the form of anxious self-talk. Reliability for the measure is acceptable (split-half reliability was .92; item total correlations ranged from .45 to .79) and the scale’s authors demonstrated that the measure is sensitive to stressful events. In the present investigation, respondents were asked to base their responses on periods of unwanted nocturnal wakefulness. Using this modification, poor

sleepers were found to have significantly higher scores than good sleepers on this measure (Fichten et al., 1995). Higher scores indicate more anxious self-talk.

IV. Psychological Adjustment: Trait Measures

Brief Symptom Inventory (BSI; Derogatis et al., 1976). A brief (53 item) self-report psychological inventory, the BSI has subscales for nine symptom dimensions and three global indices. It is a brief version of the SCL-90 (Derogatis, 1977) – a frequently used instrument with acceptable reliability and validity. Validation data indicate correlations from .92 to .98 between the symptom dimensions and global indices of the BSI and the SCL – 90 (Derogatis, 1977). Normative data for an elderly sample are provided by Hale et al. (1984). In the present investigation, two symptom scores (Depression and Anxiety) and one Global Score (Global Severity Index) are used. Lower scores indicate better adjustment.

Eysenck Personality Inventory (EPI; Eysenck & Eysenck, 1968). This reliable and valid questionnaire is among the most frequently used measures of personality (Digman, 1990). It evaluates the dimensions of neuroticism, extraversion-introversion, and the tendency to respond in a socially desirable manner. For the purposes of this investigation, the Neuroticism and Extraversion-Introversion subscale is of interest. Higher scores indicate greater Neuroticism and Extraversion.

Penn State Worry Questionnaire (Meyer, Miller, Metzger, & Borkovec, 1990). This 16 item self-report measure was designed to measure frequency and intensity of worrying in general. Respondents indicate, using a 5-point scale, how typical of them each statement is. Internal consistency evaluations obtained in the eight validation studies conducted by the authors ranged from coefficient alpha scores of .91 to .95. Test

retest reliability coefficients (after 8 to 10 weeks) ranged from .74 to .92. The data provided by the scale's authors on concurrent and criterion group validity and a recent validation study provide support for use of this measure with older individuals (Beck, Stanley, & Zebb, 1995). Higher scores indicate a more worrying personality style.

Satisfaction with Life (Diener, Emmons, Larson, & Griffen, 1985). This scale evaluates the cognitive, judgmental aspect of subjective well-being. It consists of 5 items, which use a 7-point Likert scale. Higher scores on this measure indicate greater satisfaction with life. Data reported by the authors as well as others (e.g., Pavot, Diener, Colvin, & Sandvik, 1991) indicate good psychometric properties for this measure. It has been shown to be internally consistent (item total correlations vary between .55 and .70), and items loaded on a single factor. Also, scores were found to be highly correlated with scores on other measures of life satisfaction. What makes this measure different from other measures in this investigation is that it assesses the presence of good psychological adjustment, rather than the absence of poor psychological adjustment.

Life Events Scale (Siegal, 1990). This is a 10-item inventory of potentially stressful major life events experienced by older individuals (e.g., retirement, death of a close friend). Subjects indicate which of these they experienced in the last 6 months. Stress responses were shown to vary with certain personal environmental factors (Siegal, 1990). One item regarding the occurrence of an illness in the last year was added to the scale for the purposes of this study and scores were pro-rated for comparability with other investigations. Higher scores indicate more stressful life events

Procedure

Assessments were conducted at the Sir Mortimer B Davis – Jewish General Hospital. All potential participants first received a standardized introduction and asked to provide written consent (Appendix A, p. 120). Participants were then administered the Structured Sleep History Interview to ascertain that selection criteria were indeed met. Those individuals who met the selection criteria were administered a battery of questionnaires including: Background Information Form, the Brief Symptom Inventory, the Penn State Worry Questionnaire, the Eysenck Personality Inventory, the Sleep Questionnaire, the Stanford Sleepiness Scale, the Pre-Sleep Arousal Scale, the Sleep Self-Efficacy measure, and the Anxious Self-Statement Questionnaire. The interview and the complete test battery took approximately 1-1/2 hour to complete; this was carried out in either 1 or 2 sessions. The measures were administered by a research team member who was available to address any questions and concerns.

Following the completion of the test battery, no intervention was conducted with the participants. Subjects were thanked for their contribution to the research project and told that they may be re-contacted at some future time for additional information.

Approximately 2 years later ($M=24.47$ months, range = 17 to 43 months), an attempt was made to contact the participants in the larger investigation for whom the name, address, and telephone number were available (Libman et al., 1998). At this time, respondents were asked to complete a second set of questionnaires, including the Sleep Questionnaire and the Life Events Scale. Questionnaires were administered by telephone interview or were mailed. One hundred sixty three individuals provided information at this second testing time. However, 59 individuals were excluded from the

analyses because they participated in a treatment study conducted by the Sleep and Aging Project (Creti, 1996). An additional 13 individuals did not provided sufficient data to be classified as either a good or poor sleeper. Therefore, the sample for Phase 2 consisted of 91 participants whose mean age was 72.01 years (range: 61-89 years). There were 64 females (70.3%) and 27 males (31.3%). Among the 91 participants at Phase 2, 51 were good sleepers and 40 were poor sleepers. Some participants failed to complete all measures: therefore, sample sizes can vary among comparisons.

RESULTS

Phase 1

The objective of Phase 1 was to compare the 4 groups on psychological adjustment and personality measures, nighttime indices of negative, anxious, and worried self-talk, as well as daytime variables such as fatigue, sleepiness and distress about sleep. To examine similarities and differences between male and female participants on these psychological indices, a multivariate analysis of variance followed by a series of independent t-tests were conducted.

The overall data analysis for Phase 1 followed a 2*2 factorial design. Significant two-way multivariate analyses of variance were followed by a series of 2-way analyses of variance comparisons (2 Sleep Status (GS /PS) * 2 Arousal (High/Low)) as well as post hoc analyses when necessary.

Comparison of Males and Females

Nighttime and daytime functioning. To examine similarities and differences between men and women on sleep and insomnia characteristics, a significant multivariate analysis of variance ($F(7, 174) = 2.45, p < .05$) was followed by a series of 7 t-tests. As seen in Table 3, which presents means and test results for sleep variables not used to classify subjects into the four sleep status groups, males and females did not differ significantly on any of the sleep characteristics examined. On average, participants in this study slept somewhat less than 6 hours, were awake during the night for approximately 1-1/2 hours, and men and women reported similar frequencies of insomnia. Surprisingly, men and women reported comparable levels of fatigue and sleepiness during the day. It is noteworthy that the only variable on which men and women could be distinguished was on the number of naps per week. Women took

Table 3

Sleep and Insomnia Characteristics: Mean Scores and Standard Deviations of Older Men and Women

Variable	Females (N=123)		Males (N=60)		t	p
	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>		
Nighttime functioning						
Total sleep time (hours)	6.00	1.51	5.63	1.43	2.55	.11
Total wake time (hours) ²	1.53	1.80	1.50	1.76	.01	.90
Sleep efficiency (%)	.75	.19	.74	.19	.13	.72
Insomnia frequency ¹ (1 -10)	4.93	3.53	5.05	3.29	.04	.83
Daytime functioning						
Fatigue due to lack of sleep (days/week)	1.94	2.23	1.75	2.24	.29	.59
Stanford sleepiness scale ¹ (1 - 7)	2.10	1.28	2.29	1.19	.92	.34
Naps (per week)	1.71	2.31	2.55	2.46	5.06	.03

Note. Univariate t-tests with 181 degrees of freedom.

¹Higher scores indicate higher insomnia frequency or sleepiness.

²Total Wake Time = sum of Sleep Onset Latency and Wake After Sleep Onset.

significantly fewer naps during the week than men. This finding should however be interpreted with caution as the multivariate F-test was not significant.

Psychological Adjustment. Male and female participants' psychological adjustment was compared using a 1-way multivariate analysis of variance ($F(11, 170)=60, n.s.$) followed by a series of 12 independent t-tests on measures of psychological well being, personality and various indices of nighttime negative, anxious and worried self talk. As is evident in Table 4, males and females were surprisingly similar on all of the variables examined, including for example, Depression, Anxiety or Neuroticism.

In summary, men and women in this sample did not differ on sleep or daytime functioning variables assessed in the present study. Similarly, gender differences did not emerge on any of the psychological adjustment or personality measures examined. Because none of the comparisons between males and females were statistically significant, male and female participants were not considered separately in any of the subsequent Phase 1 analyses. This allowed conservation of sample size, which was necessary because there were relatively few men in certain cells of the design.

Comparison Among The 4 Groups: Sleep Characteristics

Nighttime Functioning. As is evident in Table 5, which presents means and test results for sleep variables not used to classify subjects into the 4 sleep status groups, Good Sleepers experienced significantly better sleep than Poor Sleepers. For example, Good Sleepers slept between 1-1/2 and 2 hours more than Poor Sleepers. A significant 2-way multivariate analysis of variance (MANOVA), $F_{\text{Sleep Status}}(7, 172)=24.96, p<.001$, was followed by a series of 2-way analysis of variance (ANOVA) comparisons on nighttime functioning variables (2 Sleep Status (Good /Poor) * 2 Arousal (High/Low)).

Table 4

Psychological Adjustment: Mean Scores of Older Men and Women

Variable	Females		Males		t	p
	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>		
Daytime functioning						
Poor adjustment: BSI Global Severity Index	.49	.38	.47	.49	.16	.70
Poor adjustment: BSI Depression	.56	.61	.44	.62	1.30	.25
Good adjustment: Satisfaction with life	22.16	7.17	22.64	6.50	.19	.66
Sleep self-efficacy	30.88	8.84	31.78	8.20	.44	.51
Eysenck Personality Inventory: Extraversion	11.04	3.34	9.86	3.47	4.87	.05
Eysenck Personality Inventory: Neuroticism	8.98	4.86	8.31	5.29	.72	.40
Penn State Worry Questionnaire: Worry	45.83	14.40	42.40	13.15	2.42	.12
Poor adjustment: BSI Anxiety	.47	.50	.43	.55	.28	.59
Nighttime functioning						
Anxious Self-Statement Questionnaire	52.38	19.07	47.11	21.60	2.82	.10
Nocturnal Arousal Scale: Cognitive subscale	14.24	5.78	13.77	5.66	.28	.60
Nocturnal Arousal Scale: Somatic subscale	9.83	2.67	9.49	2.18	.75	.39
Sleep related distress: Sleep questionnaire	3.51	2.84	3.14	2.64	.72	.40

Note. Multivariate t-tests with (1, 181) degrees of freedom. With the exception of the "Satisfaction with Life" scale, higher scores on all measures indicate poorer adjustment.

Univariate F tests showed significant main effects for Sleep Status ($p < .001$) on all of the variables evaluated except number of naps taking per week. After a Bonferroni adjustment to the alpha level, all of the comparisons remained significant. Indeed, Good Sleepers reported significantly longer Total Sleep Time; they spent significantly less time awake during the middle of the night and, consequently, had significantly higher Sleep Efficiencies than Poor Sleepers. Good Sleepers also reported significantly less frequent insomnia than Poor Sleepers. Two way multivariate analyses of variance (MANOVA) and subsequent univariate F tests revealed that there were no significant Sleep Status * Arousal interaction effects ($F_{\text{Sleep*Arousal}}(7, 172) = 2.03, n.s.$) or Arousal main effects ($F_{\text{Arousal}}(7, 172) = 1.39, n.s.$). Notably, the only sleep related variable on which individuals with varying levels of cognitive activity could be distinguished was self-reported insomnia frequency ($p < .01$). Older adults experiencing greater level of cognitive arousal during nocturnal awakenings reported more frequent sleep difficulties. This result should however be viewed with caution as the multivariate analysis was not significant.

Daytime Functioning. Individuals with high Nocturnal cognitive arousal, regardless of sleep status, were expected to be more impaired in their daytime functioning than individuals with low Nocturnal cognitive arousal. However, the pattern of findings on Daytime Functioning variables was similar to that on Nighttime Functioning. The results displayed in Table 5 show that Poor Sleepers reported experiencing considerably greater Sleepiness during the day, and more frequent Fatigue attributed to lack of sleep during the day than Good Sleepers even after a Bonferroni adjustment to the alpha level.

Table 5

Sleep and Insomnia Characteristics: Mean Scores and Standard Deviations as a Function of Sleep Status and Levels of Nocturnal Cognitive Arousal

Variable	Good sleepers				Poor sleepers				F	p<
	Low arousal (N=54)		High arousal (N=23)		Low arousal (N=34)		High arousal (N=72)			
	M	SD	M	SD	M	SD	M	SD		
Nighttime functioning										
Total sleep time (hours)	6.86	1.00	6.76	.96	5.30	1.66	5.14	1.30	F(Sleep: Good/Poor)= 60.55 F(Arousal: High/Low)= .39 F(Sleep*Arousal)= .03	.001 n.s. n.s.
Total wake time (hours) ²	.09	.18	.16	.21	2.44	2.01	2.60	1.56	F(Sleep: Good/Poor)=126.27 F(Arousal: High/Low)= .29 F(Sleep*Arousal)= .04	.001 n.s. n.s.
Sleep efficiency (%)	.89	.11	.83	.10	.64	.20	.67	.18	F(Sleep: Good/Poor)= 62.57 F(Arousal: High/Low)= .30 F(Sleep*Arousal)= 2.76	.001 n.s. .10
Insomnia frequency (1 -10) ¹	1.91	1.77	3.04	3.03	6.20	3.18	7.30	2.44	F(Sleep: Good/Poor)=110.60 F(Arousal: High/Low)= 7.54 F(Sleep*Arousal)= .002	.001 .01 n.s.
Daytime functioning										
Fatigue due to lack of sleep (days/week)	1.00	1.85	.96	1.96	2.59	2.81	2.49	1.97	F(Sleep: Good/Poor)=20.69 F(Arousal: High/Low)= .04 F(Sleep*Arousal)= .006	.001 n.s. n.s.
Stanford sleepiness scale ¹ (1 - 7)	1.90	1.18	1.67	1.01	2.23	1.41	2.49	1.21	F(Sleep: Good/Poor)= 8.35 F(Arousal: High/Low)= .007 F(Sleep*Arousal)= 1.48	.005 n.s. n.s.
Naps (per week)	2.00	2.35	1.93	2.13	2.73	2.87	1.62	2.17	F(Sleep: Good/Poor)= .28 F(Arousal: High/Low)= 2.41 F(Sleep*Arousal)= 1.85	n.s. n.s. n.s.

Note. Multivariate F-test with (3, 179) degrees of freedom.

¹Higher scores indicate higher insomnia frequency, fatigue, or sleepiness.

²Total Wake Time = sum of Sleep Onset Latency and Wake After Sleep Onset.

Interestingly, Good and Poor Sleepers did not differ in terms of the number of naps taken each week. Daytime impairments did not vary as a function of cognitive arousal and there were no significant interactions on these variables.

