Evaluation of Chronic Insomnia

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Summary: Insomnia is a condition which affects millions of individuals, giving rise to emotional distress, daytime fatigue, and loss of productivity. Despite its prevalence, it has received scant clinical attention. An adequate evaluation of persistent insomnia requires detailed historical information as well as medical, psychological and psychiatric assessment. Use of a classification system for sleep disorders and familiarity with major diagnostic groups will facilitate the clinician's evaluation and treatment. Thorough assessment also requires attention to the unique aspects of presentation and specific set of etiologies which are associated with particular age groups.

1.0 INTRODUCTION

INSOMNIA IS THE MOST COMMONLY REPORTED SLEEP PROBLEM, NOT ONLY IN THE UNITED STATES, BUT IN INDUSTRIALIZED NATIONS WORLDWIDE.[1-5] Although the scope of the problem is large, most insomniacs do not seek medical treatment[6] and physician training in the recognition of sleep specific symptoms continues to be minimal.[7-9] The high incidence of insomnia complaints in conjunction with the minimal recognition of the problem by healthcare professionals has led to an underestimation of the tangible consequences of chronic insomnia. For example, poor sleep may be associated with a perceived decrease in quality of life, an increase in physical complaints, and economic repercussions including decreased work productivity.[6] There may also be dangerous and expensive consequences in the form of occupational and vehicular accidents secondary to poor quality sleep.[10-12] Even more sobering are data which suggest that decreased sleep time and use of sleeping pills are associated with increased mortality.[13,14]

The magnitude of this problem indicates that routine clinical assessment and treatment of insomnia complaints may have important health consequences for the patient. The objectives of this paper are threefold. The first is to review the current literature on diagnostic practices in the clinical evaluation of insomnia. The second is to present an overview of key features associated with an insomnia complaint. The third is to address the methods by which healthcare professionals can obtain comprehensive information regarding the nature of the disorder, its consequences, and potential contributing factors. Only clinical evaluation will be presented here since polysomnographic evaluation has been addressed elsewhere.[15,16]

2.0 METHODOLOGY

A task force was assigned by the Standards of Practice Committee (SPC) of the American Academy of Sleep Medicine (AASM) for the purpose of developing a review of the literature pertaining to the non-polysomnographic aspects of evaluation of insomnia. This review provided the basis for the development of practice parameters by the SPC.

A literature search (Medline 1966-1997) of major topics relevant to the evaluation and diagnosis of insomnia was conducted. This search focused on controlled studies in peer-reviewed journals which provided information regarding the relationship between specific diagnostic or evaluative processes and outcome. Major search terms, inclusion criteria, and search results (number of articles identified within specific category) are included as Appendix A. Review papers, commentary, case studies, pediatric populations, treatment investigations/drug trials, foreign language reports and studies which pertain only to polysomnographic or actigraphic evaluation were excluded, except where specifically noted. The level of evidence for the data in each paper relevant to evaluation is listed in Tables 1, 4, 5, 6, 8, 10, and 11, and was identified by members of the American Academy of Sleep Medicine Standards of Practice Committee according to criteria, as noted in the accompanying practice parameter paper.[17]

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3.0 OVERVIEW OF THE PROBLEM

3.1 Defining insomnia

The definition of insomnia may be viewed from two contrasting perspectives. On one hand, definitions which rely on polysomnographic data to define insomnia are of little use in the routine office-based assessment of the problem. Conversely, patient reports are often inadequate in that there is considerable variation in the degree of concern which different patients attach to a given sleep disturbance. The practical resolution of this dilemma is to define insomnia as a complaint on the part of the patient of poor or unsatisfactory sleep. This complaint may include several different aspects such as difficulty initiating sleep, repeated or lengthy awakenings, early awakening, inadequate total sleep time, or poor quality of sleep as reflected in daytime function. The definition of insomnia must also include a complaint of daytime dysfunction in the form of change in alertness, energy, cognitive function, behavior or emotional state.[18]

Two specific situations must be addressed to further clarify this issue. First, there is considerable individual variation in sleep need. In the case of normal "short sleep," patients may complain of decreased total sleep time. The key to identification of the normal "short sleeper" lies in recognizing that there are no significant daytime consequences associated with the complaint. The literature search revealed one article on epidemiology of short sleep and four reports of psychological characteristics. Partinen[19] reported that about 1% of good sleepers slept less than five hours, while approximately 7.5% slept 6 hours or less. Studies of psychological characteristics indicate that this population does not demonstrate the psychological disturbance often seen in insomniacs (see Section 4.7) and, in fact, appear reasonably well-adjusted.[20-23] Second, a large discrepancy may exist between subjective reports and objective (polysomnographic) findings or observations by others.[24,25] This discrepancy is especially evident in the case of sleep state misperception (SSM), defined in the current International Classification of Sleep Disorders (ICSD)[18] nosology as a complaint of insomnia without objective evidence of sleep disturbance. Findings pertinent to SSM are included in Table 1. Some debate exists as to whether or not this disorder represents a distinct entity or simply an exaggerated form of the well-documented tendency for insomnia patients to overestimate the degree of sleep disturbance.[26] Recent data suggest that SSM may represent a transitional state between normal sleep and objective (psychophysiologic) insomnia.[27,28] Despite the absence of objective sleep disturbance, these patients demonstrate psychological profiles and daytime performance similar to those of objective insomniacs. This suggests that complaints of insomnia and its daytime consequences are not driven solely by objectively demonstrable abnormalities in sleep latency, sleep efficiency, total sleep time or architecture. These complaints may also be fueled by more subtle changes in sleep continuity or EEG frequency, or by the effects of hyperarousal or psychological state on perception of sleep and daytime functioning. Such complaints require consideration even in the absence of objective polysomnographic abnormalities.

3.2 Epidemiology

Studies of the prevalence of insomnia in the general population demonstrate a median prevalence for all insomnia of about 35%, with a range of 10% - 15% being assessed as moderate to severe disorders.[1,6,32,33] Table 2 summarizes prevalence data from epidemiologic studies of insomnia with N>1000. It should be noted that comparison of these studies is confounded by the considerable variance in methodology, description of sleep difficulties, frequency, severity, age ranges, and other factors. These studies, with few exceptions, do not attempt to identify etiologies of the insomnia complaint. Prevalence rates for chronic insomnia are generally higher in women and increase with age. Factors associated with insomnia at higher than expected frequencies include numerous medical and psychiatric disorders, although no clear causal relationship is proven. These studies also suggest increased risk for development of new psychiatric disorders subsequent to the onset of the insomnia.

3.3 Course

Current evidence demonstrates that insomnia is often a chronic condition. Retrospective reports indicate that about 80% of severely afflicted individuals have had the problem for greater than one year, with approximately 40% reporting greater than five year duration.[1,6,50] Longitudinal studies suggest that from 30 to 80% of those identified with moderate to severe insomnia show no significant remission over time.[36,47,51-55] Rather than reflecting an inevitable chronic course, these data may reflect the fact that insomnia is often not reported, evaluated, or adequately treated in its more acute stages.[6,56]

Transient and short-term insomnias (lasting less than three months) are almost universal experiences. The ICSD[18] defines acute or transient insomnia as persisting for no greater than one week and sub-acute or short-term insomnia as lasting from one week to three months duration. Both are categorized under the diagnosis of adjustment sleep disorder, which is defined as a complaint of insomnia temporally associated with a reaction to an identifiable stressor. Other features may include: 1) remission of the insomnia with reduction of or adaptation to the stressor; 2) fatigue, increased time in bed, anxiety, dysphoria, and somatic symptoms. No studies relating specifically to the evaluation of acute, transient, or short-term insomnia,

or adjustment sleep disorder were identified. Therefore, much of what is written about these short-lived phenomena is derived from clinical experience. ICSD notes that common causes of adjustment insomnia are acute or sub-acute stresses such as threat to one's security, interpersonal conflict, occupational stress, environmental disturbance or loss. Emotional arousal is a key mediating factor. Acute medical illness, particularly when accompanied by pain and/or anxiety, may give rise to poor sleep,[57-60] as do time zone changes or abrupt shifts in sleep-wake schedule.[61-64] Substance use or discontinuation may also induce transient or short-term sleep disorder.[65-68]

Epidemiologic data suggest that the risk factors which pertain particularly to "chronic" or "severe" insomnia (see Section 3.2) are less important in "occasional" or "mild" disturbances.[32]

Although situational insomnia often resolves spontaneously, it must be recognized that it can also represent the foundation of a long-term condition. Historical information from patients with chronic insomnia suggests that the disorder frequently began as a stress-related phenomenon.[69-72] The individual's emotional and behavioral response to the condition seems to play an important role in outcome. Heightened levels of anxiety over the sleep disturbance and its consequences, negative expectations, and progressively desperate efforts to sleep with increasing time in bed awake are often associated with development of chronic insomnia.[71,73-75] Therefore, early identification and intervention may play an important role in prevention of a long-term disturbance. This can best be accomplished by attention to precipitating factors, along with assessment of maladaptive cognitive, behavioral, and emotional responses to the insomnia.

In light of the fact that the available literature focuses on chronic insomnia, the sections below address these longer term problems, except as indicated.

3.4 Current diagnostic practice

Available data suggest that insomnia most often goes unrecognized and untreated. Two surveys of insomnia in general practice[36,76] found that physicians were unaware of severe insomnia in 60-64% of cases. These surveys likewise indicate that the physicians were not cognizant of the high rate of psychopathology and substance abuse among these patients. A 1995 survey[6] found that almost 70% of patients with chronic insomnia never discuss the problem with their physicians. Even when physicians are aware of the problem and prescribe medication, evaluation (or, at least, documentation) is lacking. Shorr and Bauwens[77] examined the medical records of 536 patients prescribed hypnotic medication and identified a reference to sleep in only 12% of notes written by internists and surgeons. Rubinstein[78] found that psychiatrists reported on a larger number of insomnia patients than non-psychiatrists. However, insomnia patients are far more likely to be seen by primary care specialists than by psychiatrists.[79]

The only study identified which directly assessed physician's attitudes towards various aspects of the evaluation of insomnia shows that, while items such as sleep history, general history, physical and mental status examinations, and psychiatric assessment were viewed as moderately helpful, behavioral assessment factors (monitoring sleep habits, use of questionnaires, bed partner interviews, other sleep-related behaviors) were not.[80] Referral to sleep disorders centers was also viewed by the providers as having limited usefulness. Ratings of the importance of all assessment parameters increased in proportion to the number of insomnia patients seen by the physician.

Everitt and colleagues[56] surveyed 799 primary care practitioners using an insomnia case-based format to determine practitioner behavior. They found that fewer than half of the physicians obtained any sleep history and less than a quarter inquired about caffeine usage. Of the questions asked, exploration of psychological issues was most common. In contrast to physicians, nurse practitioners asked more questions and were more apt to pursue topics related to emotional well-being and use of medication.

In light of these data, it is not surprising that the vast majority of insomnia goes untreated.[32] Patients and physicians alike have become increasingly wary of hypnotic medication, historically viewed as a mainstay of treatment, as evidenced by the marked decline in prescriptions over the past two decades.[81] Lacking the necessary evaluation skills and awareness of nonpharmacological treatment, an attitude of nihilism and neglect may arise. Advances in our understanding of the causes of insomnia in the recent past have provided clinicians with an opportunity to make specific diagnoses and apply effective treatment. These interventions are dependent, first of all, on adequate assessment.

4.0 EVALUATION

4.1 History

A detailed, skilled sleep history comprises the foundation of an adequate evaluation of an insomnia complaint. No systematic studies have delineated the optimal way to obtain a sleep history.

However, numerous detailed descriptions of how individual clinicians proceed in taking such a history have been provided.[82-87] While each has a somewhat unique approach, comparing the different descriptions gives an overall idea about what is necessary and sufficient in taking a sleep history for insomnia patients.

Insomnia should be evaluated in a systematic manner, with a well established framework, so that crucial data are not overlooked.[56,88] The major areas of inquiry and specific details of the sleep history are included in Table 3. Numerous sleep questionnaires have been designed to pro-

vide assessment of sleep quality, duration and continuity, as well as specific factors which may be associated with sleep disturbance. These questionnaires are addressed in section 4.6 and Table 7. Evidence indicates that obtaining information about specific nights by use of sleep logs may provide more accurate estimates of the degree of sleep disturbance than global assessments (see Section 4.6 and Table 6).