Psychological Adjustment. To evaluate the contribution of sleep parameters and nocturnal cognitive arousal to the complaints of insomnia in older adults, the four groups of individuals were compared on psychological adjustment and personality measures, nighttime indices of negative, anxious, and worried self-talk, as well as distress about sleep. A significant 2-way multivariate analysis of variance (MANOVA) [2 Sleep Status (Good/Poor)* 2 Cognitive Arousal (High/Low)] was followed by 2-way ANOVAs as well as post hoc tests, when necessary. Individuals reporting greater cognitive arousal during periods of sleeplessness were expected to be more psychologically maladjusted than individuals with low nocturnal cognitive arousal even when controlling for sleep quality. Because the two multivariate main effects were statistically significant, $F_{\text{Sleep Status}}(13, 167)=10.71, p<.001$ and $F_{\text{Arousal}}(13, 167)=15.45, p<.001$, and the Sleep by Arousal interaction effect approached significance ($F_{\text{Sleep*Arousal}}(13, 168)=1.60, p<.10$), a series of 2*2 analysis of variance comparisons were performed.

Table 6 displays the mean scores of Good Sleepers and Poor Sleepers with High and Low Cognitive Arousal on state and trait measures of psychological adjustment. With the exception of the "Satisfaction with Life" scale, higher scores on all measures indicate poorer adjustment. Analyses presented in Table 6 revealed statistically significant main effects for Nocturnal Cognitive Arousal on virtually all of the

Table 6

Psychological Adjustment: Mean Scores and Standard Deviations as a Function of Sleep Status and Level of Nocturnal Cognitive Arousal

Variable	Good Sleepers				Poor Sleepers				F	p<
	Low Arousal (N=54)		High Arousal (N=23)		Low Arousal (N=34)		High Arousal (N=72)			
	M	SD	M	SD	M	SD	M	SD		
Daytime Measures										
Poor Adjustment BSI Global Severity Index	35	34	50	40	31	22	66	48	F (Sleep Good/Poor)= 93 F (Arousal High/Low)=14.88 F (Sleep*Arousal)=2.42	n.s. 0.001 n.s.
Poor Adjustment BSI Depression	39 ^a	0.49	43 ^b	0.5	29 ^a	0.39	75 ^{a,b,c}	0.74	F (Sleep Good/Poor)=1.27 F (Arousal High/Low)=6.73 F (Sleep*Arousal)=4.78	n.s. 0.01 0.05
Good Adjustment Satisfaction with Life	23.19	6.7	22.16	6.97	24.79	6.6	20.54	6.93	F (Sleep Good/Poor)=.00 F (Arousal High/Low)= 5.71 F (Sleep*Arousal)=2.13	n.s. 0.01 n.s.
Eysenck Personality Inventory Extraversion	11.01	3.83	10.48	3.44	10.91	3.3	10.31	3.16	F (Sleep Good/Poor)=.06 F (Arousal High/Low)=1.03 F (Sleep*Arousal)=.004	n.s. n.s. n.s.
Sleep Self Efficacy	39.26	4.63	34.43	6.73	31.73	7.08	23.8	5.37	F (Sleep Good/Poor)=95.99 F (Arousal High/Low)=47.38 F (Sleep*Arousal)=2.81	0.001 0.001 n.s.
Eysenck Personality Inventory Neuroticism	5.45	4.12	8.08	3.8	8.45	4.43	11.62	4.6	F (Sleep Good/Poor)=21.49 F (Arousal High/Low)= 16.99 F (Sleep*Arousal)= 15	0.001 0.001 n.s.
Penn State Worry Questionnaire Worry	35.41	10.54	44.13	10.71	43.96	12.76	52.2	13.77	F (Sleep Good/Poor)=17.25 F (Arousal High/Low)=17.95 F (Sleep*Arousal)=.01	0.001 0.001 n.s.
Poor Adjustment BSI Anxiety	29 ^b	0.44	0.46	0.47	27 ^a	0.41	68 ^{a,b}	0.55	F (Sleep Good/Poor)=1.51 F (Arousal High/Low)=13.59 F (Sleep*Arousal)=2.27	n.s. 0.001 n.s.
Nighttime Measures										
Anxious Self-Statement Questionnaire	43.32	14.57	54.11	16.06	47.13	19.83	53.65	22.25	F (Sleep Good/Poor)=1.05 F (Arousal High/Low)=10.59 F (Sleep*Arousal)=.04	n.s. 0.001 n.s.
Pre-Sleep Arousal Scale Cognitive Subscale	9.24	1.44	16.74	4.06	9.97	1.42	18.82	5.06	F (Sleep Good/Poor)=5.70 F (Arousal High/Low)=192.82 F (Sleep*Arousal)=1.32	0.05 0.001 n.s.
Pre-Sleep Arousal Scale Somatic Subscale	8.34	0.69	10.22	3	9.29	1.7	10.78	2.99	F (Sleep Good/Poor)=4.08 F (Arousal High/Low)=20.13 F (Sleep*Arousal)=.27	0.05 0.001 n.s.
Sleep Related Distress Sleep Questionnaire	1.33 ^{a,d}	1.1	1.49 ^b	1.27	3.26 ^{a,d}	2.73	5.48 ^{a,b,c}	2.48	F (Sleep Good/Poor)=65.10 F (Arousal High/Low)=16.04 F (Sleep*Arousal)=5.98	0.001 0.001 0.01

Notes. Multivariate F -tests with (3, 179) degrees of freedom. n.s. = not significant. Means in a row sharing subscripts are significantly different at $p < .05$. With the exception of the "Satisfaction with Life" scale, higher scores on all measures indicate poorer adjustment.

psychological and personality measures assessed (11 of the 13 measures). After a Bonferroni adjustment to the alpha level, all of the comparisons remained significant. In general, the results indicate that individuals experiencing high levels of cognitive arousal during nocturnal awakenings were more poorly adjusted than individuals with low cognitive arousal. Individuals with high nocturnal cognitive arousal, regardless of sleep status, entertained significantly more worried, anxious, and negative thoughts, as well as higher levels of somatic arousal during the night than individuals with lower levels of cognitive arousal. They also displayed a more neurotic personality style on the Eysenck Personality Inventory, reported significantly lower satisfaction with their life, and greater distress about their sleep impairments than individuals with low levels of cognitive arousal during periods of sleeplessness.

The results displayed in Table 6 also show significant main effects for Sleep Status on 6 of the 13 measures examined (Distress, Sleep Self-Efficacy, Neuroticism, Worry, and Nocturnal Somatic and Cognitive Arousal). Poor Sleepers displayed significantly more Neuroticism, obtained higher scores on the Penn State Worry Questionnaire, experienced greater sleep related Distress, had higher Cognitive and Somatic arousal and lower Sleep Self-Efficacy than Good Sleepers. Following a Bonferroni adjustment to the alpha level, comparisons of Good and Poor Sleepers on the measures of Cognitive and Somatic arousal were no longer significant.

Significant Sleep Status * Arousal interactions were found on 2 of the variables assessed: Depression, and sleep related Distress. The interactions approached significance on 1 additional variable: Sleep Self-Efficacy. Tukey HSD tests, detailed in Table 6, show that, in general, individuals who have both Poor Sleep and high levels of

Nocturnal Cognitive Arousal tended to fare worse than all others and that Poor Sleepers with low Cognitive Arousal during nocturnal awakenings did not differ significantly from either group of Good Sleepers on measures of psychological adjustment and personality. Notably, after a Bonferroni adjustment to the alpha level, none of the interactions remained significant.

Overall, the results of Phase 1 indicate that: (1) men and women are similar in terms of sleep and insomnia characteristics and psychological adjustment. Indeed, the sole variable distinguishing these subgroups was the number of naps taken during the week. The results also suggest that (2) there is a disproportionately large number of people with high cognitive arousal in the poor sleepers group, (3) Good Sleepers and Poor Sleepers differ on indices of nocturnal and daytime functioning, and (4) psychological adjustment is significantly related to cognitive arousal during nighttime periods of sleeplessness. In addition, significant Sleep by Arousal interactions suggest that (5) while high cognitive arousal does not interact with sleep status to determine nighttime or daytime sleep related functioning, in poor sleepers cognitive arousal is associated with the worst psychological outcomes. Conversely, the interactions suggest that Poor Sleepers displaying low levels of nocturnal cognitive arousal are not distinguishable from Good Sleepers on most indices of psychological adjustment.

Phase 2

The goal of the second phase of this investigation was to determine what happens to sleep status in older adults over time and to identify predictors of vulnerability and resilience for developing significant sleep-related complaints over a two-year period. With age, total nocturnal sleep time has been shown to diminish. Moreover, cross-

sectional studies have consistently characterized people with insomnia complaints as being more depressed, anxious, and neurotic than individuals without insomnia complaints. Finally, recent cognitive models of insomnia stipulate that nocturnal cognitive arousal is implicated in the development and maintenance of poor sleep and insomnia. Therefore, four classes of predictor variables were of interest in the present investigation: sleep parameters, anxiety/arousal, personality and affect.

In the present study, unlike in Libman et al. (1998), improvement and deterioration were assessed not only in terms of change in sleep status (good or poor sleeper) but also in terms of the frequency of sleep difficulties, daytime fatigue, and distress about sleep at the 2 year follow-up.

Predicted variables were components of the complaint of insomnia: sleep difficulty, daytime components and distress. To evaluate the relative contributions of the 4 predictor variables [nocturnal sleep parameter (Total Sleep Time), intrusive thoughts (Cognitive Arousal), a personality dimension (Neuroticism) and a psychological maladjustment variable (Depression)] to each of the three components of the insomnia complaint [sleeping difficulties (self reported Insomnia Frequency), daytime impairment (Daytime Fatigue), and Distress about the insomnia problem], a series of linear regression analyses were conducted. Regression analyses are a set of statistical techniques that allow assessment of the relationship between one dependent variable and several independent variables. These techniques can be applied to data sets in which the independent variables are correlated with one another and with the dependent variable to varying degrees (Tabachnick & Fidell, 1996). Indeed, the result of a regression analysis

is an equation that represents the linear combination of the independent variables that best predicts a particular dependent variable.

Analyses were performed separately for Males and Females to determine whether the contributions of the predictor variables to components of the complaint of insomnia expressed two years later differed as a function of sex.

Change in Sleep Status with Time

At the time of the first evaluation (Time 1), 56% of participants were Good Sleepers ($n=51$) and 45% were Poor Sleepers ($n=40$). As seen in Table 7, there were relatively few changes in sleep status over time and 78% of individuals remained unchanged. Thus, the majority of individuals who experienced Good and/or Poor Sleep at Time 1 maintained the same sleep status two years later. Of those who did change, the majority of individuals improved. Whereas 30% (12 of 40) of Poor Sleepers became Good Sleepers at Time 2, 16% (8 of 51) of Good Sleepers deteriorated.

To determine which participants improved, deteriorated or remained unchanged at the second phase of the study, discriminant function analyses were performed. Four Time 1 predictors were used in these analyses: Total Sleep Time, Nocturnal Cognitive Arousal, Neuroticism and Depression. Because individuals who were Good Sleepers at Time 1 could not improve, and Poor Sleepers could not Deteriorate, two sets of Discriminant Analyses were conducted: prediction of Unchanged versus Improved status for Poor Sleepers and prediction of Unchanged versus Deteriorated status for Good Sleepers.

Table 7

Sleep Status at Time 1 and Time 2

	<u>N</u>	Unchanged		Changed		
		<u>N</u>	%	<u>N</u>	%	
Whole sample						
Participants	91	71	78%	20	22%	
Good Sleepers						
Low arousal	32	26	82%	6	18%	
High arousal	19	17	89%	2	11%	
Poor Sleepers						
Low arousal	16	10	62.50%	6	37.50%	
High arousal	24	18	75%	6	25%	

Improvement of Sleep Status

As indicated in Table 7, of the 40 Poor Sleepers at Time 1, 12 Improved and 28 remained Unchanged. A direct discriminant function analysis was performed using four nighttime and psychological functioning variables as predictors of membership in the two groups. Predictors, as noted above, were Total Sleep Time, Nocturnal Cognitive Arousal, Depression, and Neuroticism. The predicted variable was Improved vs. Unchanged Sleep Status two years later. Table 8 displays the means and standard deviations of predictor variables as a function of change in sleep status at Time 2. The results show that Poor Sleepers who became Good Sleepers at time 2 slept significantly more at Time 1 than those who remained Poor Sleepers two years later.

One discriminant function was calculated with a Chi-Square $\chi^2(4)=12.61, p< .05$. The table in Appendix C 1 displays the loading matrix of correlations between predictors and the discriminant function and indicates that the variable most highly associated with the discriminant function is Total Sleep Time suggesting that the amount of sleep at Time 1 best distinguishes those Poor Sleepers who Changed sleep status versus those who remained Unchanged. Loadings less than .50 are not interpreted.

As seen in Table 9, out of 40 Poor Sleepers, 32 (80%) were correctly classified. The 80% classification rate was achieved by classifying a disproportionate number of cases as Poor Sleepers who remained Unchanged. Although 67.50% (28/40) of the Poor Sleepers had actually remained Unchanged, the classification scheme, computed by taking into consideration unequal group sizes as prior probabilities, correctly classified 80% of Poor Sleepers. This means that Poor Sleepers who remained Unchanged in terms of sleep status were more likely to be correctly classified (92.90%) than Poor Sleepers .

Table 8

Poor Sleepers: Means and Standard Deviations of Predictor Variables as a Function of Change in Sleep Status at Time 2

Predictor variables	Unchanged		Improved	
	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>
Total sleep time	4.74 ^a	1.67	6.50 ^a	1.65
Neuroticism	11.27	5.89	10.75	3.25
Cognitive arousal	14.77	5.10	14.17	6.38
Depression	.70	.71	.58	.57

Note. ^a Means differ significantly at $p < .01$.

Table 9

Poor Sleepers: Prediction of Improved or Unchanged Sleep Status

Actual group membership	<u>N</u>	Predicted group membership			
		Improved		Unchanged	
		<u>N</u>	%	<u>N</u>	%
Improved	12	6	50.00	6	50.00
Unchanged	28	2	7.90	26	92.10

Note. Overall percentage of cases correctly classified = 80%.

who Improved (50%). This latter group was correctly classified only at chance level.

Deterioration of Sleep Status in Good Sleepers

A direct discriminant function analysis was performed using the same 4 predictor variables (Total Sleep Time, Neuroticism, Cognitive Arousal, and Depression at Time 1) to examine change in sleep status in Good Sleepers. Groups were Deteriorated or Unchanged Sleep Status. One discriminant function was calculated with a $\chi^2(4)=2.10$, n.s.

As seen in Table 10, which displays the means and standard deviations of the predictor variables of Time 1 Good Sleepers as a function of Sleep Status 2 years later, individuals whose sleep status Deteriorated with time did not differ significantly from those who remained Unchanged on any of the Time 1 variables assessed. It is possible that the limited number of Good Sleepers who changed Sleep Status at follow-up ($n=8$) may have precluded identifying actual differences between Good Sleepers who Deteriorated and those whose remained Unchanged.