4.2 Nocturnal symptoms

Abnormal events occurring during sleep, including periodic limb movement, respiratory distress, panic attack, pain, headache, or gastro-esophageal reflux, may give rise to transient or chronic sleep disturbance. The co-existence of a nocturnal symptom and the complaint of insomnia does not necessarily imply a cause and effect relationship. Instead, they may represent independent disorders or, alternatively, common manifestations of a different underlying disorder. Detailed discussion of each of these events is beyond the scope of this paper. Major types of nocturnal events and information regarding their relationship to insomnia are summarized below:

1. Restless legs syndrome (RLS) and periodic limb movement disorder (PLMD). The crawling, uncomfortable, restless sensations of RLS may occur prior to sleep onset or, on occasion with awakenings during the night. Bed partners may describe repetitive movements. Minimal criteria for diagnosis of restless legs syndrome have been defined by the International Restless Legs Syndrome Study Group.[103] Montplaisir and colleagues, utilizing these criteria, demonstrated a strong correlation between RLS symptoms and PSG findings of increased sleep latency and awakenings and decreased sleep efficiency.[104] Periodic limb movements were observed in over 80% of these patients. One systematic investigation failed to identify a clear association between subjective complaints of disturbed sleep and degree of PLM arousal.[105] RLS/PLMS are discussed further in the Glossary of diagnoses associated with insomnia. A recent review and practice parameter paper are available for reference.[106,107]

2. Respiratory distress. Snoring, dyspnea, choking, gasping and other forms of respiratory distress have been associated with insomnia complaints in patients with respiratory disease.[4,45,48,49,108,109] Investigations of the etiology of insomnia indicate that 0-15% of chronic insomnia cases are related to some form of breathing disturbance.[110-115] Bliwise and colleagues[116] did not find insomnia to be associated with increased risk for sleep apnea. Other investigators[117] identified no relationship between mild/moderate apnea and subjective sleep disturbance in older persons. Roehrs[109] found that sleep apnea patients with insomnia complaints demonstrated fewer, briefer, and more predominantly central events. The subject of insomnia as an indication for polysomnography in suspected sleep apnea patients has been reviewed elsewhere.[16,118]

3. Nocturnal panic attacks. Investigations indicate a high frequency of subjective insomnia complaints among nocturnal panic attack sufferers.[119,120] With one exception,[121] studies of objective sleep parameters indicate prolonged sleep latency and decreased sleep efficiency.[122-127] However, these studies do not clearly establish a causal role of the panic attacks, per se, in the genesis of insomnia.

4. Pain. Pain is frequently associated with sleep disturbance in epidemiological studies.[4,49,128,129] Studies of specific populations reveal strong correlations between pain and complaints of sleep disturbance in rheumatic disorders,[130-134] other musculoskeletal pain conditions,[135] pain clinic attendees,[136] and traumatic brain injury patients.[137] However, Morin and Gramling[138] found that pain was not a distinguishing factor in a geriatric insomnia group. Insomnia may represent a marker for increased psychological distress among pain patients.[136] Physiological studies of sleep in pain patients document disturbance in sleep efficiency/continuity,[135,139,140] increased arousal,[132,141] and the presence of periodic limb movement.[139,140,142] Evaluation of the relationship between chronic pain and sleep disturbance must also take into account the role of intervening variables, especially depression.[131,136,143]

5. Headaches. The relationship between headache and sleep disturbance is complex with bi-directional cause and effect. Current literature documents poor sleep in chronic headache sufferers,[144] as well as a relatively high frequency of specific sleep disorders in those with nocturnal or morning headache.[145,146] Acute/recurrent insomnia may be related to episodic headache.[58]

6. Gastro-esophageal reflux disease (GERD). Nocturnal reflux episodes may arise during sleep but are most prominent in association with waking or transient arousals from sleep.[147] Such episodes may also induce abrupt arousals.[148] Evidence regarding sleep architectural changes and sleep disturbance in GERD patients is limited but does not indicate major sleep disturbance in this population.[149,150] One epidemiological study suggests an association between insomnia and GERD.[151]

Numerous other nocturnal events/symptoms, including environmental noise, nightmares, partial arousal disorders, REM behavior disorder, nocturnal seizure, nocturia/enuresis, sleep paralysis and hypnagogic/pompic hallucinations may contribute to sleep disruption.[71,152]

4.3 Reports from bed partners

Bed partners/roommates are potential sources of information regarding quantity and quality of sleep, daytime consequences, and occurrence of nocturnal events such as those described in Section 4.2. However, there is little information available regarding the reliability or utility of such data in the evaluation of insomnia. Five articles were

identified which compare observer reports to objective findings. Four of these focus exclusively on sleep-related respiratory disorders.[153-156] This literature indicates significant correlation between bed partner reports of respiratory events and polysomnographic findings although one report suggests low correlation.[156] Other data indicate moderate agreement between self-and roommate responses to a sleep questionnaire addressing a variety of symptoms, but agreement on symptoms of sleep disturbance was low (kappa=.08).[157] Domino[20] found a mean correlation of .66 between spouse and normal subject reports for 18 sleep variables while Lacks[158] describes high correlations (.84-.99) for insomniac/spouse estimates of sleep latency.

4.4.0 Daytime consequences

As previously discussed, the clinical significance of insomnia is heavily influenced by the extent to which it affects daytime functioning (see section 3.1). Complaints of inadequate sleep in the absence of any residual daytime effects or distress do not indicate significant insomnia. More typically, insomnia sufferers express significant concern about the adverse effects of sleep disturbances on psychosocial, physical, and occupational functioning, most commonly characterized by fatigue/lethargy, mood disturbances, cognitive inefficiency and motor impairments, social discomfort, and nonspecific physical ailments.[85,89,152,159-162] According to the Gallup survey, Sleep In America:1995,[6] chronic insomniacs report more difficulty in accomplishing needed tasks during the day than good sleepers, have more difficulties coping with minor irritations and report less enjoyment of family and social relationships. They also feel less well physically and have lower mood ratings.

4.4.1 Sleepiness/Fatigue

Despite the considerable concern registered by insomniacs regarding daytime function, there may be significant discrepancies between the perceived consequences of insomnia and their objective manifestation. Epidemiological studies demonstrate an association between insomnia and subjective daytime sleepiness.[37,40,163,164] Investigations of subjective sleepiness in defined insomnia groups reveal mixed results. The Stanford Sleepiness Scale (SSS)[165] is a self-administered, seven point rating scale, which assessess the degree of sleepiness. Of seven controlled studies which included SSS assessment in insomnia populations, four found no difference between the insomnia group and controls.[31,166-169] Schneider-Helmert[170] reported increased subjective sleepiness in insomniacs and Lichstein[168,171] found SSS scores mildly elevated, although considerable overlap with non-insomniacs was reported. Two of three investigations employing the Epworth Sleepiness Scale (ESS)[172] demonstrated associations between insomnia and increased ESS scores,[163,173] while another found insomniacs to have the lowest subjective sleepiness scores compared to patients with other sleep disorders (sleep apnea and primary hypersomnolence) and controls.[172] Reports of increased fatigue have been documented and quantified in insomnia.[162,174,175]

4.4.2 MSLT/Pupillometry

Subjective reports of sleepiness from insomniacs are generally not corroborated by objective assessment with Multiple Sleep Latency Test (MSLT) or pupillometry assessment (See Table 4). Of nine studies comparing MSLT findings in insomniacs and controls, all but one show no difference in mean daytime sleep latencies or a trend toward higher latencies (i.e. less sleepiness) in insomniacs.[27,31,166,167,169,176-178] Investigations which include subjects with sleep state misperception (SSM) suggest that their mean latencies may be intermediate between objective insomniacs and controls.[27,31,179] The report of Edinger and colleagues[180] indicates that insomniacs were slightly sleepier than controls after home study, although the difference was not significant. Consistent with the above studies, the opposite trend was observed after lab-based PSG. It is also noteworthy that normal subjects with experimentally-induced "insomnia" (objective sleep parameters matched to those of clinical insomniacs) show significantly lower sleep latencies on the MSLT than the insomniacs.[176]

Pupillometry measures pupil diameter and oscillations as an involuntary, objective indicator of daytime sleepiness. Two of three pupillometry studies of insomniacs indicated statistical discrimination of that group from controls, although it was the authors' conclusion that the substantial overlap between groups would not allow for meaningful functional discrimination of insomniacs in a clinical setting.[168,171] Neither of these studies employed PSG as objective confirmation of insomnia. A third pupillometry study demonstrated no distinction between insomniacs and controls.[167]

Chronic insomniacs display higher levels of arousal than good sleepers, both during the day[74] as well as at night.[181] Instead of being truly sleepy, they may be mislabeling their internal state, which might be more accurately described as fatigue, lethargy, or tiredness. Thus, it is important to clearly distinguish between true sleepiness and fatigue when assessing the impact of insomnia on alertness.

4.4.3 Neuropsychological Assessment

Neuropsychological measures of cognitive and psychomotor function (e.g. vigilance/ concentration, motor speed and accuracy, memory, reasoning) have been extensively employed in research settings as a measure of the clinical significance of insomnia and its consequences (See

Table 5). Although the negative impact of prolonged sleep deprivation in otherwise normal sleepers is well-documented,[182] the effect of disturbed sleep on clinical insomniacs is less clear. As indicated in Table 5, many studies show no significant difference between insomniacs and controls.[29,169,176,183-186] Others show limited deficits in vigilance,[27,31,170] or psychomotor function.[166,187-190]

In interpreting these results, several issues must be considered: 1) Many of the studies cited rely on recruited subjects rather than referred patients. In light of the findings of Stepanski and colleagues[162] which demonstrate that recruited subjects differ significantly from referred patients, such studies may not be truly representative of clinical populations; 2) Edinger and colleagues[180] demonstrated that performance assessment differs depending on the site of the previous night's study. Insomnia subjects performed worse following home study and better following lab PSG nights; 3) Sleep quality does not appear to correlate well with next day performance within individuals[187] and, in a similar vein, those patients with subjective insomnia, (i.e. no objectively demonstrable sleep disturbance) seem to perform no better or, in at least one case, worse than those with objective insomnia.[29,31] Bonnet and Arand[176] demonstrated that experimentally-induced sleep disturbance, matched to the degree of sleep disturbance in objective insomniacs, failed to produce significant performance decrements.

The absence of consistent deficits in this area suggests that either the current assessment methodology is not sensitive enough to detect impairments or that insomniacs amplify the adverse effects of disturbed sleep. Alternatively, it may also be the case that under mild sleep deprivation most individuals are able to sustain performance in a time-limited testing situation. Regardless, it is clear that insomniacs are frequently prompted to seek treatment because of their concerns regarding the negative impact of their sleep disorder on daytime function, health, and quality of life.[162] In light of this, these concerns necessarily form an important component of the evaluation.

4.5 Previous treatment trials/outcome

Inquiry about previous interventions and outcome can reveal important information for guiding treatment planning. The type, duration, and effectiveness of treatment received should be determined first. Current evidence suggests that nearly half of the chronic insomnia patients who take sleeping pills derive little or no subjective benefit from hypnotic usage, although they continue to take such medications on a daily basis for years.[36] For unmedicated patients, it is important to gauge their acceptance of pharmacological and behavioral therapies. The patient's preference for a particular regimen may influence compliance and treatment outcome.[193] The clinician should also examine whether previous interventions have received a fair trial (e.g., structured and supervised implementation, ongoing follow-ups, sufficient duration to expect therapeutic benefits) and what factors may have accounted for treatment failures (e.g., side effects, lack of therapeutic effects, noncompliance).

4.6 Self-report assessment devices

Sleep logs, questionnaires, and other self-report devices are useful to gather preliminary information about the nature of insomnia and its potential contributing factors. A listing of these assessment devices and their characteristics is included in Tables 6 and 7. The more specific of these instruments have been utilized only in the original study for which they were designed.

Sleep logs/diaries are widely employed in clinical research and practice. These logs typically include entries for bedtime, rising time, sleep latency, number and duration of awakenings, sleep duration, naps, use of sleep aids, and various indices of sleep quality and daytime functioning.[85,194] Of 20 studies which specifically evaluated the use of sleep logs or their correlation with other measures, 14 include data on insomniacs (See Table 6). Five of these employed normal sleepers as controls.[25,72,195-197] Nine of these studies report comparisons between logs and PSG or actigraphy.[24,25,30,72,135,195,198-200] These studies all report modest to poor correlations between subjective reports and objective findings. They suggest a tendency to underestimate total sleep time and overestimate sleep latency.[24,25,30,72,158,196,199,200] Two studies with controls demonstrated significant discrimination of insomniacs from normal sleepers by logs.[196,197] The reports of Lacks[158] and Mullington[201] indicate that a one week log duration is adequate, although other data suggests that a minimum of two weeks is necessary to minimize variability in treatment outcome studies.[202]

In as much as the tendency to overestimate sleep latency and time awake and to underestimate total sleep time and efficiency is a well-recognized aspect of insomnia (See Section 3.1) it is not surprising that the correlations between subjective and objective measures are not high. Given this discrepancy, sleep logs may be better indicators of patient perception of sleep disturbance than they are reflective of true, quantitative sleep abnormalities. Nevertheless, these patient perceptions may well represent as valid an index of insomnia as objective assessments and may be more accurate than a single, global, and retrospective estimate of sleep pattern.[24,205,207,210]

Sleep questionnaires (See Table 7) typically address more global estimates of sleep quality, specific sleep characteristics and behaviors, symptoms and attitudes pertaining to sleep. These questionnaires demonstrate high global test-retest correlations.[20,211-214] Of the five studies which included insomniacs/poor sleepers and normals, all show significant discrimination between groups.[20,161,212,215,216]

The most widely employed of these questionnaires also demonstrate significant correlation with polysomnographic findings[215] or PSG generated diagnoses.[212] The Pittsburgh Sleep Quality Index[215] has been applied in a variety of settings to measure sleep quality in the elderly,[217-220] in anxiety disorders,[120,221] in mood disorders,[222] in response to stressful events,[223,224] in obstructive sleep apnea,[225] HIV,[226-228] and caffeine use,[229] as well as to measure treatment response.[230-234]

Other instruments which assess a variety of sleep-related variables are also described in detail in Table 7. Six scales identified demonstrated discriminant ability between insomniacs and normals[74,75,95,246,247] or insomniacs and patients with other sleep disorders.[172]

4.7 Psychiatric and psychological assessment

Psychiatric conditions are highly prevalent among insomnia sufferers (See Table 11) implying that such conditions may play an important role in the development and perpetuation of insomnia symptoms. Numerous epidemiological studies define a high degree of association between chronic insomnia and psychiatric illness.[37,39,46,248] Specifically, these studies indicate high rates of past or present psychopathology in patients with insomnia, as well as increased risk for development of new psychiatric illness, as determined by longitudinal analysis.[46] In the absence of formal psychiatric diagnostic criteria, these epidemiologic studies often indicate a statistical association with "anxiety/tension" or "depression".[1,2,6,36,43,51]

Formal psychiatric assessments of insomnia patients utilizing specific diagnostic criteria for mental disorder (DSM III/DSM IV) likewise show high rates of psychopathology. Tan and colleagues[115] reported an Axis I or II psychiatric disorder as a primary diagnosis in 95/100 insomnia patients. Buysse and others[249] investigated establishment of diagnosis in insomnia patients by specialists and non-specialists (See Section 5.0) and found that both groups ranked a psychiatric diagnosis as primary in about 45% of cases. The median kappa value for agreement between sleep specialists and non-specialists was .42. The most common area of disagreement was between "insomnia due to mental disorder" and "primary" (psychophysiologic) insomnia, suggesting that this represents an area of diagnostic ambiguity. This ambiguity is underscored by one investigation in which structured psychiatric interview revealed high rates of psychiatric diagnoses (48%) in putative psychophysiologic insomnia patients.[250]

Psychiatric evaluation of the patient customarily includes a history of the present illness, past and present psychiatric history and current psychiatric complaints, prior psychiatric treatment and outcome, substance use, family psychiatric history, and medical history, as well as developmental, social, sexual, and occupational history and mental status exam.[251] The high rates of mood disorder, followed in frequency by anxiety and substance abuse disorders,[110,113,115] indicate that these areas deserve particular attention.