Predictors Of The Insomnia Complaint

To better understand the factors which contribute to the 3 components of the insomnia complaint (Insomnia Frequency, Daytime Fatigue, and Distress about the sleep problem) a series of three multiple regression analyses were performed. The objective was to evaluate the relative contribution of a nocturnal sleep parameter (Total Sleep Time), a personality variable (Neuroticism), intrusive thoughts (Cognitive Arousal), and an affective variable (Depression) to each of these aspects of the insomnia complaint two

Table 10

Good Sleepers: Means and Standard Deviations of Predictor Variables as a Function of Sleep Status at Phase 2

Predictor variables	Unchanged (N=43)		Deteriorated (N=8)	
	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>
Total sleep time	6.99	.96	6.56	1.37
Neuroticism	6.69	4.50	5.00	2.72
Cognitive arousal	11.10	3.87	11.00	5.78
Depression	.36	.42	.23	.25

years later. Analyses were conducted separately for women and men as well as for Good and Poor Sleepers.

Women

1. Prediction of Insomnia Frequency

The table in Appendix C 2 displays the means, standard deviations and intercorrelations for self-reported Insomnia Frequency at Time 2 and the predictor variables (i.e., selected sleep, personality and psychological adjustment variables). Appendix C 3 presents the unstandardized regression coefficients (B), the standardized error of the regression coefficients (SEB), and the standardized regression coefficients (β), R² and Adjusted R². F for the regression was significantly different from zero, F (4, 62)=9.78, $p < .001$.

Only one of the predictor variables examined contributed significantly to the prediction of Insomnia Frequency two years later: Total Sleep Time (sr²= .27, $p < .001$). In combination, the 4 variables contributed 10 % in shared variability. Altogether, 39% of the variability in Insomnia Frequency at Time 2 was predicted by knowing scores on these 4 predictor variables.

Although, as can be seen in Appendix C 2, the relationship between Insomnia Frequency and Neuroticism was $r = .27$ ($p < .05$) and the relationship between Insomnia Frequency at Time 2 and Cognitive Arousal was $r = .25$ ($p < .05$), neither variable contributed significantly to the regression. The relationships between Insomnia Frequency and these two variables seems to have been mediated by the relationship between Total Sleep Time and Insomnia Frequency two years later.

2. Prediction of Sleep Related Distress

The table Appendix C 4 displays the means, standard deviations and intercorrelations between the predictor variables and sleep related Distress two years later among women. Appendix C 5 presents the unstandardized regression coefficients (B), the standardized error of the regression coefficients (SEB), the standardized regression coefficients (β), R^2 and Adjusted R^2 . R for the regression was significantly different from zero, $F(4, 64)=5.15$, $p<.001$. Two of the predictor variables examined contributed significantly to the prediction of sleep related Distress at Time 2, Total Sleep Time (sr^2 = .10, $p<.001$) and Neuroticism (sr^2 =.12, $p<.001$). Altogether, 24% of the variability in sleep related Distress at Time 2 was predicted by knowing scores on these 4 predictor variables.

3. Prediction of Daytime Fatigue

The table in Appendix C 6 displays the means, standard deviations and intercorrelations between the predictor variables and daytime fatigue two years later among women. Appendix C 7 presents the unstandardized regression coefficients (B), the standardized error of the regression coefficients (SEB), the standardized regression coefficients (β), R^2 and Adjusted R^2 . Among women, R for the regression was significantly different from zero, $F(4, 58)=6.05$, $p<.001$.

Two of the predictor variables examined contributed significantly to the prediction of daytime fatigue at Time 2: Total Sleep Time (sr^2 = .07, $p<.001$) and Depression (sr^2 =.15, $p<.001$). In combination, the 4 variables contributed another 7 % in shared variability. Altogether, 29.5% of the variability in Daytime Fatigue at Time 2 was predicted by knowing scores on these 4 predictor variables.

Although the relationships between daytime fatigue at Time 2 and Neuroticism was $r = .32$ ($p < .001$) and between Daytime Fatigue and Cognitive Arousal was $r = .25$ ($p < .05$), neither variable contributed significantly to the regression. Apparently, the relationships between Daytime Fatigue and Cognitive Arousal as well as with Neuroticism are mediated by the relationships between Total Sleep Time, Depression and Daytime Fatigue.

Men

1. Prediction of Insomnia Frequency

The table in Appendix C 8 displays the means, standard deviations and intercorrelations between the predictor variables and reported Insomnia Frequency two years later among the male sub-sample. Appendix C 9 presents the unstandardized regression coefficients (B), the standardized error of the regression coefficients (SEB), the standardized regression coefficients (β), R² and Adjusted R². R for the regression was significantly different from zero, $F(4, 25) = 4.57$, $p < .01$.

Among the variables examined only one of the predictors contributed significantly to the prediction of Insomnia Frequency at Time 2: Total Sleep Time ($sr^2 = .23$, $p < .001$). In combination, the 4 variables contributed another 15% in shared variability. Altogether, 42% of the variability in insomnia frequency at Time 2 was predicted by knowing scores on these 4 predictor variables.

Although the relationships between Insomnia Frequency at Time 2 and Neuroticism was $r = .41$ ($p < .01$), it did not contribute significantly to the regression. The relationship between Insomnia Frequency and Neuroticism seems to be redundant to the relationship between Total Sleep Time and Insomnia frequency among men.

2. Prediction of Sleep Related Distress

The table in Appendix C 10 displays the means, standard deviations and intercorrelations between the selected sleep, personality and psychological adjustment variables and sleep related Distress at Time 2 among the men in this sample. Appendix C 11 presents the unstandardized regression coefficients (B), the standardized error of the regression coefficients (SEB), the standardized regression coefficients (β), R^2 and Adjusted R^2 . R for the regression was not significantly different from zero, $F(4, 24)=.35$, n.s., indicating that variability in sleep related distress was not reliably predicted by knowing the scores on the 4 selected predictor variables among men .

3. Prediction of Daytime Fatigue

The table in Appendix C 12 displays the means, standard deviations and intercorrelations between the selected sleep, personality and psychological adjustment variables and daytime fatigue at Time 2 among the men in this sample. Appendix C 13 presents the unstandardized regression coefficients (B), the standardized error of the regression coefficients (SEB), the standardized regression coefficients (β), R^2 and Adjusted R^2 . R for the regression was not significantly different from zero, $F(4, 24)=.1.40$, n.s., indicating that variability in Daytime Fatigue at Time 2 was not reliably predicted by knowing the scores on the 4 selected predictor variables among men .

Poor Sleepers

1. Prediction of Insomnia Frequency

Appendix C 14 displays the means, standard deviations and intercorrelations for self-reported Insomnia Frequency at Time 2 and the predictor variables among Poor Sleepers. Appendix C 15 presents the unstandardized regression coefficients (B), the

standardized error of the regression coefficients (SEB), the standardized regression coefficients (β), R^2 and Adjusted R^2 . R for the regression was significantly different from zero, $F(4, 39)=4.01$, $p<.01$.

One of the predictors examined contributed significantly to the prediction of Insomnia Frequency two years later, Total Sleep Time ($sr^2=.24$, $p<.001$), while a second variable, Neuroticism, approached significance ($p<.10$). Altogether, 29% of the variability in Insomnia Frequency at Time 2 was predicted by knowing scores on these 4 predictor variables.

2. Prediction of Sleep Related Distress

Appendix C 16 displays the means, standard deviations and intercorrelations between the predictor variables and sleep related Distress two years later among Poor Sleepers. Appendix C 17 presents the unstandardized regression coefficients (B), the standardized error of the regression coefficients (SEB), the standardized regression coefficients (β), R^2 and Adjusted R^2 . R for the regression approached significance, $F(4, 40)=2.07$, $p<.10$.

Of the variables examined, only one contributed significantly to the prediction of sleep related Distress at Time 2, Neuroticism ($sr^2=.14$, $p<.01$). Altogether, 17% of the variability in sleep related Distress at Time 2 was predicted by knowing scores on these 4 predictor variables.

3. Prediction of Daytime Fatigue

Means, standard deviations and intercorrelations between the predictor variables and Daytime Fatigue two years later among Poor Sleepers are presented in the table of Appendix C 18. Appendix C 19 presents the unstandardized regression coefficients (B),

the standardized error of the regression coefficients (SEB), the standardized regression coefficients (β), R^2 and Adjusted R^2 . Among Poor Sleepers, R for the regression was not significantly different from zero, $F(4, 35)=1.31$, n.s., indicating that variability in Daytime Fatigue in this sub-sample was not reliably predicted by knowing the scores on the 4 selected predictor variables.

Good Sleepers

1. Prediction of Insomnia Frequency

Appendix C 20 displays the means, standard deviations and intercorrelations between the predictor variables and self-reported Insomnia Frequency two years later among Good Sleepers. Appendix C 21 presents the unstandardized regression coefficients (B), the standardized error of the regression coefficients (SEB), the standardized regression coefficients (β), R^2 and Adjusted R^2 . R for the regression did not significantly differ from zero, $F(4, 48)=.58$, n.s, indicating that among Good Sleepers, it was not possible to predict Insomnia Frequency at Time 2 based on scores at Time 1 on the variables examined.

2. Prediction of Sleep Related Distress

Means, standard deviations and intercorrelations between the predictor variables and sleep related Distress at Time 2 among the Good Sleepers are displayed in Appendix C 22. Appendix C 23 presents the unstandardized regression coefficients (B), the standardized error of the regression coefficients (SEB), the standardized regression coefficients (β), R^2 and Adjusted R^2 . R for the regression was not significantly different from zero, $F(4, 48)=.87$, n.s., indicating that variability in sleep related distress was not

reliably predicted by knowing the scores on the 4 selected predictor variables among Good Sleepers .

3. Prediction of Daytime Fatigue

Appendix C 24 displays the means, standard deviations and intercorrelations between the 4 predictor variables and Daytime Fatigue at Time 2 among Good Sleepers. Appendix C 25 presents the unstandardized regression coefficients (B), the standardized error of the regression coefficients (SEB), the standardized regression coefficients (β), R² and Adjusted R². R for the regression was significantly different from zero, F (4, 47) = 3.18, p<. 01.

Among the predictor variables examined only one contributed significantly to the prediction of Daytime Fatigue at Time 2, Depression (sr²= . 18, p<. 001), while Total Sleep Time at Time 1 tended to be significantly associated with Daytime Fatigue two years later (sr²= . 05, p<.10). Altogether, 24% of the variability in Daytime Fatigue in Good Sleepers at Time 2 was predicted by knowing scores on these 4 predictor variables.

Summary, Phase 1 and Phase 2

- Good sleepers and poor sleepers differed on nocturnal, daytime and psychological variables
- Poor sleepers were likely to have high nocturnal cognitive arousal
- Psychological adjustment was related to cognitive arousal
- Highly aroused poor sleepers fared especially poorly on psychological adjustment indices
- Contrary to other findings, males and females did not differ on nighttime or daytime functioning or on psychological adjustment and personality variables
- Over a 2-year period, 78% of participants maintained the same sleep status category
- Of those who changed, most individuals improved their sleep status

- More total sleep time at time 1 predicted improved sleep status among poor sleepers two years later; none of the variables examined significantly predicted deterioration in sleep status among good sleepers
- Predictors of components of the insomnia complaint 2 years later differed between males and females
- For men, only the sleep parameter total sleep time at time 1 was related to insomnia frequency 2 years later
- For women, total sleep time at time 1 was also related to insomnia frequency two years later
- In addition, among women, total sleep time together with some psychological aspects predicted affective insomnia components 2 years later

DISCUSSION

The present study was conducted in two phases. The objectives of Phase 1 were to compare the characteristics of older men and women who report sleeping well and poorly and to evaluate the role of nocturnal cognitive arousal and its correlates in the complaint of poor sleep among older adults. To address these objectives, four groups of older adults differing in sleep quality and nocturnal levels of wake time cognitive activity were evaluated cross-sectionally. The goal of Phase 2 of this investigation was to assess changes in sleep quality in older adults over a 2-year period and to identify factors of vulnerability and resilience to the development and maintenance of insomnia complaints. Predictors of three aspects of the insomnia experience (frequency of sleep difficulties, problematic daytime functioning and sleep related distress) were investigated separately in order to address the multidimensional nature of insomnia.

Limitations of the Study

Before discussing the results of the present investigation, some of its limitations need to be considered.

While the number of participants in this investigation was reasonably large (e.g., Phase 1, 183 participants), the sample consisted of individuals who lived in the community and were generally healthy, well adjusted, educated and financially comfortable. Therefore, findings may not be generalizable to other less advantaged populations. The present sample was also restricted in that participants were generally not taking hypnotic medication and were screened for the presence of other sleep disorders. The results may, thus, not be applicable to other older adults who are at risk for insomnia due to the presence of other sleep disorders or to taking sleep medication.

Future research should study the generalizability of the findings to a more heterogeneous group of older adults.

It is also possible that the poor sleepers in this study, who were volunteers, presented less severe insomnia problems than patients seeking insomnia treatment in clinical or medical settings. While this, too, could affect the generalizability of the results to other older populations, it appears unlikely. Participants in this study reported substantial periods of nocturnal wakefulness (mean Total Wake Time was 2 1/2 hours) and had been experiencing insomnia for an average of 15 years. In addition, the literature suggests that poor sleepers who volunteer do not differ on sleep characteristics from patients seeking treatment for their insomnia (e.g., Stepanski, Koshorek, Zorick, Glinn, Roehrs, & Roth, 1989).

Another limitation of this investigation is the absence of polysomnography (PSG) or physiological data to verify participants' self-reported sleep characteristics. Indeed, insomnia in the present investigation was defined solely on the basis of subjective information rather than objective information. The absence of PSG has several implications.

First, polysomnographic evaluation might have portrayed more accurately the extent and nature of the presenting sleep disturbances. Second, it would have served as a more accurate screening to rule out insomnia due to sleep pathologies such as sleep apnea or periodic limb movements. Additionally, PSG data might have provided pertinent information about older individuals in this sample who slept well. For example, PSG could have elucidated whether this segment of individuals escaped the usual physiological changes in sleep architecture which characterize aging and could

have provided supplementary information about the physiological underpinnings of cognitive arousal.

However, objective evaluation by PSG recording is not necessarily the best criterion of sleep quality. It is, rather, another dimension of the sleep experience. Indeed, it is the subjective experience of sleep disturbance that causes people to feel distressed and seek treatment. Although PSG may be essential in diagnosing disorders such as sleep apnea, it seems to have little to add to self-reports in the diagnosis of insomnia (Reite, Buysse, Reynolds, & Wallace, 1995; Standards of Practice Committee of the American Sleep Disorders Association, 1995; Vgontzas, Kales, Bixler, Manfredi, & Vela-Bueno, 1995).

The Present Findings

Gender Differences in Sleep Characteristics, Personality and Psychological Adjustment

Phase I.

Overall the findings in the present study indicate that males and females are similar on the myriad sleep parameters and daytime variables, including time spent awake during the night, sleep related distress, and daytime fatigue attributed to poor sleep. These findings differ from those reported by others (e.g., Morgan, in press; Ohayon, 1997) which suggest that women are more likely to complain of sleep impairments in old age than men.

Cultural influences are often offered as possible explanations for women's willingness to discuss their symptoms and problems more readily than men. In the present sample, cultural influences may have operated in reverse. Since, participants in the present study were generally educated and of relatively high socio-economic status,

the men in this sample may have been more open to discussing their sleep problems than participants in other investigations.

Furthermore, contrary to expectations and to research findings reported in the literature, men and women in this investigation were not distinguishable on indices of personality and psychological adjustment, including, for example, Neuroticism. Participants in the present investigation were generally healthy, educated and financially comfortable. In addition, they were screened for psychopathology and consequently tended to be relatively well adjusted. This too may help explain the lack of differences found between men and women on sleep characteristics. The relationship between psychological adjustment, personality type, reported sleep impairments and gender merits further investigation.

Phase 2.

When different aspects of the insomnia complaint were examined longitudinally, the results of the present investigation suggested that predictors of insomnia may be different for men and women. While the three aspects of the insomnia experience (frequency of poor sleep, distress, daytime fatigue) could be reliably predicted on the basis of knowing pre-test scores on indices of nocturnal sleep, intrusive thoughts, personality and affect among women, only insomnia frequency was reliably predicted among men. Furthermore, the findings indicated that in women, both psychological / personality characteristics and sleep parameters are differentially associated with the selected three components of insomnia. In men, only the baseline sleep parameter (total sleep time) was related to self-reports of insomnia 2 years later.

Together, the results of Phase 1 and Phase 2 point to the possibility that there is a difference in the way sleep and psychological adjustment interact in men and women. Indeed, the findings suggest that the insomnia complaint among women may be more multifaceted and complex than among men. For example, men may present to a clinical setting solely with a complaint of sleep impairment whereas women may also report distress and daytime sequelae. Moreover, the present results suggest that the insomnia experience of women, contrary to that of men, may be influenced by psychological and personality characteristics in addition to sleep difficulties. Therapeutic implications may be that women require a more multi-dimensional approach to treatment which includes stress management to reduce sleep related distress and treatment of sub-clinical levels of depression to address daytime fatigue in addition to classical treatments for insomnia.

Cognitive Arousal and Sleep Characteristics

Nocturnal Sleep Characteristics.

Poor sleepers in the present sample experienced considerably worse sleep than good sleepers, as revealed by quantitative data such as total nocturnal sleep time, total wake time and sleep efficiency. There were, as expected, more high arousal individuals among poor sleepers, however, high arousal per se was not related to quantitative sleep measures. Therefore, hypothesis 1 was not supported by the current data. This was surprising since cognitive activity prior to sleep has been widely implicated in sleep difficulties. In a previous study, for example, Gross and Borkovec (1982) reported that an experimental manipulation designed to induce cognitive planning, telling subjects that

they would have to give a speech on specific topic before the end of the session, significantly increased sleep onset latency according to EEG criteria.

Interestingly, the only sleep related variable on which individuals with varying levels of cognitive activity could be distinguished was self-reported insomnia frequency. Older adults experiencing greater level of cognitive arousal during nocturnal awakenings reported more frequent sleep difficulties, suggesting that levels of cognitive arousal may be associated with the perception or the complaint of poorer sleep in both good and poor sleepers. This result should however be viewed with caution as the multivariate analysis was non-significant. Nevertheless, it suggests tentative support for the role of cognitive arousal in the complaint of insomnia. Other studies comparing older good and poor sleepers on quantitative as well as subjective measures of sleep quality are necessary to verify the association between nocturnal cognitive arousal and the complaint of poor sleep.

Daytime Functioning.

Consistent with the results of others which find that people who complain of difficulty falling asleep or staying asleep during the night often report feeling unrefreshed, sleepy and tired (Alapin et al., 1998; Hauri & Fisher, 1986; Roth & Ancoli-Israel, 1999; Zammit, 1988), poor sleepers in the present investigation reported greater daytime fatigue and sleepiness during the day than their well sleeping counterparts. These consistent reports of daytime consequences following poor nocturnal sleep are in sharp contrast to the results from studies which have compared people complaining of insomnia to normal sleepers on behavioral measures of daytime performance and functioning (e.g., Alapin, 1996; Alapin et al., 1998; Bonnet & Arand, 1995; Lichstein et

al, 1994; Mendelson et al., 1984; Seidel et al., 1984). Correlations between self-reports of feeling sleepy or fatigued during the day and behavioral measures of the same constructs are generally small and non-significant. This lack of consistency between subjective and objective measures of daytime consequences of insomnia, as well as the role of sleep deprivation in the secondary symptoms such as fatigue and sleepiness have been questioned. To quote Bonnet and Arand (1995) for example, “secondary symptoms reported by patients with primary insomnia are probably not related to their poor sleep per se”.

Previous studies have indicated that self-reported daytime impairments in people complaining of insomnia are more closely associated with indices of psychological adjustment than with nocturnal sleep parameters (Alapin, 1996; Chambers & Keller, 1993; Fichten et al., 1995; Shochat, Umphress, Israel, & Ancoli-Israel, 1999); it was, therefore, expected that individuals displaying more negative cognitive activity during the night would also report greater daytime difficulties than individuals with lower levels of nocturnal cognitive arousal (Hypothesis 2). Contrary to others' findings (e.g., Chambers & Kim, 1993) that among both insomniacs and non-insomniacs, there was a strong negative relationship between intrusive thoughts at bedtime and restedness during the day but no relationship with either variable and nocturnal sleep variables; in the present investigation, daytime functioning was not associated with levels of cognitive arousal levels during nocturnal awakening. Indeed, individuals with high and low levels of nocturnal cognitive arousal were not different on the index of daytime fatigue. The results of the present investigation showed that daytime impairments were solely related

to sleep parameters and suggest that poor sleepers reported greater levels of fatigue and sleepiness during the day than good sleepers.

Napping has been found to be quite prevalent among older adults. In a recent survey of older individuals, Hohagen, Kappler, Schramm, Riemann, Weyerer, and Berger (1994) found that the majority of participants indicated that they habitually napped during the day. Several studies have found no relationship between nocturnal sleep variables and the tendency to nap during the day (Bliwise et al., 1992; Hohagen et al., 1994; Morgan et al., 1989), while others have found that individuals who report napping on a regular basis are more likely to report nighttime sleep complaints (Hays, Blazer, & Foley, 1996). Additionally, there are suggestions in the literature that poor sleep in older adults is associated with maladaptive sleep lifestyle practices such as taking frequent naps (e.g., Hoelscher & Edinger, 1988). The results of the present research however show that good and poor sleepers were not distinguishable on how frequently they napped during the week. This finding is consistent with those of other studies which suggest that faulty sleep hygiene and lifestyle practices do not play a role in the poor sleep experienced by many older adults (Gourash Bliwise, 1992; Fichten et al., 1995; Morgan et al., 1989). Nevertheless, commonly used psychological treatments, including Stimulus Control and Sleep Restriction procedures or sleep hygiene / education applied to late life insomnia invite insomnia patients to eliminate napping during the day (for a review of insomnia treatments see, Lichstein, Riedel, & Means, in press). It is possible that napping behavior affects nocturnal sleep of some individuals more than others. However, the inclusion of a restriction on napping behavior in many of the treatment packages for insomnia does not seem warranted based on the current research.

Further research investigating not only frequency of napping among older good and poor sleepers but examining the timing and length of naps may provide more information about the effects of napping on nocturnal behavior. Moreover, it is possible that individual characteristics mediate the effects of napping on the sleep of certain individuals, further research is needed to examine the role of such characteristics on napping behavior and nocturnal sleep.

Personality And Psychological Adjustment.

Poor Sleepers in this sample experienced considerably worse sleep than good sleepers as revealed by quantitative data such as total sleep time, total wake time and sleep efficiency. Poor sleepers reporting high and low levels of cognitive arousal during nocturnal awakenings were, for their part, quite similar in terms of the severity as well as the duration of their sleep difficulties. On measures of psychological maladjustment and negative adaptation, however, the pattern of results was quite different.

Consistent with the findings of others, poor sleepers in the present investigation displayed somewhat poorer psychological adjustment than good sleepers (e.g., Fichten et al., 1995; in press; Frisoni et al., 1993; Gourash Bliwise, 1992; Monk, Reynolds, Machen, & Kupfer, 1992; Morin & Gramling, 1989). Overall, they were more neurotic, reported greater somatic and cognitive arousal as well as greater levels of worry during nocturnal wakefulness than good sleepers. Predictably, poor sleepers were also more distressed about their sleep and reported lower self-efficacy with regards to their sleep. However, contrary to others' findings that poor sleepers are more depressed and anxious during the day than good sleepers (for a review, see Benca, Okawa, Uchiyama, Ozakis, Nakajima, Shibui, & Obermeyer, 1997; Morin & Gramling, 1989), the present findings indicate that when effects of sleep quality and cognitive arousal were disentangled, poor

sleep per se was not related to higher scores on indices of depression, anxiety or psychopathology. Overall the present findings, suggest that when the effects of poor sleep and cognitive arousal are examined separately, poor sleep quality is more related to sleep related preoccupations (lower sleep self-efficacy) and distress than anxiety and depression.

Individuals reporting higher levels of cognitive activity during periods of nocturnal sleeplessness were expected to be more psychologically maladjusted and to display more neurotic and worrying personality profiles than individuals with lower levels of nocturnal cognitive arousal, even when sleep was controlled for (Hypothesis 3). The present results support this hypothesis. Regardless of sleep status, people reporting elevated nocturnal cognitive arousal differed from those with low nocturnal cognitive arousal on virtually all of the personality and psychological indices examined: they entertained more anxious, worried and negative thoughts and had higher neuroticism scores and lower satisfaction with their lives than individuals with low cognitive arousal during nocturnal wakefulness.

The findings revealed some interaction between sleep status and cognitive arousal. These interactions suggest that (1) in poor sleepers, high nocturnal cognitive arousal is associated with the worst psychological profiles, while (2) poor sleep and low nocturnal cognitive arousal is associated with indices of psychological adjustment similar to that of good sleepers.

Though cognitive arousal and poor sleep proved to be related in the present investigation, there were sufficient numbers of participants who were either poor sleepers with low levels of nocturnal cognitive arousal or good sleepers with high

cognitive arousal to separate the respective effects of sleep quality and cognitive arousal. Moreover, though a close relationship between cognitive arousal and poor sleep has been assumed, it is of some import that cognitive arousal is not a necessary feature of poor sleep and presumably, not always the cause of it. The present findings are thus consistent with suggestions in the literature that poor sleepers do not represent a homogeneous group and that subgroups, in fact, present different psychological profiles (Chambers & Keller, 1993; Fichten et al., 1995; Knab & Engel-Sittenfeld, 1983; Ohayon et al., 1997; Watts, Coyle, & East, 1994; Zorick et al., 1981). The results of this investigation are unique however in demonstrating the separate as well as combined effects of both sleep parameters and nocturnal cognitive arousal in the complaint of poor sleep as well as poor psychological adaptation among older adults. It is important to note that the effect of poor sleep and cognitive arousal identified in the present study are probably additive. The majority of poor sleepers in this investigation also reported high levels of cognitive arousal during nocturnal wakefulness; therefore many poor sleepers also manifested the effects attributed to cognitive arousal.

Sleep researchers and clinicians have increasingly implicated cognitive hyperarousal and intrusive thoughts during nocturnal awakenings in the etiology and maintenance of insomnia (Bonnet & Arand, 1998; Borkovec et al., 1981; Coates et al., 1983; Coyle & Watts, 1991; Kuisk et al., 1989; Lamarche & Ogilvie, 1997; Lichstein & Fanning, 1990; Lundh, Lunqvist, Broman, & Hetta 1991; Morin et al., 1993; Perlis et al., 1997b; Waters, Adams Jr, Binks, & Varnado, 1993; Watts et al., 1994). Moreover, researchers have found that individuals suffering from insomnia tend to endorse an anxious, dysphoric or worried cognitive style (Edinger et al., 1983) which is considered

to heighten the affective response to poor sleep (Coyle & Watts, 1991; Fichten et al., in press; Morin et al., 1993). Recent cognitive models of insomnia suggest that there tends to be a vicious cycle involving insomnia, emotional distress, intrusive and negative thoughts, dysfunctional cognitions and attitudes and further sleep disturbance (Fichten et al., in press; Morin et al., 1993).

The results of this investigation are consistent with these conceptualizations of poor sleep, at least for a segment of poor sleepers. However, the findings are correlational rather than causal and poorer adaptation in individuals with elevated levels of nocturnal cognitive arousal is not limited to the sleep experience. Therefore, whether poor psychological adjustment and a worrying, anxious, and neurotic personality style preceded the onset of insomnia in the subgroup of poor sleepers with high levels of cognitive arousal, or whether these characteristics resulted from the combination of sleeplessness and excessive cognitive activity cannot be determined by cross-sectional data. The longitudinal component of this study, Phase 2, attempted to elucidate the respective roles of cognitive arousal and psychological adjustment in the onset and maintenance of insomnia.

Changes in Sleep Status over Time

Cross sectional studies of a variety of populations have generally indicated that insomnia complaints increase with age (e.g., Bliwise et al., 1992). Indeed, the prevalence of sleep impairments over the age of 65 years has been estimated as high as 50% (Prinz et al., 1990).

Psychophysiological changes in sleep architecture that accompany the aging process is commonly believed to accelerate the rate of deterioration in old age. However, poor sleep in older adults is not inevitable. In fact, recent longitudinal studies suggest that while sleep complaints are relatively stable in later life, sleep can improve with time in older adults (Libman et al., 1998; Mellinger et al., 1985; Mendelson, 1995; Monjan & Foley, 1995; Morgan et al., 1989; Rodin et al., 1988; Roberts, Shema, & Kaplan, 1999). In a longitudinal study of 2380 older adults, Roberts et al. (1999) found that only 60% of individuals complaining of insomnia at baseline, continued to report insomnia one year later. Similarly, among 2000 individuals with chronic insomnia at baseline, Foley et al. (1995) found that almost half reported no symptoms of insomnia three years later.

Results of the present investigation were consistent with these findings and indicate that over a 2-year period there was relatively little change in sleep status. Indeed, the large majority of individuals (78%) who experienced good or poor sleep at pre-testing remained good or poor sleepers 2 years later. Whether the symptoms of poor sleep persisted through out the time of the follow up was not determined in the present study but the results suggest that a large proportion of older adults may have chronic poor sleep. Among those older adults who did change in terms of sleep status, the majority of individuals improved. These results clearly demonstrate that sleep impairments do not necessarily develop as a consequence of increasing age, per se, in older adults.

As noted by Libman et al. (1998), findings such as these underscore the necessity for longitudinal studies since cross-sectional analyses would have simply indicated the

percentage of good and poor sleepers at pre and post-testing and would have failed to detect the rate of improvement as well as the rate of deterioration in this older sample.