The use of structured psychiatric or sleep interviews, although most often employed in research settings, may assist in the identification of psychiatric disorders in insomnia patients.[252,253] Application of structured interviews in the evaluation of insomnia produces not only significant rates of psychiatric diagnoses (46-48%) but high interrater agreement (91%) as well.[250,253] Psychiatric screening and diagnostic tools developed for use in primary care settings have demonstrated utility, reliability and validity in the identification of mood, anxiety, and substance abuse disorders in primary care populations.[254-259] The most extensively evaluated instrument, Primary Care Evaluation of Mental Disorders (PRIME-MD), is a two-step process (questionnaire/interview) which requires less than ten minutes of physician time and which yields significant rates of previously unidentified psychopathology.[254]

The main objectives of psychological assessment in the context of insomnia evaluation are to: (a) examine for the presence of comorbid psychiatric disorders; (b) quantify the intensity of psychological symptomatology and of emotional distress; (c) monitor the temporal course of psychological distress as treatment unfolds; and (d) predict outcome. Results of psychological assessments are included in Table 8.

Minnesota Multiphasic Personality Inventory (MMPI)

Twelve of thirteen studies comparing insomniacs to normals demonstrated significantly higher scores on one or more scales of the MMPI in the insomnia group.[23,27,28,72,170,181,260-265] Scales most commonly elevated in these studies include (D) depression, (Hs) hypochondriasis, (Hy) hysteria, and (Pt) psychasthenia. Eight additional studies without normal controls showed that 56 - 86% of subjects had at least one elevated scale by defined MMPI norms. These MMPI findings suggest a pattern of internalized emotion, obsessive rumination, anxiety, depression and a tendency to somaticize psychological conflict.[72,266]

Several other findings emerge from these MMPI studies: 1) cluster analytic studies utilizing MMPI data identify distinct sub-groups of insomniacs;[73,267] 2) two investigations have revealed an association between degree of psychopathology on MMPI and severity of sleep disturbance[268,269] although Shealy and colleagues[260] found no relationship between severity or chronicity and MMPI results; 3) Two studies[270,271] found no evidence of increased psychopathology on MMPI in an older population of insomniacs; 4) Vgontzas[272] found that MMPI criteria provided better discrimination between insomniacs and controls than did polysomnographic criteria. This observation is consistent with the concept that psychological variables

(reflecting baseline personality traits or, possibly, response to the insomnia) define chronic insomnia better than objective measures of sleep.

Although the MMPI is self-administered and computerized scoring and interpretation programs are available, it is time-consuming and training is required to make appropriate clinical interpretations. While it is clearly a tool which has been widely used by researchers and clinical specialists in the evaluation of insomnia, its widespread application as a routine assessment procedure in evaluation of insomnia by non-specialists seems impractical.

Profile of Mood States (POMS)

The Profile of Mood States (POMS) was administered to insomniacs and controls in seven identified studies. Four of these reveal significant elevations of one or more scales, most commonly tension, depression, anger and fatigue.[27,42,72,162] Seidel[169] reported a similar but non-significant trend, while two investigations found no significant difference between insomniacs and controls on any scales.[28,31] Bonnet and Arand[176] demonstrated that one week of experimental sleep deprivation (matched to the sleep patterns of insomnia patients) produced increased tension, depression and anger scales. Other psychometric evaluations demonstrate a clear tendency toward increased anxiety[72,93,94,264,265,275] and depression.[31,264,265,275]

Discussion

Interpretation of studies involving psychological assessment of insomnia patients is complicated by several factors. It is critical to recognize that the term "insomnia" describes a heterogeneous condition and, therefore, considerable variation may exist within the defined "insomnia" populations in these investigations. The data of Stepanski and colleagues[162] demonstrates that referred patients scored significantly higher than recruited insomniacs on multiple MMPI and POMS scales. Inasmuch as 18/28 MMPI studies were based entirely or in part on recruited insomniacs, these reports may, to some extent, underestimate the degree of psychopathology which may be present in a clinical population. These studies also vary in the extent to which they exclude patients with diagnosed psychiatric disorders or physiologic sleep disorders such as sleep apnea or periodic limb movement disorder. However, 7/8 controlled studies which specifically excluded patients with psychiatric diagnoses still demonstrated significant differences between insomniacs and normals. Kalogjera-Sackellares and colleagues[273] found no difference on MMPI scales between "medically-based" and "psychologically-based" insomniacs. Therefore, in spite of the considerable heterogeneity of populations, it seems reasonable to conclude that a significant degree of psychopathology does exist in insomnia sufferers, although it should be emphasized that not all patients demonstrate such psychological disturbance.

Demonstration of psychological disturbance on the MMPI or other psychological assessments does not constitute clear evidence that such disturbance is a primary cause of insomnia. Rather, it may be argued that psychopathology is secondary to the effects of a chronic health problem, rather than causative of the disturbance.[170] However, assessment of patients with sleep state misperception/subjective insomnia (i.e. no objectively demonstrable sleep deficit) manifest similar psychological findings,[27,28,274] suggesting that sleep deprivation itself is not the cause of this psychopathology. Similarly, Bonnet and Arand[176] demonstrated that experimental induction of "objective insomnia" (i.e. sleep disturbance matched to that of true clinical insomniacs) did not produce the psychopathology seen in the true insomniacs. Therefore, it appears unlikely that sleep deprivation, per se, is causative of psychological disturbance. Rather, the evidence more strongly suggests that psychological disturbance and associated hyperarousal play a key role in the genesis and maintenance of chronic insomnia.

A more focused approach to psychological assessment is to use brief self-administered instruments that target specific psychological features (e.g. emotional distress, anxiety, depression) which may be associated with insomnia.[276] Information regarding the more commonly used measures is included in Table 9. These instruments provide valuable baseline data about the intensity of symptoms and can be administered at repeated intervals for clinical correlation of mood and sleep pattern improvements.[85,277] Because self-report scales may be subject to bias resulting from a patient's denial or exaggeration of symptoms, they should complement and not replace an in depth clinical interview.

4.8 Medical assessment

Data from epidemiological studies suggest that there is an association between poor physical health and insomnia.[4,5,32,36,38,40,45,49,51] However, there have been no systematic or controlled studies which have explored the potential benefit derived from comprehensive medical history, physical examination, and diagnostic laboratory procedures in the assessment of insomnia. Certain medical conditions are known to be associated with chronic sleep disturbance (See Glossary: Insomnia secondary to medical/neurological disorder) while numerous prescribed and recreational substances have also been associated with sleep disruption (See Glossary: Extrinsic disorders - substances). The diagnostic yield of specific laboratory tests in the assessment of insomnia has not been critically evaluated in the literature.

4.9 Psychophysiologic Evaluation

Psychophysiologic evaluation entails assessment of a variety of physiological functions and their relationship to psychological states, cognition, behaviors and symptoms. In the case of insomnia, these assessments have typically been conducted in an effort to identify the mediating role of heightened somatic arousal in insomnia. The most commonly employed measures are heart rate, temperature, muscle tension and skin conductance. More recently, 24 hour metabolic rate has been utilized as a global measure of arousal (see Table 10). Four studies demonstrated significantly elevated heart rate in insomniacs or poor sleepers compared with normal sleepers during the pre-sleep period or in response to stress.[91,181,283,284] Other investigations revealed no significant difference in heart rate.[183,263] Core temperature was significantly increased during sleep in three studies,[176,183,263] while others failed to demonstrate significant elevation in insomniacs.[242] Freedman and Sattler[181] demonstrated increased frontalis EMG in a group of sleep-onset insomniacs. Limited investigations of vasoconstriction and finger temperature have yielded mixed results.[181,263]

Bonnet and Arand utilized 24 hour metabolic rate as a global measure of hyperarousal.[27,176,191] These studies demonstrate significantly increased metabolic rate among insomniacs compared to normal sleepers. The increase in metabolic rate is not dependent on the sleep deprivation, per se, as it is not observed in normals following experimental induction of an insomniac sleep pattern,[176] but is seen in subjects with sleep state misperception who have no objective sleep disturbance.[27] This evidence suggests that hyperarousal, as measured by metabolic rate, is an inherent psychophysiologic component of insomnia and, as such, may represent the basis for many of the complaints related to this condition.

Recent research has shown higher physiological reactivity to stressors and longer time to recover from exposure to such stressors in insomniacs relative to good sleepers.[285] Paradoxically, there is little evidence of a process-outcome relationship between lowered arousal during therapy sessions and improvement of sleep patterns.[92]

Psychophysiological assessments are limited by availability of necessary hardware and expertise and, as a result, are often not practical in the general clinical practice setting. A simpler approach to evaluation of hyperarousal in insomniacs is the Hyperarousal Scale developed by Regestein and colleagues.[74] This scale, a 26 item self-administered questionnaire, demonstrated clearly increased scores for insomniacs with little overlap between a group of 20 primary insomniacs and 20 controls.

5.0 SUBTYPES AND DIAGNOSIS

Two major diagnostic systems for sleep disorders are currently in use. The International Classification of Sleep Disorders nosology[18] is a highly specific system which includes approximately 42 diagnoses which may be associated with an insomnia complaint. The ICSD uses a multiaxial approach and includes major sections for dyssomnias, parasomnias and secondary sleep disorders due to psychiatric disorder, medical illness, or substance use, with numerous specific diagnoses contained within each section.

The Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition,[286] although less detailed than ICSD, maintains the essential division between primary dyssomnias, including insomnia, and those disorders secondary to other psychiatric or medical conditions. Primary insomnias are not subtyped in DSM-IV,[26] although mention of ICSD subtypes is included in the text. Buysse and colleagues[249] assessed interrater agreement (between sleep specialists and non-specialists) across five sites for DSM-IV sleep disorder diagnoses in 216 patients. Their data indicate a moderate level of agreement (kappa values .35 - .56) for first diagnosis between specialists and non-specialists. Substantial differences in frequency of diagnoses were seen across sites. Interviewers generally rated ease of use of the classification system, diagnostic fit, and confidence in a good to excellent range. In a related report, Buysse and others,[287] utilizing DSM-IV diagnostic categories, were able to demonstrate that non-sleep specialists could recommend distinct treatment approaches (including specific interventions for insomnia) based on different diagnoses. These findings suggest that the DSM-IV nosology distinctions have practical therapeutic impact for non-specialists. Schramm and colleagues[253] employed a structured interview based on DSM-III-R which classified insomnia as primary or secondary to other mental disorders or "organic" factors. This interview, the Diagnostic Interview for Sleep Disorders (DIS-D), is a 20-30 minute structured inquiry regarding general health, medications, substance use and psychiatric history, coupled with specific screening questions for major sleep disorders and sleep-related symptoms. Their results demonstrate high interrater reliability (mean kappa=.77) and good agreement between SIS-D generated diagnoses and PSG diagnoses (90% concordance). They suggest that such an interview can be effectively used by generalists, although the number of non-sleep specialist interviewers was small and further study would be necessary to conclusively demonstrate its applicability for generalists. Comparison of the DSM-III-R nosology to ICSD in a cluster analysis study utilizing questionnaires and PSG yielded 14 sub-types which corresponded, to a moderate degree, to DSM-III-R and ICSD diagnostic groups.[288] However, the analysis suggests that the greater specificity of ICSD diagnoses did not significantly enhance characterization of the clusters.

The ICSD has been broadly accepted by sleep disorders specialists who possess the knowledge and expertise which may be necessary to comfortably utilize this more detailed approach. It may be argued that this level of detail is

unwieldy and unnecessary for non-sleep specialists. The most appropriate choice is dictated by a number of considerations which include ease of use by the diagnostician, reliability achieved by a given system, correlation with polysomnographic results, and, ultimately, impact on application of treatment and outcome.