Predicting Improvement and Deterioration of Sleep in Older Adults

The results of this investigation indicate that knowing scores on indices of total sleep time, nocturnal cognitive arousal, depression, and neuroticism facilitated distinguishing those older poor sleepers who became good sleepers over a two-year period. These factors did not predict which good sleepers deteriorated with time. Among poor sleepers, greater total sleep time was the only significant predictor of improved sleep status. Indeed, poor sleepers who slept longer were more likely to have improved two years later than those who slept less. Contrary to expectations and to Libman et al.'s (1998) findings, better psychological adjustment, including lower neuroticism, less nocturnal cognitive arousal, and less depressed affect was not related to improvement 2 years later. These differences may result from the absence of a "medium quality sleepers" group in the present study, which made it more difficult for poor sleepers to change sleep status.

As was the case in Libman et al.'s (1998) study and despite the use of less stringent criteria to classify participants as good sleepers in the present investigation, it was not possible, based on the four selected predictors to distinguish good sleepers who deteriorated from those who remained good sleepers at the end of a two year period. This finding differs from previous studies which have identified risk factors associated with incident insomnia in older adults (Bliwise, 1993; Foley et al., 1999; Hoch et al., 1994; Morgan & Clarke, 1997). Foley et al. (1999), for example, found that incident insomnia was associated with depressed mood, respiratory symptoms, fair to poor

perceived health and physical disability. As was the case in this study, it should be underlined that increasing age was never identified as a significant risk factor of future insomnia when the effects of other putative risk factors were controlled for in longitudinal studies (Libman et al., 1998; Mellinger et al., 1985; Mendelson, 1995; Monjan & Foley, 1995; Morgan et al., 1989; Morgan & Clarke, 1997; Rodin et al., 1988; Roberts, Shema, & Kaplan, 1999).

What explains the fact others have identified predictors of sleep status over time and that this investigation did not? Different reasons may explain the discrepancy. First, it should be noted that in the present investigation, only 12 of the 40 poor sleepers improved and only 8 of the 51 good sleepers deteriorated. It is, therefore, possible that small sample size of people who changed sleep status is one reason why: psychological variables did not distinguish poor sleepers who improved from those who remained unchanged, and why none of the variables were useful in discriminating good sleepers who deteriorated from those who remained unchanged. Hence, lack of power may have interfered with the possibility of detecting differences among the groups. Larger samples of good and poor sleepers are needed to determine how poor sleep can be improved and how good sleep can be preserved in older adults and to clarify whether the same protective and risk factors influence sleep evolution in men and women.

Another reason why this study may not have been able to reliably distinguish older adults who changed sleep status over time concerns the predictor variables selected in the present study. An important limitation pertains to the lack of attention to physical health in this sample of older adults. Indeed, apart from depressive and anxious symptomatology, poor physical health has consistently been found to be associated with

most incident cases of insomnia in this cohort. Morgan and Clarke (1997), for example, note that although depressive mood represents a major risk factor, the most likely source of risk was physical rather than mental. As an index of health, the total number of medications used by participants at Time 1 was added to the discriminant analyses predicting Good and Poor Sleepers who changed or remained unchanged over time. Addition of this measure did not improve the prediction of older adults who changed sleep status over time. This may reflect the fact that total number of medications is not a good index of health among older adults. This lack of added predictive power may also stem from the fact that participants included in this investigation were required to be free from any major illness and thus may not be representative of older individuals in the general populations.

A final reason why others' have identified risk factors for the development of insomnia over time, and no predictor variable was associated with deterioration of sleep among good sleepers in the present investigation, may relate to the different definitions of sleep status used here and in other studies. Indeed, whereas the criteria for poor sleep in this study was operationalized as 30 minutes of undesired awake time 3 times per week for a minimum of 6 months, others have used less stringent criteria to define poor sleep. For example, in Roberts et al.'s (1999) study, sleep complaints were measured using an item that inquired whether respondents had experienced "nearly every day" trouble falling asleep or staying asleep in the last 2 weeks (p. 189). Similarly, the occurrence of insomnia in Foley et al.'s (1999) investigation was based on the response of "most of the time" versus "sometimes, rarely, or never" to the questions "How often

do you have trouble falling asleep?” and “How often do you have trouble waking up too early and not being able to fall asleep again?” (p. S374).

The definitions of “insomnia” or “sleep complaints” used in these studies seem more open to subjective interpretation and hence more subject to the influence of individual differences (e.g., response biases) than that used in the present study. Therefore, it is possible that the findings reported in other investigations overestimate the role of depressed affect and health in the prediction of sleep deterioration among older adults.

Different Aspects of the Insomnia Complaint: Good and Poor Sleepers

Modern conceptualizations increasingly recognize insomnia as being a multifaceted syndrome which requires a multi-dimensional assessment (e.g., APA, 1994; ASDA, 1990; Knab & Engel-Sittenfeld, 1983; Coyle & Watts, 1991; Fichten et al., 1995; Sateia, Doghramji, Hauri, & Morin, 2000). In clinical settings, insomnia is defined not only in terms of nocturnal sleep/wake parameters but also in terms of presumed daytime consequences of poor sleep and sleep related distress. The major sleep disorder classification systems require a report of daytime difficulties in addition to reports of nighttime sleep impairments for the diagnosis of insomnia (APA, 1994; ASDA, 1990). Additionally, both the DSM-IV (APA, 1994) and the International Classification of Diseases (ICD-10: World Health Organization, 1992), include a criterion of distress related to the sleep problem as a central feature of primary insomnia.

The multifaceted nature of insomnia is further supported by empirical data (Fichten et al., 1995; Watts & Coyle, 1991). Watts and Coyle (1991), for example, performed a factor analysis on combined items of two questionnaires designed to assess

sleep disturbance. Six separate factors were derived from their analysis: an “aftereffects” factor which reflected concerns about the consequences of poor sleep, a “sleep dissatisfaction” factor that represented general dissatisfaction with sleep, a “sleep attitudes” factor referring to pre-bed worry about the ability to sleep, a “mental activity” factor which encompasses non-specific pre-sleep thoughts and cognitive arousal, and two other factors related respectively with “sleep onset” and “sleep maintenance”. Coyle and Watts (1991) found different patterns of correlations between these factors and various sleep variables as well as personality and individual differences. Such findings suggest that the insomnia complaint encompasses several dimensions.

Consistent with this multidimensional conceptualization of insomnia, the findings of the present study indicate that indices of sleep quality, personality, psychological adjustment and intrusive thoughts were differentially associated with aspects of the insomnia experience 2 years later. Among poor sleepers, while insomnia frequency 2 years later was best predicted by lower total sleep time at pre-test, sleep related distress was associated with neuroticism at time 1 and the complaint of daytime fatigue 2 years later was related to depression.

It should be noted that the association between low levels of depression and daytime fatigue two years later was evident among good and poor sleepers alike, raising the possibility that what are generally considered to be daytime consequences of an insomnia problem may, in fact, simply reflect an underlying sub-clinical depression (Fichten et al., 1995). Although the present data were gathered longitudinally and, thus, suggest that depression preceded the occurrence of daytime fatigue in time, the findings are correlational and causality cannot be inferred.

It is noteworthy that among good sleepers, none of the predictor variables examined significantly predicted insomnia frequency or sleep related distress. This may have reflected the fact that sleep quality among good sleepers was quite resilient to change and that individuals who did not suffer from insomnia at the pre-test continued not to display poor sleep and therefore sleep related distress two years later.

Among poor sleepers, self-reported insomnia frequency and sleep related distress at follow-up were somewhat predictable when baseline data on depression, nocturnal cognitive arousal, neuroticism and total sleep time were simultaneously entered into linear regressions. The percentages of variance explained by these predictors were 29.5% and 17% for insomnia frequency and sleep related distress, respectively. This leaves much of the variance of these two components of the insomnia complaint unexplained. The impact of other factors, such as physical health or stressful life events (e.g., bereavement) as well as their interaction with certain types of psychological and personality profiles, on the incidence of the different facets of the insomnia complaint needs to be explored further.

Nocturnal Cognitive Arousal and Components of the Insomnia Complaint

Hypothesis 4 of the present study proposed that high levels of cognitive arousal would pose a significant risk factor for developing or maintaining sleep difficulties to predictions. Contrary to expectations, high levels of nocturnal cognitive activity was not significantly associated with any of the aspects of the insomnia complaint examined two years later in either good / poor sleepers or women / men. Several reasons may explain this counter-intuitive finding.

First, the measure used to assess nocturnal cognitive arousal in the present investigation, a modified version of the Nicassio et al.'s (1985) Pre-Sleep Arousal scale, is a state rather than a trait measure. As such, this measure was not useful in predicting insomnia complaints longitudinally. A corollary to this is that cognitive arousal during nocturnal wakefulness may be an epiphenomenon of trait anxiety and / or general affect. In this investigation, the pattern of correlations between cognitive arousal and depression and neuroticism were consistently significant in all subgroups of older adults examined (good and poor sleepers, women and men). It is therefore possible that the relationship between nocturnal cognitive arousal and the different dimensions of insomnia were mediated by the association between depression or neuroticism and the sleep complaints.

Another reason why nocturnal cognitive arousal did not emerge as a significant predictor of any of the components of the insomnia complaint, including future reports of sleep difficulties pertains to the actual role of cognitive arousal in insomnia. Recent cognitive conceptualizations of insomnia (e.g., Fichten et al., in press; Morin et al., in press) implicate cognitive factors and distressing and intrusive thoughts in the etiology and maintenance of insomnia. Fichten et al. (in press), for example, posit that negative cognitive activity and high levels of tension during periods of wakefulness contribute to poor sleep experiences on the one hand, and may act as mediators between personality factors and negative affect and self-reported poor daytime functioning and insomnia complaints on the other.

However, the present investigation identified a substantial group of poor sleepers who experienced considerable sleep impairments, but reported low levels of cognitive

activity during nocturnal wakefulness. This suggests that high levels of cognitive arousal are not necessarily associated with poor sleep. Furthermore, in the cross-sectional portion of this investigation, high cognitive arousal was not associated with quantitative sleep parameters (total sleep time, total wake time) nor daytime fatigue. Cognitive arousal was, however, highly and significantly associated with the myriad psychological and personality variables examined in this study. It is thus possible that, cognitive arousal, rather than being directly associated with poor sleep, is an additional expression of psychological maladjustment, which, in turn, is related to the overall insomnia experience.

Consistent with this hypothesis is the suggestion in the literature that it is the content and, more specifically, the affective valence of cognitions, and not excessive cognitive activity per se, which constitute an important mediating factor in the experience of insomnia (e.g., Morin et al., 1993). Researchers have found that when thoughts of people who complain of insomnia were sampled at night, these were more negatively toned compared to those of good sleepers (Borkovec et al., 1981; Fichten et al. in press; Kuisk et al., 1989; Van Egeren, Haynes, Franzen, & Hamilton, 1983).

A shortcoming of the present study is the lack of attention to the type and valence of the thoughts entertained by participants during periods of sleeplessness. A recent study, which examined the role of thoughts during nocturnal awakenings in the insomnia experience of older adults, and included participants of this investigation in its sample, provides clues about the content and affective tone of these cognitions (Fichten et al., 1998; in press). Fichten et al. (1998; in press) found that while older adults tended to endorse positive rather than negative thoughts. Highly distressed poor sleepers reported

more negative and worried thoughts during periods of sleeplessness than good sleepers or minimally distressed poor sleepers. Surprisingly, even though, half of the participants in their study had diagnosable, chronic insomnia, only 5% reported that they thought about their troubled sleep or the consequences of staying awake at night.

In a similar effort to clarify the nature of sleep interfering cognitions and to identify which aspects of cognitive activity are most crucial in determining sleep quality, Coyle and Watts (1991) factor analyzed a commonly used sleep questionnaire and found two distinct cognitive factors which they labeled "Sleep Attitudes", concerned with performance anxiety about sleep, and "Mental Activity" which reflects high levels of cognitive mentations of a non-specific kind (e.g., "My mind keeps turning things over"). Of particular interest is the finding that these two cognitive factors revealed very different patterns of correlations. While the "Mental Activity" factor showed significant correlations with the Neuroticism scale of the Eysenck Personality Inventory and a short worry proneness questionnaire, the "Sleep Attitudes" factor did not. Notably, the "Mental Activity" factor identified by Coyle and Watts (1991) is akin to the process of catastrophizing.

Together, such findings suggest a mediational role for negative thinking during nocturnal awakenings and personality on the one hand and components of the insomnia complaint on the other (Fichten et al., in press).

Studies combining poor sleep, indices of cognitive arousal as well as indices of physiological arousal in sleep laboratories are starting to clarify the nature of the pre-sleep process. Recent investigations have implicated cortical hyperarousal as the physiological mechanism underlying intrusive cognitive activity at sleep onset (e.g., Hall

et al., 2000; Mérica, Blois, & Gaillard, 1998; Perlis et al., 1997). At present, one study has evaluated the symptoms of stress and depression in conjunction with laboratory sleep EEG in a sample of adults with chronic primary insomnia (Hall et al., 2000). The specific hypothesis investigated was that the tendency to experience stress related intrusive thoughts and symptoms of depression would be associated with indices of Central Nervous System arousal during sleep. The results indicated that among insomniacs, symptoms of stress and depression were associated with poorer subjective sleep quality as well as with markers of CNS hyperarousal (attenuated delta power and heightened alpha power) through out the non-REM sleep. Hall et al. (2000) concluded that heightened CNS hyperarousal in patients with insomnia probably reflect heightened wake like mentations, which are experienced as wakefulness (p. 229). Additional studies combining poor sleep, indices of cognitive arousal in conjunction with indices of physiological arousal will help illuminate the nature of the pre-sleep process.

Overall, the results of the present investigation and recent research findings argue against the direct role of nocturnal cognitive arousal on the onset and/or maintenance of insomnia among older adults, as stipulated by others. Rather, these results suggest that cognitive arousal is part of the psychological complex associated with the complaint of insomnia. Autonomic hyperarousal is considered to be the physiological basis for certain personality characteristics and psychological adjustment parameters (e.g., Neuroticism). Similarly, cortical arousal is seen as the physiological substrate of negative nocturnal cognitive activity. Negative cognitive activity, affective and personality characteristics may thus best be viewed as behavioral correlates of physiological arousal.

Existing cognitive models of insomnia in older adults are descriptive and behavioral. The above conceptualization orders research findings into a more theoretical formulation where insomnia complaints in older adults can be seen as resulting from a combination of varying configurations of physiological hyperarousal (both autonomic and cortical) and age related sleep disruptions which provide the older adult more time to think during the night.

Conclusions

The present investigation attempted to disentangle the role of sleep status and nocturnal cognitive arousal in the nocturnal and daytime experiences of older adults. The study demonstrated the existence of a substantial number of older adults reporting poor sleep without concurrent high levels of cognitive hyperarousal. In general, the results suggest that while poor sleepers were indeed more concerned and distressed about their sleep than good sleepers, high levels of cognitive arousal were more highly and more consistently associated with an anxious, neurotic, and worried profile than was the "Poor Sleeper" status. Additionally, the results argue against the direct role of nocturnal cognitive arousal in the development and maintenance of insomnia. Instead, nocturnal cognitive activity is viewed as a behavioral correlate of physiological arousal. An alternative conceptualization of the insomnia complaint in old age, which takes into account age related sleep disruption (increased nocturnal awakenings) and physiological predispositions, in the form of cortical and autonomic hyperarousal, is proposed.

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Appendices

Appendix A

**Telephone Screening Interview
Structured Sleep Interview**

Telephone Screening Interview

My name is _____. I am part of the research team of the Sleep and Aging Project (and am working with Dr. _____). We are studying sleep in people over 60. The information we collect will be helping us to understand more about what makes people sleep well or poorly and will help us in developing an effective treatment for insomnia.

Let me tell you about what is involved. We would like to see you for about 1 hour to 1 hour and ½ to answer some questions and fill in some questionnaires about your sleep patterns. Of course this will all be confidential. Once the questionnaires have been completed you will have an opportunity to discuss any concerns you may have related to sleep.

Does this sound like something you would be willing to do?

IF YES

I would like to ask you a few questions just to make sure that your situation fits the needs of this particular study.

- 1) Since we are studying sleep in people over age 55, are you over 55?
- 2) Since all the questionnaires are in English, do you think you will have difficulty reading them?
- 3) Are you suffering from any serious medical or personal problems right now?
 How does it affect you life and sleep?
 Are you currently seeking professional help for this?
- 4) When was the last time you took medication to help you fall asleep?

IF LESS THAN 6 MONTHS AGO:

- how much medication (dosage)?
- how often (should be <3 times per week)?
- for how long?

Thank you, you are just the kind of person we are looking for. May we set up an appointment that is convenient for you to come to the hospital? (ASK THEM TO BRING ANY MEDICATION THEY ARE CURRENTLY TAKING)

OR

Thank you for your time. You have been very helpful. For this part of the study we are looking for people who:

- 1) are older than 50, or
- 2) have no major personal or medical problem right now, or
- 3) who do not frequently use medication to help them fall asleep, or
- 4) who have not taken medication in the last 6 months

We may be calling you at a later date. If you have any questions about this study I would be happy to try to answer them. If you are interested in the results of the study you can give us a call in about 8 months at 340-8266.

Thank you again.

Structured Sleep History Interview

I AM GOING TO ASK YOU SOME QUESTIONS ABOUT YOUR SLEEP PATTERNS.

How often do you feel exhausted during the day?
 _____ days/week

1. APNEA

a) i: Do you snore? Yes _____ No _____

ii: Has a bed partner ever complained of your snoring? Yes _____ No _____

IF YES:

b) INTERVIEWER'S JUDGEMENT OF OBESITY:

No _____ Moderate _____ Yes _____

c) Do you ever wake up in the middle of the night and feel unable to breathe? _____ Yes _____ No

d) Has a bed partner ever noticed that you seem to stop breathing? _____ Yes _____ No

e) How often do you wake up with a headache?
 _____ days/week.

If YES to c) or d) or e):

f) How often do you have this problem? _____

g) How long have you had this problem? _____

EXCLUSION CRITERIA: Snoring and at least 2 of the following, with a duration of > 2 months:

- unable to breath (> 2/wk)
- headache (> 2/wk)
- fatigue (> 2/wk)

2. MYOCLONUS AND RESTLESS LEG

- a) Do your legs ever bother you after you go to bed at night (e.g., cramps, jerking movements, crawling sensations)? Yes No
- b) At night, do you feel like something is crawling on your legs and you have to shake it off or move your legs? Yes No
- c) Do you ever wake up because of a cramp in your leg? Yes No
- d) Have you or your bed partner noticed that parts of your body jerk at night? Yes No

If YES to any of the above:

- e) How often do you have this problem? _____
- f) How long have you had this problem? _____

EXCLUSION CRITERIA: a) or b) or c) or d): frequency > 2/wk.

3. PARASOMNIAS

- a) i) How often do you have nightmares? _____

IF MORE THAN 6 NIGHTMARES PER YEAR:

- ii) How often do they wake you up? _____
- b) i) How often do you wake up afraid with no dream recall, or you only recall a frightening image? _____

IF POSITIVE:

- ii) At times, do you notice sweating, fast pulse? Yes No
- iii) How long has this been happening? _____
- c) i) How often do you sleepwalk? _____

IF POSITIVE:

ii) How long has this been happening? _____

EXCLUSION CRITERIA: a) or b) or c: frequency > 1/wk &
duration > 1 month

4. HYPERSOMNIA

a) i) Do you have any problem waking up?

_____ Yes _____ No

IF YES:

ii) How often? _____

b) i) Do you have difficulty staying awake during the day when you really want to be awake?

_____ Yes _____ No

ii) Does this happen while you are driving, at a table with friends, while at work, etc?

_____ Yes _____ No

IF YES:

iii) When exactly does this happen?

iv) How often does this happen? _____

EXCLUSION CRITERIA: b) iv: frequency > 1/wk.

5. SLEEP-WAKE SCHEDULE

a) i) Do you work the night shift or a rotating or split shift? _____ Yes _____ No

IF YES:

ii) How often? _____

iii) How long have you had this shift? _____

EXCLUSION CRITERIA: Poor sleeper and shift change in the last six months.

- b) i) Do you travel across time zones?
 ___ Yes ___ No

IF YES:

ii) When was the last time? _____

iii) Did you get jet lag? ___ Yes ___ No

IF YES, ASK PARTICIPANT TO RETURN IN ONE MONTH WITHOUT JET LAG.

6. MEDICAL

- a) Have you recently taken any prescription or over-the-counter medication for sleeping problems?
 ___ Yes ___ No
- b) Have you recently discontinued the use of these drugs? ___ Yes ___ No

IF YES TO a) OR b), RECORD THE ANSWERS TO THE FOLLOWING IN THE TABLE PROVIDED:

- c) What medication and amount are/were you taking?
- d) How many nights a week do/did you usually take this medication?
- e) How long have you been taking sleeping medication?
- f) If discontinued use of drugs, when did you stop?

MEDICATIONS	AMOUNT	NIGHTS/WEEK	DURATION	WHEN STOPPED
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

EXCLUSION CRITERIA: Frequency of medication use > 3/wk
and/or discontinued use of medication
< 2 months ago.

7. a) Are you currently taking any other medication?
_____ Yes _____ No

IF YES:

- b) What medication is it? c) What illness is it
prescribed for?

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

- d) Do you feel that any medications interfere with
your sleep? _____ Yes _____ No

IF YES:

e) Which medications? _____

f) How do they interfere? _____

g) How often do you take them? _____

EXCLUSION CRITERIA: Frequency of medication that interfere
with sleep > 2/wk.

8. a) Do you have any other problems or illnesses which
interfere with your sleep? _____ Yes _____ No

IF YES:

b) What are they? _____

EXCLUSION CRITERIA: Interviewer judgement

9. a) i) During the past year, have you been severely depressed? Yes No

IF YES:

ii) How long did it last? _____

iii) Are you currently depressed? Yes No

b) Are you currently taking medication for medication for depression? Yes No

IF YES:

c) What is it? _____

EXCLUSION CRITERIA: If YES for i) and ii) > 1 year or iii) or b)

10. a) Have you been hospitalized in the past year?
 Yes No

IF YES:

b) For what? _____

EXCLUSION CRITERIA: Interviewer judgement

11. a) Do you ever have trouble sleeping because of pain? Yes No

IF YES:

b) How often does it disturb you sleep? _____

EXCLUSION CRITERIA: Frequency > 1/week

12. a) How many times per night do you wake up to use the bathroom? _____

IF MORE THAN TWICE:

b) How long has this been happening? _____

c) Is it illness related? Yes No

IF YES:

d) What is the problem? _____

EXCLUSION CRITERIA: If illness causes difficulty falling back to sleep.

13. **EXPECTATIONS**

a) How long would you like to be able to sleep each night? hrs.

b) Relative to other people your age, do you think your sleep is:

better worse or the same

IF BETTER OR WORSE:

c) How does it differ? _____

14. a) Is it easier for you to fall asleep in places other than your bedroom? Yes No

IF YES:

b) How often do you fall asleep in places other than your bedroom? days/week

c) Where do you usually fall asleep? _____

15. What do you do when you can't fall asleep?

16. a) On weekends (or your days off), do you sleep more than an hour later than your usual bed time?

Yes No

b) Do you go to bed more than an hour later than your usual bed time? Yes No

- c) i) Are there certain days of the week when you experience more difficulty falling asleep than on other days? Yes No

IF YES:

- ii) When? (How does it relate to your days off?)
-
-

- iii) What is the sleeping difficulty? (i.e., difficulty falling asleep at night, waking too early)
-
-

17. a) How much alcohol do you drink? _____

- b) At what time of the day do you usually drink?
- _____

18. a) Have you previously received treatment for sleeping problems? Yes No

IF YES:

- b) What was the treatment? _____

- c) When did you receive it? _____

19. a) Have you tried self-help remedies for your sleeping problems? Yes No

IF YES:

- b) What have you tried? _____

- c) How effective was it? _____

20. Is there anything else related to your sleep that you think I should know but have not asked you about?

Sleep and Aging StudyCONSENT FORM

1. I am informed that this study is an attempt to evaluate how sleep patterns relate to work, leisure activities and lifestyle.
2. I am being asked to take part in this study. If I agree, I understand that I will be expected to complete a battery of brief questionnaires designed to assess the nature of my sleep pattern, my lifestyle, and aspects of my physical and psychological well being. This will require about one hour of participation.
3. I understand that I may discuss any questions or concerns I have about this study with the Project Coordinator and the Patient Representative, Roslyn Davidson, 340-8222, local 5833.
4. I have the right to withdraw from the study at any time without it affecting my care and to which I am entitled.
5. I understand that if the results of this study are published, my part in the study will be completely anonymous and my privacy will be completely protected.
6. On the basis of this information, I _____ willingly consent to participate as a subject in this study conducted at the Jewish General Hospital.

Date: _____ Participant: _____

Project Coordinator: _____

Witness: _____

Appendix B
Questionnaires

Background Information Form

1. Sex: Male: Female:
2. Age:
3. Religion: Catholic Other
 Jewish None
 Protestant
4. Education: Please indicate the levels of education you have completed. Check all those that apply.
- Elementary
 High School
 CEGEP
 Trade
 University
 Post-Graduate
5. Marital Status: Please check all those that apply.
- Now married
 Now living with a partner
 Separated
 Divorced
 Widowed
 Single
6. Current Living Arrangement:
- Alone
 With spouse/partner
 Other (please specify): _____
7. Employment: Are you employed? Please check all those that apply.
- Full-time
 Part-time
 Retired
 Homemaker
 Volunteer
 Unemployed

8. **Income Satisfaction:** Put an X in the box that best describes how adequate you consider your income to be in meeting your needs.

Inadequate	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> </tr> </table>											More than adequate
	<div style="display: flex; justify-content: center; align-items: center; gap: 5px;"> <div style="border-top: 1px solid black; width: 100%;"></div> <div style="font-size: 10px;">↓</div> </div>											
	Adequate											

What was your annual income last year (include you partner's if applicable)? Please circle one.

\$10,000 or less	\$10,000 - \$20,000	\$20,000 - \$30,000
\$30,000 - \$40,000	\$40,000 - \$50,000	more than \$50,000

Sleep Questionnaire

9. Do you have insomnia? (problem with falling asleep or going back to sleep after waking up at night or early in the morning) Put an " X " in the appropriate box.

Very rarely	1	2	3	4	5	6	7	8	9	10	Very often
-------------	---	---	---	---	---	---	---	---	---	----	------------

10. a) How distressed are you by an insomnia problem?

Not at all	1	2	3	4	5	6	7	8	9	10	Very much
------------	---	---	---	---	---	---	---	---	---	----	-----------

- b) For how many years have you had this problem? _____

11. a) How many hours, on average, do you usually sleep per night? _____

- b) How many days per week do you nap? _____

FALLING ASLEEP

12. a) How long does it usually take you to fall asleep? _____

- b) During a typical week, how often do you have difficulty falling asleep?

Days Per Week: 0 1 2 3 4 5 6 7

- c) How often does difficulty falling asleep distress you?

Days Per Week: 0 1 2 3 4 5 6 7

WAKING DURING THE NIGHT

13. Do you usually wake up during the night?
YES _____ NO _____

IF YES: a) How many times per night? _____
 b) How often?

Days Per Week: 0 1 2 3 4 5 6 7

c) How often do you have difficulty getting back to sleep?

Days Per Week: 0 1 2 3 4 5 6 7

d) How often does difficulty getting back to sleep distress you?

Days Per Week: 0 1 2 3 4 5 6 7

e) Approximately what is the total amount of time that you are awake during the middle of the night? _____ hrs _____ mins

WAKING TOO EARLY

14. a) During a typical week, how often do you wake up earlier than you want to?

Days Per Week: 0 1 2 3 4 5 6 7

b) How often do you have difficulty getting back to sleep?

Days Per Week: 0 1 2 3 4 5 6 7

c) How often does difficulty falling asleep again after waking too early distress you?

Days Per Week: 0 1 2 3 4 5 6 7

d) How much earlier do you wake up than you want to?
 _____ hrs _____ mins

15. Do you have any other problems related to falling or staying asleep?

Please specify: _____

16. How often do you take medication to help you sleep?

Days Per Week: 0 1 2 3 4 5 6 7

17. a) How often do you feel tired during the day because of a lack of sleep?

Days Per Week: 0 1 2 3 4 5 6 7

18. Describe what you do when you have problems falling asleep:

19. How busy are you in a typical week?

I have too
little to do

1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	----

I have too
much to do

20. During a typical week (except on weekends):

a) What is the earliest time you go to bed? _____

b) What is the latest time you go to bed? _____

c) What is the usual time you go to bed? _____

21. During a typical week (except on weekends):

a) What is the earliest time you get up in the morning? _____

b) What is the latest time you get up in the morning? _____

c) What is the usual time you get up in the morning? _____

Stanford Sleepiness Scale

Indicate with an " X " which statement best describes how sleepy you feel on most days.

- _____ feeling active and vital; alert; wide awake
- _____ functioning at a high level, but not at peak; able to concentrate
- _____ relaxed; awake; not at full alertness; responsive
- _____ a little foggy, not at peak; let down
- _____ foggy; beginning to lose interest in remaining awake; slowed down
- _____ sleepy; prefer to be lying down; fighting sleep; woozy
- _____ lost struggle to remain awake

Name: _____

Patient No.: _____ Technician _____

Location: _____

Visit No.: _____ Mode: S-R _____ Nar _____

Age: _____ Sex: M _____ F _____ Date: _____

Remarks: _____

INSTRUCTIONS

Below is a list of problems and complaints that people sometimes have. Read each one carefully, and select one of the numbered descriptors that best describes HOW MUCH DISCOMFORT THAT PROBLEM HAS CAUSED YOU DURING THE PAST _____ INCLUDING TODAY. Place that number in the open block to the right of the problem. Do not skip any items, and print your number clearly. If you change your mind, erase your first number completely. Read the example below before beginning, and if you have any questions please ask the technician.