An essential first step in the evaluation of insomnia is for the practitioner to recognize that insomnia is a symptom, not a diagnosis. Beyond this fundamental principle, the clinician should be familiar with the concept of dyssomnias, which include primary insomnia (psychophysiologic, idiopathic, and sleep state misperception) and other primary sleep disorders which may present with an insomnia complaint (e.g. periodic limb movement or circadian rhythm disturbances). These must be distinguished from insomnia which is secondary to psychiatric or medical conditions or substance use. At present, most general clinicians probably lack exposure to or awareness of either diagnostic system for sleep disorders.

5.1 Diagnoses associated with insomnia complaints

Many sleep disorders may include a complaint of insomnia. Large scale epidemiological studies of the prevalence of specific sleep disorders among insomniacs, other than those attributable to psychiatric disorders, are lacking. One epidemiological study performed by telephone interviews demonstrated high rates of mood and anxiety disorders, as well as primary insomnia, among interviewees dissatisfied with sleep quality.[37] Most of the available data is that obtained from insomniacs evaluated in sleep disorders centers.[110-113,288,289] Table 11 lists diagnoses in insomnia populations based on questionnaires, interviews, and polysomnography. Although significant disparities exist in the frequency of certain diagnoses between studies and, in the case of multi-site studies, between centers, there is reasonable uniformity regarding the frequency of psychiatric diagnoses (about 30-50%) and psychophysiological insomnia / inadequate sleep hygiene (15-20%).

Specific diagnoses associated with a complaint of insomnia are listed in the Glossary of diagnoses, with pertinent references.

6.0 TECHNICAL DEVICES/EVALUATION

6.1 Use of polysomnography in the diagnosis of insomnia

There has been considerable controversy concerning the diagnostic use of polysomnography in insomnia.[87,88,113,114,250] The current American Academy of Sleep Medicine reports on polysomnography in the diagnosis of insomnia[15] and indications for polysomnography and related procedures[16,118] provide specific recommendations regarding this topic. In summary, the reports conclude that: 1) polysomnography is indicated in cases in which sleep-related breathing disorders or narcolepsy are suspected, or in cases where violent behavior or unusual parasomnias are present; 2) polysomnography may be indicated when sleep-related manifestations of certain neurological conditions are present, or when periodic limb movement is strongly suspected; 3) polysomnography is not routinely indicated for diagnosis of circadian rhythm disorders, restless legs syndrome, diagnosis of certain psychiatric conditions, uncomplicated parasomnias, or seizures without sleep complaint; 4) polysomnography is not routinely indicated in evaluation of transient or chronic insomnia, with the possible exception of cases in which there is diagnostic uncertainty or when treatment interventions have proven unsuccessful.

6.2 Actigraphs and other sleep assessment devices

Actigraphs are small, watch-like devices worn on the wrist to record movement. These devices have been used to assess insomnia. This subject has been reviewed elsewhere[290] and specific recommendations have been issued regarding their use.[291] In summary, these conclusions state that: 1) actigraphy is not indicated in the routine diagnosis of any sleep disorder including insomnia; 2) actigraphy may be useful as an adjunct to other assessment procedures in the evaluation of insomnia; 3) actigraphy may be effective in assessment of sleep-wake patterns when such information is not reliably available by other means such as sleep logs.

Ambulatory or home monitoring devices which are designed primarily for screening of respiratory disturbance in sleep have been reviewed elsewhere[292] and specific guidelines have been issued regarding their use.[293] Instruments which record EEG as well as respiratory and leg movement channels (ambulatory polysomnography) have undergone limited reliability testing outside of their application in sleep apnea patients. Ancoli-Israel et al.[294] compared in-lab polysomnography to simultaneous portable recordings and to in-home recording. They reported 9/36 home recordings and 8/36 portable lab recordings were lost due to technical failure. However, others have reported much better data acquisition in sleep disorder patients,[295,296] and in normals.[297] Ancoli-Israel et al[294] described significant correlations between PSG and portable recordings (in-lab) for sleep duration (r=.82), wake after sleep onset (.61), periodic limb movement (PLM) (.64), and apnea (.80). Across night comparisons showed lower but significant correlations, except for PLM.

Edinger[114] described the use of ambulatory PSG in evaluation of 100 patients with chronic insomnia. They reported that 34% had PSG-dependent diagnoses, while the home assessments yielded useful diagnostic information in 65% of patients. In a later investigation, Edinger and colleagues[296] found significant night-to-night variability in

home PSG's of 20 insomnia patients. They advise that, while a one night recording may be sufficient to rule out specific disorders (e.g. sleep apnea or periodic limb movement), more nights may be necessary to accurately characterize the sleep disturbance of this population. Zucconi and colleagues[250] utilized a structured interview and ambulatory PSG's in an effort to differentiate sub-groups of insomnias and found that the interview provided better discrimination.

Home monitoring has been employed to assess first-night effect in insomnia,[296,298,299] sleep parameters in insomnia associated with psychiatric disorders,[250,300] and treatment response.[300-302]

Static-charge-sensitive beds (SCSB) record bodily movement as well as respiratory and cardio-ballistic activity in sleeping subjects.[303] Eight references were identified which contained original data on sleep assessment in adults with SCSB. Of these eight, four contained information regarding correlation of SCSB data with nocturnal or daytime physiological assessment. SCSB has been used to investigate sleep in shift workers,[304] mood disorders,[305] fibromyalgia,[306] and insomnia/poor sleep.[307] Analysis of the correlation between sleep scoring utilizing conventional sleep EEG and a system based on SCSB results reveal variable results, dependent in part on the level of scoring detail defined (sleep vs. wake, nREM/REM/wake, specific nREM stages).[308,309] These studies show agreements ranging from 52%-75% for full sleep staging to 86-98% for awake vs. asleep classification.[308] Salmi and Leinonen[309] demonstrated 81% correct classification using a wake/quiet sleep/REM system. Increased daytime psychophysiological arousal and psychological distress were associated with increased nocturnal movement activity[310]

7.0 SPECIAL POPULATIONS

7.1 Children and adolescents

The assessment of sleep disturbance in children differs substantially from the evaluation in adults. The reader is referred to reviews for additional information.[311-313]

7.2 Elderly

Awareness of sleep disorders is especially important when working with the elderly because of the frequency of insomnia complaints and the increased prevalence of specific physiological etiologies. Epidemiologic investigations indicate the prevalence of serious insomnia complaints in the elderly to be in the range of at least 20% - 40%[1,32,49,50] (See Table 2). The seriousness of this problem is underscored by the disproportionately high use of hypnotic medications in older age groups.[32,81,314]

An evaluation of insomnia in this age group must begin with an understanding of the changes in sleep physiology associated with aging.[315] Numerous studies have described the age-related decrease in sleep efficiency, increase in nocturnal awakenings, lengthier awakenings, and increased time in bed.[316-318] Distribution of sleep stages typically reveals an increase in Stage 1 sleep and decreased slow-wave sleep.[319] Daytime napping may be increased.[217,320,321] The relative redistribution of sleep across the 24-hour period suggests that aging may be associated with a dampening of the normal circadian sleep-wake rhythm.[217,322] Bedtimes and waketimes approximately 0.5 - 1 hour earlier than those of younger subjects (phase advance) are also characteristic of older populations.[204,320,323,324] In the clinical setting it may be difficult to reliably determine where the "normal" changes in sleep physiology end and pathology begins. On the one hand, practitioners must recognize that some alteration in quality may be an inevitable part of aging and that education, support, and sleep hygiene are the best remedies for complaints related to these changes. On the other hand, it is unwise to routinely assume that poor sleep in the elderly is secondary to physiologic change without consideration of pathological causes.

In many cases sleep disturbances in the elderly may represent a complex interaction of age-related change and sleep disorders.[315] Medical and neurologic causes of insomnia are discussed in Section 4.8 and are increasingly important with advancing age. Pain, cardiovascular disease, pulmonary disease and urinary problems are frequently associated with insomnia in the elderly[49] as are various neurological disorders, especially degenerative disorders associated with dementia and related complications such as sundowning.[49,325-329] In light of the large number of medications taken by many older persons, a careful history of all prescribed and over-the-counter drugs is warranted. Alcohol and drug use were a leading cause of insomnia in persons over the age of sixty in one investigation.[111] Abuse of sedative-hypnotic compounds is of particular concern in the elderly because of the high rate of prescribing[32,81,330] and the potential for delayed metabolism and accumulation,[331] aggravation of cognitive or motor difficulties,[332,333] or worsening of sleep-related breathing disorder.[334,335] Rebound insomnia associated with the use of shorter-acting hypnotics in the elderly may help to perpetuate the cycle of sleep disturbance and chronic hypnotic usage[336] (see Glossary).

Along with substance use and cognitive impairment, depression and anxiety are the most common psychiatric disorders associated with insomnia in older individuals. Studies concerning the prevalence of psychiatric disorders among elderly insomnia patients show considerable discrepancy - from a low of 6%[111] to a high of 47%.[337]

Consideration must be given to aspects of sleep hygiene and environment which have a particular bearing on insomnia of later life. Isolation, and the corresponding absence of Zeitgebers (time/schedule cues), may contribute to dys-

regulation of the sleep-wake cycle and development of insomnia.[338] In the extreme, a completely irregular sleep-wake pattern may emerge. Changes in environment, such as hospitalization or other institutionalization, can also have a devastating impact on sleep in the elderly.[59,339,340] Components of these changes, such as alteration of schedules, loss of supports, anxiety and environmental factors (e.g. noise or light) must be evaluated.

Finally, any assessment of insomnia in the elderly must take into account the substantial increases in prevalence of sleep-related breathing disorders and RLS/PLMD in this population. Numerous studies document the high prevalence of sleep apnea in elderly persons with and without sleep complaints.[341-344] Excessive sleepiness is a well described complication of obstructive apnea, but the extent to which sleep-related breathing disorders may be associated with insomnia complaints in the elderly is less clear. Sleep apnea, especially of the central variety, has previously been associated with insomnia.[109,345] However, Mant and colleagues[343] found no statistical correlation between mild to moderate apnea and subjective complaints of nocturnal sleep disturbance. Roehrs and others[111] reported that sleep related respiratory impairment (undefined) was the identified cause of an insomnia complaint in only 4% of those over age sixty. Without question, co-existing complaints of excessive sleepiness and snoring should raise the index of suspicion for a sleep-related breathing disturbance as the cause of insomnia complaints. Concurrent use of hypnotics in the elderly should also be of concern to the clinician as a potentially complicating factor.[334,335]

PLMD and RLS are common etiologies of difficulty initiating or maintaining sleep in the elderly. In the study of Roehrs and colleagues, these diagnoses were the most common cause of an insomnia complaint in the elderly, accounting for 33% of all cases. The estimated prevalence of PLMS in the elderly with sleep complaints ranges from 4% to 31%.[111,294,337,346] Higher frequencies of these problems in older patients may reflect an increase in vascular insufficiency, neuropathy, rheumatoid arthritis, renal insufficiency, medication use, caffeine intake, decreased exercise or other factors (see Glossary).

8.0 FUTURE RESEARCH

Before ambitious programs to improve evaluation of insomnia are begun, it is first necessary to demonstrate that such evaluation can produce reliable diagnostic information and, in turn, that specific treatment recommendations follow from these diagnoses. The DSM-IV field trial suggests that this is the case.[287] However, it remains to be demonstrated that these treatments, based on specific diagnoses, produce improved clinical outcome. A new review and practice guideline on nonpharmacologic treatment of insomnia may be helpful on this topic.[347,348]

With respect to the specific components of the evaluation of insomnia, research should be oriented toward providing primary care doctors and associated health care professionals simplified approaches, such as structured interview, and algorithms, which have demonstrated applicability and reliability in the hands of non-sleep specialists. In designing and implementing such instruments, issues of applicability, utility, reliability, and, ultimately, effect on outcome must be considered.

Specific aspects of the evaluation must be further investigated. The use of polysomnography as a diagnostic tool for insomnia is still somewhat controversial.[15,16,87,88,113,114,250] Additional research which examines the accuracy of diagnosis with and without polysomnography would be helpful in better defining the role of sleep studies in the evaluation. Investigations which utilize other means of sleep assessment, such as actigraphy, may lead to more cost efficient means of obtaining necessary data, if evidence supports such use.

There are numerous screening devices which have been utilized for the assessment of psychological factors and psychiatric disorders in patients with insomnia (Table 9). While of great importance and potential utility, these instruments have not been validated in sleep disorders patients who may present a symptom profile partially mimicing those of certain psychiatric conditions, such as depression. Investigations which focus on the identification of primary mood or anxiety disorders by use of screening instruments in those with a chief complaint of insomnia would be helpful.

As previously discussed, no consistent picture of the daytime consequences of clinical insomnia has emerged. The ultimate significance of insomnia lies, at least in part, on in such consequences. Current data seems to suggest that the daytime consequences which are associated with an insomnia complaint may not be due to sleep deprivation but, instead, to hyperarousal which gives rise to both sleep disturbance and waking complaints. To the extent that this is true, it suggests that evaluation and treatment efforts might be most effectively aimed at this underlying arousal. Further research in this area is necessary.

The cost-effectiveness and quality impact of routine medical procedures and laboratory tests in screening for medical etiologies of insomnia should be assessed.

Recent data identifies hyperarousal as a potentially key factor in the genesis and/or maintenance of insomnia. Research which further characterizes the nature of this arousal and its relationship to constitutional, psychological, behavioral and physiological parameters, and which develops methods by which clinicians may identify or quantify this arousal may be diagnostically and therapeutically useful.

Finally, in order for the problem of insomnia to be more effectively addressed in our society, it is necessary that it first be reported by patients and/or identified by physicians.

We know very little about how to accomplish this. A better understanding of the attitudes and knowledge which patients and physicians bring to this issue would be an appropriate place to begin. Such information would provide the necessary foundation for educational efforts among healthcare professionals and the community to improve recognition of insomnia as a legitimate health problem with specific causes and treatments.

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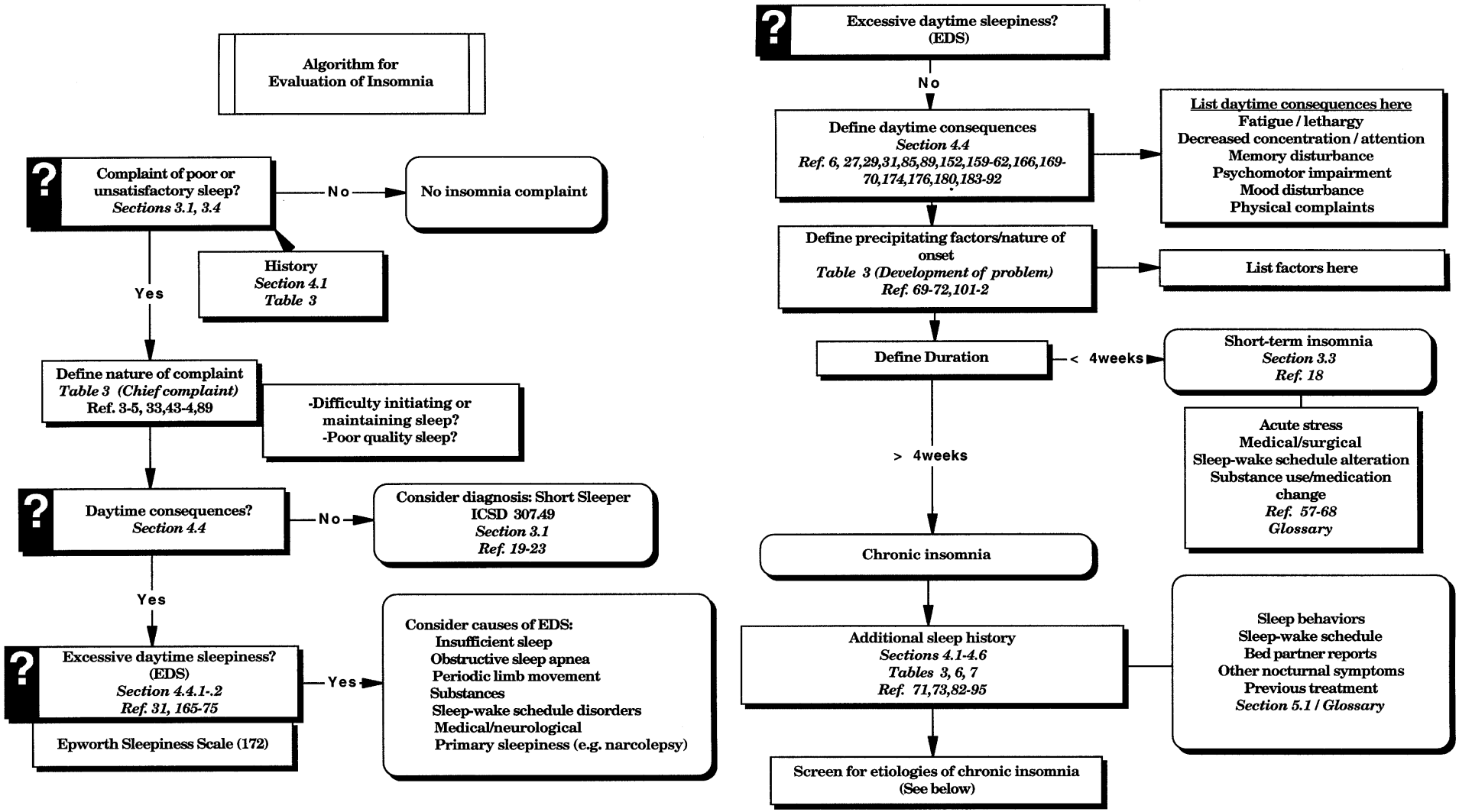
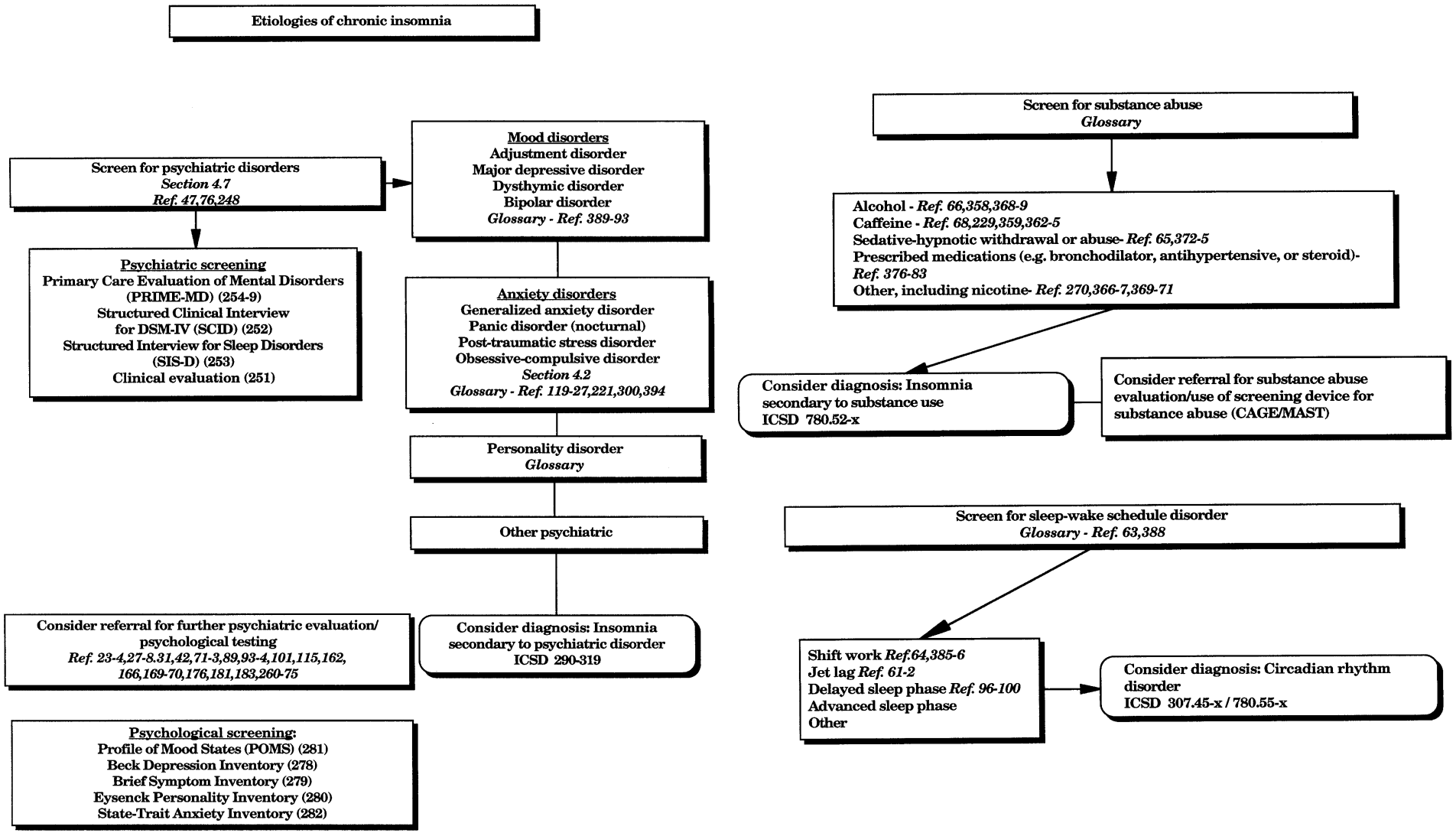

Algorithm for Evaluation of Insomnia
Complaint of poor or unsatisfactory sleep? Sections 3.1, 3.4
No
No insomnia complaint
History Section 4.1 Table 3
Yes
Define nature of complaint Table 3 (Chief complaint) Ref. 3-5, 33,43-4,89
-Difficulty initiating or maintaining sleep?
-Poor quality sleep?
Daytime consequences? Section 4.4
No
Consider diagnosis: Short Sleeper ICSD 307.49 Section 3.1 Ref. 19-23
Yes
Excessive daytime sleepiness? (EDS) Section 4.4.1-.2 Ref. 31, 165-75
Epworth Sleepiness Scale (172)
Yes
Consider causes of EDS:
Insufficient sleep
Obstructive sleep apnea
Periodic limb movement
Substances
Sleep-wake schedule disorders
Medical/neurological
Primary sleepiness (e.g. narcolepsy)
Excessive daytime sleepiness? (EDS)
No
Define daytime consequences Section 4.4 Ref. 6, 27,29,31,85,89,152,159-62,166,169-70,174,176,180,183-92
List daytime consequences here
Fatigue / lethargy
Decreased concentration / attention
Memory disturbance
Psychomotor impairment
Mood disturbance
Physical complaints
Define precipitating factors/nature of onset Table 3 (Development of problem) Ref. 69-72,101-2
List factors here
Define Duration
< 4weeks
Short-term insomnia Section 3.3 Ref. 18
Acute stress
Medical/surgical
Sleep-wake schedule alteration
Substance use/medication change
Ref. 57-68
Glossary
> 4weeks
Chronic insomnia
Additional sleep history Sections 4.1-4.6 Tables 3, 6, 7 Ref. 71,73,82-95
Sleep behaviors
Sleep-wake schedule
Bed partner reports
Other nocturnal symptoms
Previous treatment
Section 5.1 / Glossary
Screen for etiologies of chronic insomnia (See below)


Etiologies of chronic insomnia
Screen for psychiatric disorders
Section 4.7
Ref. 47,76,248
Psychiatric screening
Primary Care Evaluation of Mental Disorders (PRIME-MD) (254-9)
Structured Clinical Interview for DSM-IV (SCID) (252)
Structured Interview for Sleep Disorders (SIS-D) (253)
Clinical evaluation (251)
Mood disorders
Adjustment disorder
Major depressive disorder
Dysthymic disorder
Bipolar disorder
Glossary - Ref. 389-93
Anxiety disorders
Generalized anxiety disorder
Panic disorder (nocturnal)
Post-traumatic stress disorder
Obsessive-compulsive disorder
Section 4.2
Glossary - Ref. 119-27,221,300,394
Personality disorder
Glossary
Other psychiatric
Consider referral for further psychiatric evaluation/ psychological testing
Ref. 23-4,27-8.31,42,71-3,89,93-4,101,115,162, 166,169-70,176,181,183,260-75
Consider diagnosis: Insomnia secondary to psychiatric disorder
ICSD 290-319
Psychological screening:
Profile of Mood States (POMS) (281)
Beck Depression Inventory (278)
Brief Symptom Inventory (279)
Eysenck Personality Inventory (280)
State-Trait Anxiety Inventory (282)
Screen for substance abuse
Glossary
Alcohol - Ref. 66,358,368-9
Caffeine - Ref. 68,229,359,362-5
Sedative-hypnotic withdrawal or abuse- Ref. 65,372-5
Prescribed medications (e.g. bronchodilator, antihypertensive, or steroid)- Ref. 376-83
Other, including nicotine- Ref. 270,366-7,369-71
Consider diagnosis: Insomnia secondary to substance use
ICSD 780.52-x
Consider referral for substance abuse evaluation/use of screening device for substance abuse (CAGE/MAST)
Screen for sleep-wake schedule disorder
Glossary - Ref. 63,388
Shift work Ref.64,385-6
Jet lag Ref. 61-2
Delayed sleep phase Ref. 96-100
Advanced sleep phase
Other
Consider diagnosis: Circadian rhythm disorder
ICSD 307.45-x / 780.55-x

Screen for medical disorder
Section 4.8
Glossary
Current medical symptoms
Past medical history
Physical examination
Screening laboratory data
Ref. 354-6,361,395-414
Consider diagnosis: Insomnia secondary to medical disorder
ICSD Multiple codes
Screen for primary insomnia
Glossary - Ref. 26
?
Evidence of childhood onset
Ref. 101-2
Consider diagnosis: Idiopathic insomnia
ICSD 780.52-7
Screen for sleep-related physiological disorder
?
Evidence of observed normal sleep
Ref. 27-31,94,351
Consider diagnosis:
Sleep state misperception
ICSD 307.49-1
Section 3.1
Glossary
?
Loud snoring
Observed apnea
Daytime sleepiness
Obesity
Section 4.2
Glossary - Ref. 109,117,341-5
Consider diagnosis: Obstructive sleep apnea
ICSD 780.53-0
?
Conditioned arousal to bed
Negative expectations regarding sleep
Excessive time in bed awake
Ref. 226,29,72,74,250,267,349-50
Consider diagnosis: Psychophysiologic (conditioned) insomnia
ICSD 307.42-0
?
Restless legs/observed periodic limb movement
Section 4.2
Glossary - Ref. 103-7,352-9
Consider diagnosis: Periodic limb movement disorder
ICSD 780.52-4

Table 1. *Evidence For Subjective Insomnia (SI) / Sleep State Misperception (SSM)*