EXAMPLE

HOW MUCH WERE YOU DISTRESSED BY: Descriptors

- 0 Not at all
- 1 A little bit
- 2 Moderately
- 3 Quite a bit
- 4 Extremely

Answer

Ex. Body Aches Ex.

HOW MUCH WERE YOU DISTRESSED BY: Descriptors

- 0 Not at all
- 1 A little bit
- 2 Moderately
- 3 Quite a bit
- 4 Extremely

HOW MUCH WERE YOU DISTRESSED BY:

- 1. Nervousness or shakiness inside
- 2. Faintness or dizziness.
- 3. The idea that someone else can control your thoughts . . .
- 4. Feeling others are to blame for most of your troubles. . .
- 5. Trouble remembering things
- 6. Feeling easily annoyed or irritated
- 7. Pains in heart or chest
- 8. Feeling afraid in open spaces
- 9. Thoughts of ending your life
- 10. Feeling that most people cannot be trusted
- 11. Poor appetite
- 12. Suddenly scared for no reason
- 13. Temper outbursts that you could not control
- 14. Feeling lonely even when you are with people.
- 15. Feeling blocked in getting things done.
- 16. Feeling lonely.
- 17. Feeling blue
- 18. Feeling no interest in things.
- 19. Feeling fearful
- 20. Your feelings being easily hurt.
- 21. Feeling that people are unfriendly or dislike you.
- 22. Feeling inferior to others
- 23. Nausea or upset stomach.
- 24. Feeling that you are watched or talked about by others . .
- 25. Trouble falling asleep
- 26. Having to check and doublecheck what you do
- 27. Difficulty making decisions

- 28. Feeling afraid to travel on buses, subways, or trains
- 29. Trouble getting your breath.
- 30. Hot or cold spells
- 31. Having to avoid certain things, places, or activities because they frighten you
- 32. Your mind going blank.
- 33. Numbness or tingling in parts of your body
- 34. The idea that you should be punished for your sins
- 35. Feeling hopeless about the future.
- 36. Trouble concentrating
- 37. Feeling weak in parts of your body.
- 38. Feeling tense or keyed up
- 39. Thoughts of death or dying
- 40. Having urges to beat, injure, or harm someone
- 41. Having urges to break or smash things
- 42. Feeling very self-conscious with others
- 43. Feeling uneasy in crowds
- 44. Never feeling close to another person
- 45. Spells of terror or panic
- 46. Getting into frequent arguments
- 47. Feeling nervous when you are left alone.
- 48. Others not giving you proper credit for your achievements
- 49. Feeling so restless you couldn't sit still
- 50. Feelings of worthlessness
- 51. Feeling that people will take advantage of you if you let them.
- 52. Feelings of guilt
- 53. The idea that something is wrong with your mind

Pre-Sleep Arousal Scale

During last night's sleep period, while you were in bed and trying to fall asleep, did you at any time have any of the following experiences? Please indicate (by circling the appropriate number) the degree to which you experienced each of those listed below.

	Not at all	A little	Moderately	A lot	Extremely
1. Heart racing, pounding, or beating irregularly	1	2	3	4	5
2. A jittery, nervous feeling in your body	1	2	3	4	5
3. Worry about falling asleep	1	2	3	4	5
4. Review or ponder events of the day	1	2	3	4	5
5. Shortness of breath or laboured breathing	1	2	3	4	5
6. Depressing or anxious thoughts	1	2	3	4	5
7. A tight, tense feeling in your muscles	1	2	3	4	5
8. Worry about problems other than sleep	1	2	3	4	5
9. Being mentally alert, active	1	2	3	4	5
10. Cold feeling in you hands, feet or your body in general	1	2	3	4	5
11. Can't shut off your thoughts	1	2	3	4	5
12. Have stomach upset (knot or nervous feeling in stomach, nausea, gas, etc.)	1	2	3	4	5
13. Perspiration in palms of your hands or other parts of your body	1	2	3	4	5
14. Thoughts keep running through your head	1	2	3	4	5
15. Dry feeling in mouth or throat	1	2	3	4	5
16. Distracted by sounds (e.g., ticking clock, house noises, traffic)	1	2	3	4	5
17. Was last night's sleep period typical of most nights? yes _____ no _____					

Sleep Self-Efficacy Scale

For the following 9 items, please rate (by circling a number from 1 to 5) your ability to carry out each behavior. If you feel able to accomplish a behavior some of the time but not always, you should indicate a lower level of confidence.

Indicate how confident you are that you can:

1. Lie in bed, feeling physically relaxed.

1	2	3	4	5
Not at all confident				very confident

2. Lie in bed, feeling mentally relaxed.

1	2	3	4	5
Not at all confident				very confident

3. Lie in bed with your thoughts "turned off."

1	2	3	4	5
Not at all confident				very confident

4. Fall asleep at night in under 30 minutes.

1	2	3	4	5
Not at all confident				very confident

5. Wake up at night fewer than three times.

1	2	3	4	5
Not at all confident				very confident

6. Go back to sleep within 15 minutes of waking in the night.

1	2	3	4	5
Not at all confident				very confident

7. Feel refreshed upon waking in the morning.

1	2	3	4	5
Not at all confident				very confident

8. Wake after a poor night's sleep without feeling upset about it.

1	2	3	4	5
Not at all confident				very confident

9. Not allow a poor night's sleep to interfere with daily activities.

1	2	3	4	5
Not at all confident				very confident

Anxious Self-Statements Questionnaire (ASSQ)

Listed below are a variety of thoughts that pop into people's heads when they are trying to fall asleep. Please read each thought and indicate how frequently, if at all, the thought occurred to you over the last week when you were trying to fall asleep. Please read each item carefully.

Read each item and rate its frequency according to the following scale.

- 1 - hardly ever had the thought
- 2 - rarely had the thought
- 3 - sometimes had the thought
- 4 - often had the thought
- 5 - very often had the thought

- ___ 1. What am I going to do with my life?
- ___ 2. I'm not going to make it.
- ___ 3. What will people think of me?
- ___ 4. What am I going to do?
- ___ 5. Can I make it?
- ___ 6. I can't take it.
- ___ 7. Who can I turn to?
- ___ 8. I wish I could die.
- ___ 9. I shouldn't feel this way.
- ___ 10. I need help.
- ___ 11. Can I overcome the uncertainties?
- ___ 12. How will I handle myself?
- ___ 13. I think I want to cry.
- ___ 14. I can't get through this.
- ___ 15. Will I make it?
- ___ 16. I want to fight back but I'm afraid to do so.

Anxious Self-Statements Questionnaire (ASSQ) (cont'd)

Read each item and rate its frequency according to the following scale.

- 1 - hardly ever had the thought
- 2 - rarely had the thought
- 3 - sometimes had the thought
- 4 - often had the thought
- 5 - very often had the thought

- ___ 17. It's my own fault.
- ___ 18. Am I going to make it?
- ___ 19. No one likes me or cares about me.
- ___ 20. I can't do anything right.
- ___ 21. I feel totally confused.
- ___ 22. What will happen to me?
- ___ 23. I can't stand it.
- ___ 24. I wish I could escape.
- ___ 25. I can't escape.
- ___ 26. I can't stand it anymore.
- ___ 27. Don't let me be crazy.
- ___ 28. I wonder if I look as stupid as I feel?
- ___ 29. I don't want to feel this way.
- ___ 30. What's going to happen next?
- ___ 31. I can't take it anymore.
- ___ 32. I'll never finish.

Penn State Worry Questionnaire

Please indicate the extent to which each statement is like you, using the scale below. Answer questions honestly and accurately and don't let your answers to one question influence your answers to other questions. There are no right and wrong answers.

Scale: 5 - very typical of me
 4 - moderately typical of me
 3 - somewhat typical of me
 2 - slightly typical of me
 1 - not at all typical of me

- ___ 1. If I do not have enough time to do everything, I do not worry about it.
- ___ 2. My worries overwhelm me.
- ___ 3. I do not tend to worry about things.
- ___ 4. Many situations make me worry.
- ___ 5. I know I should not worry about things, but I just cannot help it.
- ___ 6. When I am under pressure, I worry a lot.
- ___ 7. I am always worrying about things.
- ___ 8. I find it easy to dismiss worrisome things.
- ___ 9. As soon as I finish one task, I start to worry about everything else I have to do.
- ___ 10. I never worry about anything.
- ___ 11. When there is nothing more I can do about a concern, I do not worry about it any more.
- ___ 12. I have been a worrier all my life.
- ___ 13. I notice that I have been worrying about things.
- ___ 14. Once I start worrying, I cannot stop.
- ___ 15. I worry all the time.
- ___ 16. I worry about projects until they are all done.

Eysenck Personality Inventory

INSTRUCTIONS

Here are some questions regarding the way you behave, feel, and act. After each question is a space for answering "YES" or "NO." Try and decide whether "YES" or "NO" represents your usual way of acting or feeling. Indicate your response by putting an "X" over the word "YES" or "NO."

Work quickly, and don't spend too much time over any question; we want your first reaction, not a long, drawn-out thought process. The whole questionnaire shouldn't take more than a few minutes. Be sure not to omit any questions. Now turn the page over and go ahead. Work quickly, and remember to answer every question. There are no right and wrong answers and this isn't a test of intelligence or ability, but simply a measure of the way you behave.

Eysenck Personality Inventory (cont'd)

- | | | | |
|-----|--|-----|----|
| 1. | Do you often long for excitement? | YES | NO |
| 2. | Do you often need understanding friends to cheer you up? | YES | NO |
| 3. | Are you usually carefree? | YES | NO |
| 4. | Do you find it hard to take no for an answer? | YES | NO |
| 5. | Do you stop and think things over before doing anything? | YES | NO |
| 6. | If you say you will do something do you always keep your promise, no matter how inconvenient it might be to do so? | YES | NO |
| 7. | Does your mood often go up and down? | YES | NO |
| 8. | Do you generally do and say things quickly without stopping to think. | YES | NO |
| 9. | Do you ever feel "just miserable" for no good reason? | YES | NO |
| 10. | Would you do almost anything for a dare? | YES | NO |
| 11. | Do you suddenly feel shy when you talk to an attractive stranger? | YES | NO |
| 12. | Once in a while do you lose your temper and get angry? | YES | NO |
| 13. | Do you often do things on the spur of the moment? | YES | NO |
| 14. | Do you often worry about things that you should not have done or said? | YES | NO |
| 15. | Generally do you prefer reading to meeting people? | YES | NO |
| 16. | Are your feelings easily hurt? | YES | NO |
| 17. | Do you like going out a lot? | YES | NO |
| 18. | Do you occasionally have thoughts and ideas that you would not like other people to know about? | YES | NO |
| 19. | Are you sometimes bubbling over with energy and sometimes very sluggish? | YES | NO |
| 20. | Do you prefer to have a few but special friends? | YES | NO |
| 21. | Do you daydream a lot? | YES | NO |
| 22. | When people shout at you, do you shout back? | YES | NO |
| 23. | Are you often troubled about feelings of guilty? | YES | NO |
| 24. | Are all your habits good and desirable ones? | YES | NO |
| 25. | Can you usually let yourself go and enjoy yourself at a gay party? | YES | NO |
| 26. | Would you call yourself tense or "highly-strung"? | YES | NO |

Eysenck Personality Inventory (cont'd)

- | | | |
|--|-----|----|
| 27. Do other people think of you as being very lively? | YES | NO |
| 28. After you have done something important, do you often come away feeling you could have done better? | YES | NO |
| 29. Are you mostly quiet when you are with other people? | YES | NO |
| 30. Do you sometimes gossip? | YES | NO |
| 31. Do ideas run through your head so that you cannot sleep? | YES | NO |
| 32. If there is something you want to know about, would you rather look it up in a book than talk to someone about it? | YES | NO |
| 33. Do you get palpitations or thumping in your heart? | YES | NO |
| 34. Do you like the kind of work that you need to pay close attention to? | YES | NO |
| 35. Do you get attacks of shaking or trembling? | YES | NO |
| 36. Would you always declare everything at customs, even if you knew that you could never be found out? | YES | NO |
| 37. Do you hate being with a crowd who plays jokes on one another? | YES | NO |
| 38. Are you an irritable person? | YES | NO |
| 39. Do you like doing things in which you have to act quickly? | YES | NO |
| 40. Do you worry about awful things that might happen? | YES | NO |
| 41. Are you slow and unhurried in the way you move? | YES | NO |
| 42. Have you ever been late for an appointment or work? | YES | NO |
| 43. Do you have many nightmares? | YES | NO |
| 44. Do you like talking to people so much that you would never miss a chance of talking to a stranger? | YES | NO |
| 45. Are you troubled by aches and pains? | YES | NO |
| 46. Would you be very unhappy if you could not see lots of people most of the time? | YES | NO |
| 47. Would you call yourself a nervous person? | YES | NO |
| 48. Of all the people you know are there some whom you definitely do not like? | YES | NO |
| 49. Would you say you were fairly self-confident? | YES | NO |
| 50. Are you easily hurt when people find fault with you or your work? | YES | NO |

Eysenck Personality Inventory (EPI)

- | | | |
|---|-----|----|
| 51. Do you find it really hard to enjoy yourself at a lively party? | YES | NO |
| 52. Are you troubled with feelings of inferiority? | YES | NO |
| 53. Can you easily get some life into a rather dull party? | YES | NO |
| 54. Do you sometimes talk about things you know nothing about? | YES | NO |
| 55. Do you worry about your health? | YES | NO |
| 56. Do you like playing pranks on others? | YES | NO |
| 57. Do you suffer from sleeplessness? | YES | NO |

PLEASE CHECK TO SEE THAT YOU HAVE ANSWERED ALL THE QUESTIONS

LIFE EVENTS QUESTIONNAIRE

138

Please indicate with an " X " which of the following events have happened to you in the last six months.

- separation or divorce
- death of a close family member
- personal major illness or injury
- major illness of spouse
- job retirement
- death of a close friend
- move
- being a victim of crime
- relative being a victim of crime
- being denied a drivers license
- money problems
- none of the above
- other changes (specify): _____

SATISFACTION WITH LIFE SCALE

Below are five statements with which you may agree or disagree. Using the 1-7 scale below, indicate your agreement with each item by placing the appropriate number on the line preceding that item. Please be open and honest in your responding.