Reference	N	Definition	PSG	Psychological	Performance	MSLT	Comment
Bonnet & Arand1997 (27) Level IV – C	SSM=9 Control=9 Referred/ recruited	SSM = S Lat<30m; SE>90%; overestimate SLat by ≥ 100%	No difference SSM vs. C on any sleep EEG parameters	POMS -increased tension; confusion, depression; MMPI-SSM scores more pathological	No difference except increased vigilance sensitivity in C	SLat slightly higher in SSM (n.s.)	SSM shows increased 24 hour metabolic rate
Dorsey & Bootzin 1997 (29) Level IV – C	SI=9 OI=9 C=13 Student volunteers	SI=Ratio of subjective SLat/objective SLat >1.5	OI SLat>SI One night	SI shows increased extraversion / neuroticism vs. OI	No significant differences among SI/OI/N on reaction time or memory addition task	N.S. trend toward lower latencies in SI vs. OI.	Suggest SI more neurotic and less aware of internal state of consciousness
Hauri & Wisbey 1992 (30) Level V – C	PPI=10 SSM=8 Psy D=13 Recruited	SSM=SE>85% and SLat <40 min on 2/3 nights	3 night PSG 1 week actigraphy; no significant difference in sleep duration among groups	No measures	No measures	No measures	Increased sleep movement in SSM
Salin-Pascual et al. (28) Level IV – C	SSM=7 OI=7 C=7 Recruited	Estimated TST < 6.5h (SSM+OI); OI=SE< 85%; SSM=SE > 90% and under-estimated TST by ≥ 1 hour	6 nts PSG (2 consecutive @ 3 week intervals); OI-↓ TST (vs.C/SSM); ↑SLat (vs.C/SSM) ↑WASO vs. C/SSM)	SSM resembles OI on MMPI; both differ from C	No measures	No measures	No night effect or group x nt interaction suggests night-to-night variability does not account for distinction from OI
Sugerman, et al. 1985 (31) Level III – C	SI=8 OI=8 C=8 Recruited	OI=SLat > 30 min. or SE < 90%; SI=SLat < 30 min and SE > 90%	3 nts PSG OI-SE< SI/C	No measures	Auditory vigilance task(AVT): SI performed worse than OI or C	No difference between groups on mean SLat	"Flattened" MSLT profile, ↑ AVT "misses" suggest greater daytime impairment in S

OI = Objective insomnia; C = Controls; PPI = Psychophysiologic insomnia; SLat = Sleep latency; SE = Sleep efficiency; TST = Total sleep time; PSG = Polysomnography; POMS = Profile of Mood States; MMPI = Minnesota Multiphasic Personality Inventory; MSLT = Multiple Sleep Latency Test; n.s. = not statistically significan

Table 2. *Epidemiological Data and Associated Factors*

Reference	Description	N	Age	Prevalence (%)	F/M (%)[a]	Associated Factors[b]
Gallup 1995 (6)	National telephone survey (U.S.) "Frequently difficulty sleeping" (Lifetime)	1027	≥ 18	12	14/11	Depressed mood
Mellinger, et al. 1985 (32)	National survey (U.S.) Household interviews "Serious insomnia"	3161	18-79	17	20/14	Increasing age, anxiety, major depression, ≥2 health problems
Karacan, et al. 1976a (34)	Community survey (U.S.) 317 item interview "Trouble Sleeping - often"	1967	≥ 18	13.4	15.4/10.9	Increasing age
Bixler, et al. 1979 (1)	Community survey (U.S.) "Current complaint of insomnia"	1006	≥ 18	32.2	35/28	Increasing age, "recurring health problems," "need for help with emotional problems," tension/depression
Husby & Lingjaerde 1990 (35)	Community health survey (Norway) "Bothered by sleeplessness"	14667	20-54	29.6	41/29.9	Increasing age
Hohagen, et al. 1993 (36)	General medical practice survey (Germany) "Severe insomnia" (Current)	2512	15-65	18.7	21/13.7	Increasing age, chronic somatic disorders, depression/personality disorder / acute psychological distress / substance abuse
Ohayon, et al. 1997a (37)	National telephone survey expert system (SLEEP-EVAL) (United Kingdom) Insomnia symptoms/I Dissatisfaction with sleep / (DQS)(Current)	4972	≥15	I = 36.2 DQS = 8.7	40.1/31.9 11/7.4	Psychiatric disorder present in 35.5% of I/DQS; higher rates of I/DQS in unemployed women, separated/divorced women, night workers (see diagnoses)
Ohayon 1996a (38)	National telephone survey expert system (SLEEP-EVAL) (France) Dissatisfied with sleep/taking meds for sleep (DQS)(Current)	5622	≥15	20.1	24.4/15.6	Low income, Age ≥ 65, separated/widowed/divorced, physical illness
Weyerer and Dilling 1991 (39)	Regional sample with psychiatric interview (Germany) (Past 7 days)	1529	≥15	15 (mild) 9 (moderate) 4.5 (marked / severe)	16.8/12.9 17.5/8.5	Five fold increase of severe insomnia in group with psychiatric disorder; little difference in male/female prevalence in younger age groups

a. Prevalence in female/male populations. Hyphenated data indicates range for subgroups
b. Factors associated with increased rates of insomnia

Ohayon et al. 1997b (40)	Metropolitan area sample telephone survey expert system (SLEEP-EVAL) (Canada) Insomnia symptom(s) (I) Dissatisfied with sleep (DQS)	1722	≥15	I = 21.7 DQS=17.8	24.2/18.9 19.5/15.8	Age ≥ 45 (I+DQS), separated/widowed/divorced, physical illness, psychiatric illness
Kageyama, et al. 1997 (41)	Urban sample utilizing self-administered questionnaire (Japan - females only) Current insomnia	3600	≥20	11.2	11.2/N.A.	Age ≥70, living with young children, medical treatment, major life events, irregular bedtime, "sleep apnea" symptoms, environmental noise
Lugaresi, et al. 1983 (2)	Representative national sample (San Marino) Interview-123 item questionnaire "Poor sleepers" - always or almost always sleep badly	5713	20 - 94	19.1	23.1/14.7	Marked rise in prevalence in females after age 45, in males after age 60, daytime sleepiness complaints, napping, decreased caffeine intake, worry / pain / trouble breathing / depression / anxiety (before age 64), headache, problems in family life
Johnson & Spinweber 1983 (42)	Naval health science students 35 item sleep questionnaire "Poor" or "very poor" sleep	2929	17 - 34	10.7	- / -	Psychological variables (see Table 8), decreased job performance (longitudinal study)
Partinen, et al. 1983 (19)	Finish Twin Cohort Study (Twins / non-twins) Postal questionnaire "Fairly poor or poor" sleep	31140	≥18	9.0	9.1/8.8	
Karacan, et al . 1983 (43)	Representative urban sample (U.S.) 214 item questionnaire interviews: Difficulty initiating (DIS) Difficulty maintaining (DMS) Early awakening (EMA)	2347	≥18		11.2/6.0 17.4/12.9 8.0/6.2	Increasing age (DIS/EMA), widowed/separated/divorced (DMS/EMA), less education, lower SE status/income, worry/tension
Welstein, et al. 1983 (44)	Random telephone survey – metropolitan area (U.S.): "sleep problem" "Insomnia" Difficulty initiating Difficulty maintaining Early awakening	6340	≥6	 30.7 4.3 13.8 15.8 15.8	 33.2/27.3 5.0/3.2 15.3/11.9 18.6/12.0 17.0/14.1	
Klink, et al. 1992 (45)	Tucson Epidemiologic Study of Obstructive Airways Disease Self-administered questionnaire/interview "Trouble falling asleep/staying asleep" - very often / often / occasionally	2101	≥18	33.9	38.4/28.2	Increasing age, widowed/divorced, snoring, obstructive airway disease, arthritis, other medical disorder

Gislason & Almquist 1987 (4)	Random survey / eight item health questionnaire and 13 item sleep questionnaire of urban males (Sweden). Difficulty initiating sleep (DIS) "Great" "Moderate" Difficulty maintaining sleep (DMS) "Great" "Moderate"	3201	30 - 69	 6.9 14.3 7.5 14.9		Increased age (DMS), frequent medical visits, hypertension, bronchitis (DMS), diabetes, pain
Weissman 1997 (46)	NIMH Epidemiologic Catchment Area Study Difficulty initiating/maintaining sleep[c] (≥2 wks. in past year)	18571	≥18	4.9 Complicated [d] 3.6 Uncomplicated[e]	NA	Increased risk for mood / anxiety / substance abuse disorder at one year follow-up in those with no prior history
Breslau, et al. 1996 (47)	Random HMO sample: (U.S.) Home interview: Difficulty initiating/maintaining sleep (Lifetime)	1007	21-30	24.6	26.7/21.4	Increased risk for new mood / anxiety / substance abuse disorder at 3.5 year follow-up
ELDERLY						
Foley, et al. 1995 (48)	Three community survey - elderly (U.S.) "Chronic insomnia"	9282	≥ 65	23.2 - 33.7 [f]		Depressive symptoms, physical disabilities
Gislason, et al. 1993 (49)	Community survey - elderly (Iceland) "Habitual difficulty maintaining sleep"	800	65-84	33.4	29.6/ 37.1	Pain, chronic lung disease (early awakening), hypertension (early awakening), anxiety (sleep initiation and early awakening)
Hohagen, et al. 1994 (50)	General medical practice survey (Germany) "Severe insomnia" (Current)	330	>65	23	29.1//7.9	Depression, cognitive impairment disorders
Morgan & Clark 1997 (51)	National survey (England)	1042	≥ 65	____	____	Depressed mood, lower physical health, low levels of physical activity
Ganguli, et al. 1996 (3)	Random sample rural community (U.S.) Difficulty falling asleep Sleep continuity disturbance Early awakening	1050	66-97	 36.7 28.7 19.17	 44.1/36.7 35.8/28.7 23.3/19.1	No association between age and insomnia complaint
Maggi, et al. 1998 (5)	Random community sample (Italy) Any insomnia complaint Difficulty falling asleep Difficulty maintaining sleep Early awakening	2398	≥65		 54.0/35.6 38.9/20.3 59.8/60.8 33.3/24.5	Depression, "poor health", medical illness

c. Insomnia not due to medical disorder or substance use
d. Psychiatric disorder within the past year
e. No history of psychiatric disorder
f. Range across three sites

Table 3. *The Sleep History*

CHIEF COMPLAINT

Area of Inquiry		Features
The primary sleep problem		Falling asleep, staying asleep, early morning awakenings, decreased amount of sleep, poor sleep quality, daytime fatigue, or a combination of these problems (see Section 4.6 and Table 6) (3-5, 33, 43, 44, 89)
Frequency of sleep problem		# Nights per week or per month
Seriousness of problem		Scaled 1 to 10 (1=Mild; 10=Severe)
NIGHTTIME SLEEP		
Pre-sleep and Sleep Onset:		
Pre-bedtime activities		Watching TV, reading in bed, having a snack, working, physical activity (71)
Regularity of bedtime		Time of retiring on weekdays/time of retiring on weekends (see Section 4.6 and Table 6)
Estimated time to sleep onset		Minutes or hours
Factors which prolong sleep onset		Noises, bed partner, a "racing mind", worry, restroom visits, pain, caffeine containing beverages, bedroom temperature, watching the clock, medications, daytime or evening naps (71, 73, 90-92)
Factors which decrease sleep onset		Degree of physical tiredness, absence of worry or tension, alcohol use, medication use, relaxation before bedtime
Behavior when sleep latency prolonged		Tossing and turning in bed, getting out of bed and relaxing, lying in bed and worrying, getting out of bed and working, eating a snack (71)
Sleep During the Night:		
Frequency of awakenings		# of awakenings per night (see Section 4.6 and Table 6)
Duration of awakenings		Length of awakening in minutes or hours
Time of awakenings		Shortly after sleep onset, middle of the night or early morning hours
Causes for awakenings		Environmental factors (light, noise, temperature), psychological factors (stress, anxiety, worry), physical factors (pain, discomfort, hunger, thirst), nocturia; features of sleep disorders such as sleep apnea, periodic limb movements, nocturnal panic attacks, parasomnias (see Section 4.2)
Pre-sleep activities associated with awakenings		Alcohol consumption, medication use, stress, exercise (5, 32, 38, 40, 52, 93, 94)
Behavior during awakenings		Watching the clock, eating a snack, lying in bed watching television or reading, getting out of bed and working (71, 73, 95)
Morning Awakenings		

Regularity of morning awakening time		Time of awakening on weekdays/time of awakening on weekends (see Section 4.6 and Table 6)
Method of awakening		Alarm clock, telephone call, family member, spontaneous awakening
Ease of getting out of bed		Scaled 1 to 10 (1 = No difficulty; 10 = Great difficulty)
Feelings of restedness upon arising		Scaled 1 to 10 (1 = Not at all rested; 10 = Very rested) (71)
DAYTIME FUNCTIONING		
Degree of daytime drowsiness		Subjective reports of sleepiness or lack of sleepiness during sedentary daytime activities including driving a car, watching television, reading, attending church or movies, at work. May be quantified by Epworth Sleepiness Scale (see Section 4.4.1)
Impairment of daytime mood		Subjective reports of irritability, depression, anxiety, or mood swings. May be quantified by Profile of Mood States (see Section 4.7 and Table 8)
Napping behavior		Time of day when naps or extreme sleepiness occurs, duration of naps in minutes or hours, planned or spontaneous naps (24, 49, 93)
SLEEP-WAKE RHYTHMS		
Delayed sleep phase syndrome		Difficulty with sleep onset, but normal quality and duration after sleep is initiated (96-100)
Advanced sleep phase syndrome		Difficulty with early awakenings, but no difficulty initiating sleep early at night with normal quality and duration of sleep
Shift work sleep disorder		Work shift rotation, often at a rapid pace, to a night schedule
Irregular sleep-wake schedule		Differing sleep wake schedules on weekends as compared to weekdays; travel across differing time zones
Time of year effects		Differing degrees of difficulty with sleep in the winter as compared to the summer months
THE SLEEPING ENVIRONMENT		
Condition of the bed		Type of bed, age of the bed, location of the bed in the room
Sound in the environment		Level of noise in outside environment, sleep/wake schedules of other household members, presence of pets, noisy equipment in the environment such as air conditioning and heating systems
Temperature of the environment		Adjustability of room temperature to patient preference
Light in the environment		Type of window coverings for blocking out morning sun
Safety of the environment		Degree of security from home invasions; privacy of sleeping area

Clocks		Type of clock (large bright illuminated numerals/small dim numerals), manual winding (ticking sounds) or electronic (silent), location of the clock in the bedroom (by the bed/across the room)
The bed partner		Sleep schedule similar or dissimilar to the patient's; potential sleep disorders in the bed partner which disturb the patient's sleep such as loud snoring (possible sleep apnea), leg jerking (possible periodic limb movements), sleep talking, nightmares or other unusual, disruptive behaviors; bed partner reports regarding patient's sleep (see Section 4.3)
Bedroom activities		Watching television, reading, working, paying bills, talking on the telephone, or other activities which are not compatible with sleep or sex (71)
New sleeping environments		Quality of sleep in a hotel or other unfamiliar sleeping environment as compared to home
BELIEFS ABOUT SLEEP		
Beliefs about the physical and psychological effects of poor sleep		(71, 89)
Attitudes and beliefs associated with poor sleep		See Section 4.6 and Table 7 "Other assessment devices"
Beliefs about the cause of the problem		
DEVELOPMENT OF THE SLEEP PROBLEM		
Sleep across the life-span		Quality of sleep as a child, in adolescence, and during young adulthood (73, 101)
Age at which the problem began		Childhood, adolescence, or adulthood (72, 73, 102)
Life circumstances when the problem began		Identification of stressful life circumstances such as a birth, death, job change, lifestyle change, financial or job stress which may have been associated with the development of the sleep problem
Onset of the problem		Abrupt in association with a significant life event or a gradual onset (70-72)
Worsening or improvement in the problem		Events which may worsen the problem (physical illness, stress) and events which may lessen the problem (vacation periods, weekends)

Table 4. *Evidence for Sleepiness in Insomnia*

Reference	Group	N	Polysomnography	MSLT	Comment
Multiple Sleep Latency Test (MSLT)					
Bonnet & Arand 1996 (176) Level III – C	Perceived sleep problem and > 45m. SLat or > 60m WASO for ≥ 4 nights / week	10 INS 10 Yoked C's	Control sleep experimentally disturbed to match insomnia sleep TST: INS - 361 m. C - 348 m.	Mean MSLT latency: INS - 18.7m C (after 1 week of induced "insomnia") - 10.9m	No evidence of sleepiness in INS group by MSLT; daytime symptoms of INS "probably not related to poor sleep, per se"
Edinger, et al. 1997 (180) Level II – B	Older adults (≥ 60); complaints of poor sleep, difficulty initiating / maintaining sleep; structured interview criteria	32 INS 32 C	16 subjects from each group recorded at home, 16 in laboratory; 3 consecutive nights recording	Mean MSLT latency: Lab: INS - 11.8m C - 10.5m Home: INS - 9.6m C - 11.0m	Home INS sleepier than C's all trials; reverse pattern in lab Monitoring site may affect daytime test results
Lichstein, et al. 1994 (167) Level III – B	Perceived poor sleep and SLat > 30m or "repeated awakening/perception of sleep disturbance"	20 PPI 20 C	PSG results do not discriminate PPI from controls	Mean MSLT latency: INS - 10.0m C - 10.9m	No evidence for sleepiness in INS vs. controls
Stepanski, et al. 1988 (177) Level III – C	Patients referred for chronic insomnia (consensus diagnosis) with multiple etiologies.	70 INS 45 C	One night PSG TST: INS - 364m C - 416m	Mean MSLT latency: INS - 14.7 m C - 12.2m	No evidence for sleepiness in INS vs. controls; "suggests hyperarousal in sleep environment"
Anderson, et al. 1994 (179) #	Patients complaining of chronic insomnia.	12 SSM (SE≥88%) 28 OI (SE <88%) No controls	Three consecutive nights baseline; data represent average of nights 2/3 TST: SSM - 410m OI - 351m	Mean MSLT latency: SSM - 8.8m OI - 13.4m	SSM patients significantly sleepier; both groups show significant decrease in MSLT SLat following behavioral treatment
Seidel, et al. 1984 (169) Level IV-C	Chronic insomnia (volunteers) Diagnosis by interview	87 PPI 19 SSM 32 PLMD 9 PsyD 89 C	One night PSG TST: INS - 402.8m C - 445.8m	Mean MSLT latency: INS - 12.7m C - 12.9m	Poor sleep not associated with daytime sleepiness - better sleep associated with increased sleep tendency by MSLT
Bonnet & Arand 1997 (27) Level IV – C	Patients with Sleep State Misperception (SSM)	9 SSM 9 C	Two nts. PSG TST: SSM – 451m C – 433m	Mean MSLT latency: SSM – 10.2m C – 9.6m	No significant difference between SSM and C in objective degree of sleepiness

Sugerman, et al. 1985 (31) Level III – C	Volunteer insomniacs (SLat >45m or SE < 85%) SSM - SLat (PSG)<30m and SE > 90% OI - SLat >30m or SE < 90%	16 INS 8 SSM 8 OI 8 C	Three consecutive nights; TST: SSM - 419.8m OI - 378.7m C - 407.5m	No significant differences among groups for mean MSLT latencies	Tendency towards greater sleepiness and "flattening" of MSLT curve in SSM
Mendelson, et al. 1984a (166) Level III – C	Inadequate quality/quality of sleep > 1 year (Volunteers)	10 INS 10 C	3 nights PSG: TST: INS – 364.7m C – 389.8m	Mean MLST latency: INS – 18.7m C – 18.9m	INS group does not differ from controls on subjective or objective measures of sleepiness
Stepanski, et al. 1984 (178) Level III – C	Patients with SLat (Stage 2) ≥ 30 m. on 2/3 nights or SE < 90%	15 INS 10 C	One night PSG TST: INS - 6.4h C - 7.0h	MSLT mean latency: INS - 11.2 m C - 8.6m	Insomnia group does not show significantly greater sleepiness than normals; trend toward less objective sleepiness
Pupillometry					
Lichstein, et al. 1994a (167) Level III – B	See Above	See Above	See Above	No significant difference between INS and C	Pupillometry does not distinguish INS from controls
Lichstein, et al. 1992 (168) Level III – C	Perceived sleep disturbance; SLat > 30m or multiple/ extended awakenings/early awakening; students (17-24y/o)	29 INS 34 C	None	Pupillometry statistically discriminates C's from INS	Substantial overlap between groups does not allow functional distinction of groups
Lichstein, et al.. 1994b (171) Level III – C	Perceived sleep disturbance SLat > 30m or multiple/ extended awakenings/early awakening; students (17-24y/o); > 6 months duration	30 INS 30 C	None	Resting pupil diameters distinguishes INS from C	"Functional (discrimination) is limited" Overlap prevents practical application to distinguish INS from controls

INS = Insomnia group; C = Control group; TST = Total sleep time; SE = Sleep efficiency; SLat = Sleep latency; WASO = Wake time after sleep onset; PPI = Psychophysiologic insomnia; SSM = Sleep state misperception insomnia; OI = Objective insomnia; PLMD = Periodic Limb Movement Disorder; PsyD = Psychiatric/Depressed # This refers to a book, abstract, or letter that was not peer reviewed, and therefore, no evidence level or grade was assigned.

Table 5. *Evidence for Performance Measures*

Reference	Description	Group	Performance measures	Results / Comment
Edinger, et al. 1997 (180) Level II – B	Daytime function after lab and home-based PSG	32 INS 32 N (16 Home PSG/ 16 Lab PSG per group) (recruited) Age = 60	Signal detection/reaction time: a) Simple Reaction Time (SRT) b) Continuous Performance (CPT) c) Switching Attention (SWAT)	Normals perform better than INS on CPT after home study; INS perform better than N on CPT after lab study; data suggests that lab PSG preceding performance evaluation may obscure identification of decrements in INS
Dorsey & Bootzin 1997 (29) Level IV - C	Sleep tendency, psychological factors and daytime consequences	31 student volunteers (18 sleep-onset complaint / 13 non-complaining)	Simple reaction time memory-addition task	No difference between INS group and normals on performance measures; no difference between objective insomnia and subjective insomnia sub-groups on performance
Bonnet & Arand 1995 (191) Level III – C	Sleep, performance, psychological factors and metabolism in INS vs. N	10 INS 10 N (referrals/recruited)	Memory and search task (MAST) Proofreading Hand tremor Digit symbol substitution Word memory test Visual vigilance	INS show slightly worse performance on short-term memory and one-letter search on MAST than N, other performance measures show no difference
Schneider – Helmert 1987 (170) Level III – C	Sleep, psychological profile, cognitive performance	16 INS (referrals) 16 N (recruited)	Auditory vigilance; Digit symbol substitution; Logical reasoning task; Addition; Visual search; Word detection; Line judgment	INS performed significantly worse than N on auditory vigilance (morning) logical reasoning (morning session), and time tracing; INS performed better than N on line judgment and visual search (n.s.); data suggests greater difficulty in morning performance, reduced psychomotor function and reasoning although overall battery shows limited differences
Sugerman, et al. 1985 (31) Level III – C	Sleep, daytime alertness, performance	16 INS (8 subjective/ 8 objective) 16 N (recruited)	Auditory vigilance (AVT)	Subjective INS shows significantly worse performance on AVT than objective INS/N; no differerce between OI and N
Seidel, et al. 1984 (169) Level IV-C	Sleep, alertness, mood and performance	138 INS 89 N (recruited)	Card sorting task	No significant difference between INS and N; no correlation between performance measure and MSLT result in INS

Adam, et al. 1986 (183) Level III – C	Sleep, temperature, reaction time, metabolic function	18 "poor-sleepers" 18 "good-sleepers" (recruited)	Psychomotor performance (simple/choice reaction time; critical flicker fusion test)	No significant difference in psychomotor performance
Hauri 1997 (187) Level II – B	Cognitive / psycho-motor, vigilance assessment in insomnia	26 INS 26 N (recruited)	Balance board Simple/Complex reaction time (SRT/CRT) Digit span (DS) Divided attention (DA) Digit symbol substitution (DSS) Audio visual learning Vigilance	INS group showed significantly worse performance on elements of balance, SRT, CRT, DS; INS performance after "worst night" not significantly different from performance after "best night."
Saletu – Zyhlarz, et al. 1997 (188) Level V – C	Sleep, vigilance, psychophysiologic and cognitive evaluation in insomnia due to anxiety disorder	44 INS (Due to generalized anxiety disorder-referred patients) 34 N	Attention, concentration, numerical memory, reaction time, fine motor activity	INS show significantly worse performance than N in reaction time and fine motor activity; all other measures show no significant difference
Hyypa, et al. 1991 (184) Level IV-V – C	Verbal and visual retention, abstraction, attention, visuo-spatial percept formation in good and poor sleepers	127 Poor sleepers 215 Intermediate 309 Good sleepers (random selection)	Wechsler Memory Scale Wechsler Adult Intelligence Scale Benton Visual Retention Rey-Osterrieth Complex Figure Test	No differences between groups on neuropsychological testing
Hart, et al. 1995 (192) Level V – C	Performance measures in elderly insomniacs	78 INS (elderly) (recruited)	Intelligence Shipley Institute of Living Scale Verbal memory (word recall) Reasoning, (telegram generation) Psychomotor performance (DSS) Problem solving (Porters maze) Vigilance/Reaction time Continuous Performance Test	Subjective sleep disturbance predicted performance on CPT, DSS, word recall, maze and telegram; objective disturbance predicted performance on word recall and maze; subjective sleep efficiency most consistent predictor of performance
Broman, et al. 1992 (185) Level III – C	Subjective and objective performance	20 INS (primary) 20 N	Memory (word/figure recognition) Psychomotor speed (simple reaction time; finger tapping)	No significant differences between groups