The 7-point scale is:

- 1 = strongly disagree
- 2 = disagree
- 3 = slightly disagree
- 4 = neither agree nor disagree
- 5 = slightly agree
- 6 = agree
- 7 = strongly agree

_____ In most ways my life is close to my ideal.

_____ The conditions of my life are excellent.

_____ I am satisfied with my life.

_____ So far I have gotten the important things I want in life.

_____ If I could live my life over, I would change almost nothing.

NOTE TO USERS

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Appendix C
Longitudinal Data Analyses

Appendix C 1

Poor Sleepers: Correlation Between Predictor Variables
and Discriminant Functions (Function Structure Matrix)

Variable	Function 1
Total sleep time	.74
Neuroticism	-.07
Cognitive arousal	-.08
Depression	-.12

Appendix C 2

Women: Insomnia Frequency at Time 2, Means, Standard Deviations, and Intercorrelations of Selected Sleep, Personality and Psychological Adjusted Variables (N=64)

Variable	<u>M</u>	<u>SD</u>	TST	Neuroticism	Cog. arousal	Depression
Predicted variable (Time 2)						
Insomnia frequency	3.89	3.02	-0.59**	0.27*	0.25*	0.06
Predictor variables (Time 1)						
Total sleep time (TST)	6.43	1.54	—	-0.14	-0.25*	0.05
Neuroticism	8.73	4.84		—	0.46**	0.52**
Cognitive arousal	12.93	5.13			—	0.47**
Depression	.53	.56				—

**p<.001

*p<.05

Appendix C 3

Women: Predicting Insomnia Frequency at Time 2, Regression Analysis Summary for Selected Sleep, Personality and Psychological Adjustment Variables

Variable	<u>B</u>	<u>SEB</u>	<u>β</u>
Total sleep time	-1.08	.21	-.55*
Neuroticism	.12	.08	.19
Cognitive arousal	.02	.07	.04
Depression	-.17	.66	-.03

Note. R²=.39 , Adjusted R²=.35 (N= 64, p<.001).

*p<.001.

Appendix C 4

Women: Sleep Related Distress at Time 2, Means, Standard Deviations, and Intercorrelations for Selected Sleep, Personality and Psychological Adjusted Variables (N=64).

Variable	<u>M</u>	<u>SD</u>	TST	Neuroticism	Cog. arousal	Depression
Predicted variable (Time 2)						
Sleep related distress	2.51	2.11	-.35*	.28*	.01	-.06
Predictor variables (Time 1)						
Total sleep time (TST)	6.43	1.53	—	-.08	-.22*	.12
Neuroticism	8.58	4.66		—	.46**	.50**
Cognitive arousal	13.07	5.23			—	.44**
Depression	.51	.55				—

**p<.001

*p<.01

Appendix C 5

Women: Predicting Sleep Related Distress at Time 2, Regression Analysis Summary for
Selected Sleep, Personality and Psychological Adjustment Variables

Variable	<u>B</u>	<u>SEB</u>	<u>β</u>
Total sleep time	-.47	.16	-.34**
Neuroticism	.19	.06	.42**
Cognitive arousal	-.08	.05	-.19
Depression	-.57	.51	-.15

Note. $R^2=.24$. Adjusted $R^2=.20$ (N= 64, $p<.001$).
** $p<.005$.

Appendix C 6

Women: Daytime Fatigue at Time 2, Means, Standard Deviations, and Intercorrelations for Selected Sleep, Personality and Psychological Adjusted Variables (N=63)

Variable	<u>M</u>	<u>SD</u>	TST	Neuroticism	Cog. arousal	Depression
Predicted variable (Time 2)						
Daytime fatigue	2.05	2.03	-.21*	.32**	.25*	.46***
Predictor variables (Time 1)						
Total sleep time (TST)	6.49	1.54	—	-.09	-.23*	.11
Neuroticism	8.58	4.82		—	.45***	.49***
Cognitive arousal	12.97	5.20			—	.46***
Depression	.51	.56				—

***p<.001

** p<.01

*p<.05

Appendix C 7

Women: Predicting Daytime Fatigue at Time 2, Regression Analysis Summary for Selected Sleep, Personality and Psychological Adjustment Variables

Variable	<u>B</u>	<u>SEB</u>	<u>β</u>
Total sleep time	-.36	.15	-.27*
Neuroticism	.04	.06	.10
Cognitive arousal	-.03	.05	-.08
Depression	1.74	.49	.48**

Note. $R^2=.29$, $\text{Adjusted } R^2=.25$ (N= 63, $p<.001$).

** $p<.001$.

* $p<.05$.

Appendix C 8

Men: Self-reported Insomnia Frequency at Time 2, Means, Standard Deviations, and Intercorrelations for Selected Sleep, Personality and Psychological Adjusted Variables (N=27)

Variable	<u>M</u>	<u>SD</u>	TST	Neuroticism	Cog. arousal	Depression
Predicted variable (Time 2)						
Insomnia frequency	4.30	3.05	-.52**	.41*	.18	.15
Predictor variables (Time 1)						
Total sleep time (TST)	5.67	1.62	—	-.06	-.05	.29
Neuroticism	7.61	5.25		—	.35*	.67**
Cognitive arousal	12.40	4.66			—	.25
Depression	.30	.45				—

** p<.001

* p<.01

Appendix C 9

Men: Predicting Insomnia Frequency at Time 2, Regression Analysis Summary for Selected Sleep, Personality and Psychological Adjustment Variables

Variable	<u>B</u>	<u>SEB</u>	<u>β</u>
Total sleep time	-1.01	.32	-.53**
Neuroticism	.18	.13	.30
Cognitive arousal	-.01	.11	.02
Depression	.69	1.53	.10

Note. $R^2=.42$, Adjusted $R^2=.33$ (N= 27, $p<.01$).
 ** $p<.005$

Appendix C 10

Men: Sleep Related Distress at Time 2, Means, Standard Deviations, and Intercorrelations for Selected Sleep, Personality and Psychological Adjusted Variables (N=27)

Variable	<u>M</u>	<u>SD</u>	TST	Neuroticism	Cog. arousal	Depression
Predicted variable (Time 2)						
Sleep distress	2.69	1.73	-.18	.12	.12	.06
Predictor variable (Time 1)						
Total sleep time (TST)	5.67	1.65	—	-.06	-.05	.29
Neuroticism	7.67	5.33		—	.34*	.67**
Cognitive arousal	12.52	4.70			—	.24
Depression	.31	.46				—

** p<.001

*p<.01

Appendix C 11

Men: Predicting Sleep Related Distress at Time 2, Regression Analysis Summary for Selected Sleep, Personality and Psychological Adjustment Variables

Variable	<u>B</u>	<u>SEB</u>	<u>β</u>
Total sleep time	-.21	.23	-.20
Neuroticism	.009	.09	.03
Cognitive arousal	.03	.08	.08
Depression	.32	1.12	.09

Note. $R^2 = .05$ ($N = 27$, n.s.).

Appendix C 12

Men: Daytime Fatigue at Time 2, Means, Standard Deviations, and Intercorrelations for Selected Sleep, Personality and Psychological Adjusted Variables (N=27)

Variable	<u>M</u>	<u>SD</u>	TST	Neuroticism	Cog. arousal	Depression
Predicted variable (Time 2)						
Daytime fatigue	1.79	2.02	-.24	.14	-.11	.19
Predictor variables (Time 1)						
Total sleep time (TST)	5.69	1.64	—	-.05	-.06	.31*
Neuroticism	7.51	5.31		—	.38*	.66**
Cognitive arousal	12.55	4.66			—	.28*
Depression	.29	.46				—

** $p < .001$

* $p < .05$

Appendix C 13

Men: Predicting Daytime Fatigue at Time 2, Regression Analysis Summary for Selected Sleep, Personality and Psychological Adjustment Variables

Variable	<u>B</u>	<u>SEB</u>	<u>β</u>
Total sleep time	-.48	.26	-.39
Neuroticism	-.03	.10	-.08
Cognitive arousal	-.10	.09	-.23
Depression	1.88	1.22	.43

Note. R²=.19. Adjusted R²=.05 (N= 27, n.s.).

Appendix C 14

Poor Sleepers: Insomnia Frequency at Time 2, Means, Standard Deviations, and Intercorrelations of Selected Sleep, Personality and Psychological Adjustment Variables (N=40)

Variable	<u>M</u>	<u>SD</u>	TST	Neuroticism	Cog.arousal	Depression
Predicted variable (Time 2)						
Insomnia frequency	5.95	2.96	-.46***	.14	.004	-.07
Predictor variables (Time 1)						
Total sleep time (TST)	5.27	1.70	—	.27*	.12	.41**
Neuroticism	10.99	4.67		—	.31*	.54***
Cognitive arousal	14.82	5.22			—	.46**
Depression	.61	.63				—

*** $p < .001$

** $p < .01$

* $p < .05$

Appendix C 15

Poor Sleepers: Predicting Insomnia Frequency at Time 2, Regression Analysis Summary
for Selected Sleep, Personality and Psychological Adjustment Variables

Variable	<u>B</u>	<u>SEB</u>	<u>β</u>
Total sleep time	-.94	.26	-.54**
Neuroticism	.19	.10	.29
Cognitive arousal	-.01	.09	-.02
Depression	.07	.86	.001

Note. $R^2=.29$, Adjusted $R^2=.22$ (N= .40, $p<.01$).

** $p<.001$.

Appendix C 16

Poor Sleepers: Sleep Related Distress at Time 2, Means, Standard Deviations, and Intercorrelations for Selected Sleep, Personality and Psychological Adjustment Variables (N=40).

Variable	<u>M</u>	<u>SD</u>	TST	Neuroticism	Cog. arousal	Depression
Predicted variable (Time 2)						
Sleep related distress	3.24	2.30	-.18	.24*	-.07	-.11
Predictor variables						
Total sleep time	5.32	1.71	—	.31	.17	.44**
Neuroticism	10.77	4.53		—	.29*	.53**
Cognitive arousal	15.09	5.28			—	.45**
Depression	.57	.62				—

** $p < .001$

* $p < .05$

Appendix C 17

Poor Sleepers: Predicting Sleep Related Distress at Time 2, Regression Analysis Summary
for Selected Sleep, Personality and Psychological Adjustment Variables (N=40)

Variable	<u>B</u>	<u>SEB</u>	<u>β</u>
Total sleep time	-.27	.22	-.20
Neuroticism	.22	.08	.44*
Cognitive arousal	-.02	.07	-.06
Depression	-.57	.72	-.23

Note. $R^2=.17$, Adjusted $R^2=.09$ (N= 45, n.s).
* $p<.01$.

Appendix C 18

Poor Sleepers: Daytime Fatigue at Time 2, Means, Standard Deviations, and Intercorrelations for Selected Sleep, Personality and Psychological Adjustment Variables (N=40)

Variable	<u>M</u>	<u>SD</u>	TST	Neuroticism	Cog. arousal	Depression
Predicted variable (Time 2)						
Daytime fatigue	2.82	2.17	.04	.07	.03	.30*
Predictor variables (Time 1)						
Total sleep time (TST)	5.29	1.76	—	.32*	.15	.44**
Neuroticism	10.87	4.74		—	.30*	.53**
Cognitive arousal	15.08	5.28			—	.50**
Depression	.57	.64				—

**p<.001

*p<.05

Appendix C 19

Poor Sleepers: Predicting Daytime Fatigue at Time 2, Regression Analysis Summary
for Selected Sleep, Personality and Psychological Adjustment Variables

Variable	<u>B</u>	<u>SEB</u>	<u>β</u>
Total sleep time	-.14	.22	-.12
Neuroticism	-.05	.09	-.11
Cognitive arousal	-.07	.08	-.17
Depression	1.74	.74	.49*

Note. $R^2 = .13$, Adjusted $R^2 = .03$ (N= 40, n.s).

* $p < .05$.

Appendix C 20

Good Sleepers: Insomnia Frequency at Time 2, Means, Standard Deviations, and Intercorrelations of Selected Sleep, Personality and Psychological Adjusted Variables (N=51)

Variable	<u>M</u>	<u>SD</u>	TST	Neuroticism	Cog.arousal	Depression
Predicted variable (Time 2)						
Insomnia frequency	2.41	1.95	-.18	-.11	.01	-.14
Predictor variables (Time 1)						
Total sleep time (TST)	6.97	.99	—	.17	-.13	.22*
Neuroticism	6.22	4.13		—	.30*	.51**
Cognitive arousal	11.06	4.06			—	.18
Depression	.34	.43				—

** $p < .001$

* $p < .05$

Appendix C 21

Good Sleepers: Predicting Insomnia Frequency at Time 2, Regression Analysis Summary
for Selected Sleep, Personality and Psychological Adjustment Variables

Variable	<u>B</u>	<u>SEB</u>	<u>β</u>
Total sleep time	-.30	.29	-.15
Neuroticism	-.02	.08	-.05
Cognitive arousal	-.01	.07	.02
Depression	-.40	.76	-.09

Note. $R^2 = .05$. Adjusted $R^2 = -.03$ (N= 51, n.s).

Appendix C 22

Good Sleepers: Sleep Related Distress at Time 2, Means, Standard Deviations, and Intercorrelations for Selected Sleep, Personality and Psychological Adjusted Variables (N=51).

Variable	<u>M</u>	<u>SD</u>	TST	Neuroticism	Cog. arousal	Depression
Predicted variable (Time 2)						
Sleep distress	1.98	1.50	-.16	-.10	-.17	-.13
Predictor variables (Time 1)						
Total sleep time	6.97	.99	—	.17	-.13	.22*
Neuroticism	6.22	4.13		—	.30*	.51**
Cognitive arousal	11.06	4.06			—	.18
Depression	.34	.42				—

** $p < .001$

* $p < .05$

Appendix C 23

Good Sleepers: Predicting Sleep Related Distress at Time 2, Regression Analysis Summary for Selected Sleep, Personality and Psychological Adjustment Variables

Variable	<u>B</u>	<u>SEB</u>	<u>β</u>
Total sleep time	-.26	.22	-.17
Neuroticism	.01	.06	.03
Cognitive arousal	-.07	.05	-.19
Depression	-.26	.58	-.07

Note. R²=.07 . Adjusted R²=-.01 (N= 51, n.s).

Appendix C 24

Good Sleepers: Daytime Fatigue at Time 2, Means, Standard Deviations, and Intercorrelations for Selected Sleep, Personality and Psychological Adjusted Variables (N=51)

Variable	<u>M</u>	<u>SD</u>	TST	Neuroticism	Cog. arousal	Depression
Predicted variable (Time 2)						
Daytime fatigue	1.31	1.63	-.10	.16	-.03	.43**
Predictor variables (Time 1)						
Total sleep time (TST)	6.96	1.00	—	.17	-.13	.22*
Neuroticism	6.22	4.17		—	.30*	.51**
Cognitive arousal	11.12	4.08			—	.17
Depression	.35	.43				—

** $p < .001$

* $p < .05$

Appendix C 25

Good Sleepers: Predicting Daytime Fatigue at Time 2, Regression Analysis Summary
for Selected Sleep, Personality and Psychological Adjustment Variables

Variable	<u>B</u>	<u>SEB</u>	<u>β</u>
Total sleep time	-.37	.21	-.23
Neuroticism	-.06	.06	-.01
Cognitive arousal	-.06	.05	-.15
Depression	1.94	.57	.51**

Note. $R^2 = .24$, Adjusted $R^2 = .18$ (N = 51, $p < .01$).

** $p < .001$.