Bonnet & Arand 1996 (176) Level III – C	Sleep, psychological factor, sleepiness, performance in INS vs. experimentally sleep-deprived N	10 INS (referral and recruitment) 10 Yoked controls (1 week experimental sleep disruption to match INS group)	Memory and search task performance Proofreading Hand Tremor Digit symbol substitution Word memory test Visual vigilance	See Bonnet and Arand, 1995; no significant decrements in experimentally-induced INS group over time
Bonnet & Arand 1997 (27) Level IV – C	Subjective and objective sleep, daytime alertness/ performance, psychological state, metabolic rate	SSM = 9 Normals = 9	Memory and search task performance Proofreading Hand Tremor Digit symbol substitution Word memory test Visual vigilance	No difference in performance measures between SSM and N except improved vigilance sensitivity in N
Mendelson, et al 1984b (189) Level III – C	Difference in psychomotor performance	10 INS (recruited) (PPI, SSM, NOS) 10 N	Simple reaction time Continuous tracing Continuous performance Visual vigilance Visual evoked response Quantitative Romberg	No difference on tasks except Romberg (INS show greater instability – eyes open)
Stone, et al. 1994 (186) Level V – C	Assessment of neuropsychological function in relation to sleep loss and sleep apnea	45 INS (with and without sleep apnea) No normal controls	Intelligence (Shipley Institute of Living Scale) Verbal memory (word list recall) Logical reasoning Digit symbol substitution Planning / problem-solving Vigilance and reaction time	No significant differences between apneic and non-apneic groups, comparison of insomnia without apnea group to published data on age/IQ matched groups suggests no impairment
Pedrosi, et al. 1995 (190) Level II – B	Performance measures and drug effect	12 INS (chronic) 12 N	Choice reaction time Divided attention Memory	Insomnia group significantly slower on reaction time; non-significant trend in same direction for other measures
Mendelson, et al. 1984a (166) Level III – C	Psychomotor and cognitive performance	10 INS (recruited) 10 N	Pegboard Finger tapping Letter cancellation Word recall Category response generation	Insomnia group shows slower finger tapping rate (right hand) in early trials; no difference between insomnia and controls for attention, vigilance, learning and episodic memory but marked decline in response generation in insomnia group on semantic memory testing

Broman, et al. 1992 (185) Level III – C	Subjective and objective performance assessment	20 INS (Referrals) 20 N	Simple reaction time Word recognition Figure recognition Finger tapping	No significant difference between insomniacs and normals in objective neuropsychological performance; insomnia group reports significantly lower performance expectation, evaluation results compared to others and results compared to personal capacity; increased objective SLat and WASO related to lower finger tap rate
Lichstein, et al. 1997 (174) Level V - C	Fatigue Severity Scale (9 item) (FSS) in sleep disorders	10 INS (Psychophysiologic)	7 point FSS	PPI subjects score higher on FSS than other major groups (apnea/snoring/multiple diagnosis)

INS = Insomnia group; N = Normal controls; SSM = Sleep state misperception; PPI = Psychophysiologic insomnia; NOS = Not otherwise specified; Slat = Sleep latency; WASO = Waking time after sleep onset

Table 6. *Evidence for Self-report Assessment Devices*

SLEEP LOGS / DIARIES				
Reference	Design	Number	Comparison	Comment
Insomnia				
Carskadon, et al. 1976 (24) Level V – C	Global interview ratings night-to-night vs. PSG	122 drug-free chronic INS	≥ 2 consecutive nts PSG (range 1-13)	Poor correlation between subjective and objective ratings; logs underestimate TST, overestimate SLat; logs paralleled PSG findings more closely than pre-PSG interview sleep ratings
Brooks, et al. 1993 (198) Level IV – C	Measurement of effects of sleep restriction by actigraphy and sleep logs	9 older adults - primary INS	3 nts actigraphy and logs pre-treatment 3 nights post-treatment	Subjective reports (logs) overestimate treatment effect; actigraphy measures "very nearly independent" of sleep log measures
Beck, et al. 1992 (199) Level II-III – B-C	Comparison of actigraphy and sleep log measures	41 INS	48h actigraphy and logs (x3)	Significant differences between actigraphy and logs on sleep time, latency, efficiency and awakenings
Pollack, et al. 1992 (195) Level III – C	Daily logs and wrist actigraphy in elderly insomniacs	14 INS 8 C (elderly)	14 nts actigraphy and sleep logs	Sleep log indices of poor sleep not significantly correlated with motor activity

Knab & Engel 1988 (196) Level III – C	Perception of sleep / wake by logs, PSG, and behavioral signal	14 INS 14 C	1 wk log 1 nt PSG	Logs vs. PSG not analyzed; logs demonstrated distinction of insomnia from controls on SLat, WASO, quality score and expectation rating
Hauri & Wisby 1992 (30) Level V – C	Analysis of wrist actigraphy vs. subjective reports and PSG	36 INS	1 wk actigraphy and logs 3 nts PSG	Consistent underestimation of sleep time by logs (vs. PSG) - difference not statistically significant; logs underestimate sleep time vs. actigraphy for psychophysiological and psychiatric sub-groups
Frankel, et al. 1976 (25) Level III – C	Analysis of sleep logs vs. PSG	18 chronic INS 18 C	5 nts PSG Post-sleep questionnaire	Post-sleep questionnaires underestimate TST/SE, overestimate SLat in INS; opposite trend (n.s.) in controls
Wilson, et al. 1998 (135) Level V – C	Analysis of logs vs. actigraphy vs. PSQI	40 INS with chronic pain	2 nts actigraphy and sleep diary	Modest correlations between logs and actigraphy for TST (.34) and awakening (.42), SE not correlated; logs correlate with PSQI for SLat (.50), TST (.44), SE (.32)
Chambers & Kim, 1993 (197) Level III – C	Sleep logs and anxiety assessment in chronic insomnia	31 INS (PPI) 35 good sleepers	1 wk log	Logs discriminate INS from good sleepers; no correlation between logs SLat/TST and anxiety measures
Hauri & Fisher, 1986 (72) Level III – C	PSG and psychological characteristics of PPI	22 PPI 19 Dysthmia 22 Normal controls	2-3 nts PSG and post-sleep questionnaire	PPI do not differ with respect to PSG - log discrepancies for SLat; greater underestimation of TST in PPI than N
Lacks, 1988 (158) #	Summary data on nightly sleep diary	Mixed populations	———	Test & retest reliability: SLat correlation = .86. SLat (poor sleepers) correlation = .93. Validity: Insomnia subjects correlation with spouse/roommate report = .84 - .99; significant increase in correlation between objective and subjective measures over first 4 nights; consistent overestimate of SLat by insomniacs
Krahn, et.al., 1997 (200) Level IV – C	Comparison of nursing observation, patient sleep logs, and actigraphy	30 psychiatric inpatients	3 consecutive nights recording and logs	Poor agreement between actigraphy and logs; patients underestimate TST/WASO, overestimate SLat and TIB

Haythornthwaite, et al. 1991 (203) Level IV – C	Daily sleep diary (DSD) measures standard sleep parameters (SLat, TST, awakenings, quality) vs. retrospective ratings	46 pain clinic patients	5 day mean DSD duration	Inter-item correlations: .38 - .62; DSD correlations with retrospective reports: SLat .48, DSD measures show correlation with pain measure (-.34), depression (-.40/.-50) and anxiety (-.48)
Monk, et al., 1994 (204) Level V-C	Pittsburgh Sleep Diary - correlation with PSG, actigraphy, PSQI and questionnaires	96 N (young/ middle-aged) 81 N (older) 28 sleep disorder (14 INS)	Variable protocols including PSG, actigraphy, Pittsburgh Sleep Quality Index, and diary	Diary/actigraphy correlation for TST=0.43; diary demonstrates significant differences between controls and mixed sleep disorder group on multiple sleep parameters; test-retest correlations=0.56-.66
Normals				
Babkoff, et al. 1996 (205) Level V – C	Sleep log vs. general (retrospective) sleep estimates	146 young adult normals (includes 33 pregnant women)	3 nts logs	Modest correlations between sleep log and general estimates for SLat (0.31); TST and number of awakenings shows no significant correlation between logs and general estimates
Reyner, et al. 1995 (206) Level V – C	Home-recorded sleep logs and actigraphy	400 adults/normals - grouped by age	15 nts actimetry and logs	No specific statistical analysis comparing logs and actigraphy data; differences in sleep latencies by two methods=18 min.; difference most pronounced in youngest and oldest groups
Horne, et al. 1994 (207) Level III – C	Effects of aircraft noise on sleep: logs and actigraphy assessment	400 adults normals	15 nts actimetry and logs	Significant correlation between night-to-night logs and actigraphy indicators of sleep quality; poor correlation of one-off version of subjective quality estimate and actigraphy
Baekel & Hoy, 1971 (208) Level V – C	Sleep logs vs. PSG	21 normal controls	14 nts home logs 1-3 nts PSG with logs	Normals accurately estimate SLat, awakenings, and body movement; "restedness" related to decreased awakenings/WASO and increased Stage 2
Mullington, et al., 1988 (201) #	Analysis of correlation between subjective global reports and logs; required duration of logs	22 N (graduate students)	6 week sleep logs; retrospective global estimates of sleep length	Subjective estimate of average sleep length correlate only moderately with logs (.59); one week log correlates acceptably (.85) with total 6 week log, suggesting duration of one week is adequate
Johns, 1977 (209) Level V – C	Correlations between objective sleep measures, global retrospective measures and nightly logs	28 N (with PSG) 37 N (Question-naires only)	3-12 night PSG "Few weeks" sleep questionnaire Nightly logs in lab	Significant correlations between objective and subjective measures of sleep latency (Stage 2) in healthy volunteers; tendency for longer objective latencies to be over-estimated

INS = Insomnia group; C = controls; PPI = Psychophysiologic insomnia; SLat = Sleep latency; TST = Total sleep time; WASO = Waking after sleep onset; SE = Sleep efficiency; PSQI = Pittsburgh Sleep Quality Index # This refers to a book, abstract, or letter that was not peer reviewed, and therefore, no evidence level or grade was assigned.

Table 7. *Sleep Questionnaires*

Reference	Structure	Population	Validation / Reliability / Comment
Pittsburgh Sleep Quality Index Buysse et al, 1989 (215) Level III – C	19 item self-rated measures of sleep quality and disturbance	52 good sleepers 116 poor sleepers	Component score/individual item reliability coefficients = .83/.83; significant discrimination of good vs. poor sleepers; sensitivity 89.6%; specificity 86.5%; no significant positive correlations between PSQI items and PSG measures
Gentili et al, 1995 (211) #	Test-retest reliability of PSQI	19 cognitively intact nursing home residents	Nineteen day mean test-retest interval; Component intra-class correlation (ICC) = .45-.84; global ICC=.82
Sleep Questionnaire and Assessment of Wakefulness (SQAW) Miles, 1982 (235) #	863 item comprehensive survey of sleep and related symptoms	No data reported	SQAW later modified to Sleep Disorders Questionnaire (see Douglass et al, 1994)
Sleep Disorders Questionnaire (SDQ) Douglass et al, 1986 (236) #	Development of modified, 165 item questionnaire from SQAW	345 patients referred for suspected sleep disorder	Utilizes summation of repetitive questions, factor analysis of 8 specific groups of questions, and clinician judgment to design SDQ. Developed for diagnostic prediction utilizing ASDC system; predictive data not reported
Douglass et al, 1990b (237) #	Test-retest reliability of SDQ	57 student volunteers 14 psychiatric outpatients	14 day test-retest interval ; Item correlation =.163-.999, mean = .495
Douglass et al, 1994 (212) Level II – B	Multivariate analysis for development of diagnostic subscales (apnea, narcolepsy, periodic limb movement, psychiatric)	Test-retest-130 patients referred for evaluation; Multivariate analysis-430 referred patients and 84 controls	Test-retest interval 3-4 months; item correlation = .308-.985; Mean = .636 Psychiatric sleep disorder test-retest = .848; Specificity .79; Sensitivity .64; Positive predictive value .28-.57; Negative predictive value .87-.95
St. Mary's Hospital Sleep Questionnaire Ellis et al, 1981 (213) Level V – C	14 item questionnaire; sleep quality, latency, continuity, satisfaction; single night assessment	32 psychiatric inpatient 16 surgical; 21 medical 24 control	Four hour test-retest interval; item correlation = .70-.96
Leigh et al, 1988 (238) Level IV - C		222 rheumatic disease inpatients	Four factors extracted (% variance): I. Latency (35.1); II. Quality (6.9); III. Ease of waking (10.6); IV. Behavior after waking (3.9)

Sleep Questionnaire Domino et al, 1984 (20) Level V – C	55 item questionnaire - Likert format	145 subjects from general population 45 normals 22 couples	Seven factors extracted (% variance): I. Depth (19.8); II. Difficulty in waking (12.1); III. Quality/latency (9.3); IV. Negative-affect/dreams (9.1); V. Duration (7.6); VI. Dream recall (7.2); VII. Sleep irregularity (6.6); Ten week test-retest interval, Item correlation = .68-.96. mean = .79; Self-spouse correlation = .66
VSH Sleep Scale Snyder-Halpern and Verran, 1987 (239) Level V – C	Eight sleep characteristics measuring fragmentation, duration, latency, depth; visual analogue scales	69 normals	Theta reliability = .80; Two factors identified (% variance): I. Sleep disturbance (44%); II. Effectiveness (16%); Construct validity: Correlation with St. Mary Hospital Questionnaire items = .50-.74
Nordic Sleep Questionnaire Biering-Sorensen et al, 1994 (214) Level III – C	26 item questionnaire concerning qualitative and quantitative aspects of sleep	32 spinal cord injured patients (SCI) 79 normals	Test-retest interval 4-103 days (mean 27); most item correlations>.80, mean not reported; Correlations not different for long interval vs. short interval groups (normals) vs. SCI group
Post-sleep Inventory Webb et al, 1976 (216) Level V – C	29 variables measuring pre-sleep, sleep, and post-sleep characteristics; single night assessment	130 student volunteers	Seven factors identified (% variance): I. Mental activity (10.9); II. Morning factors (9.5); III. Sleep factors (7.7); IV. Evening/night ailments (7.7); V. Dream amount (6.6); VI. Evening sleepiness (6.2); VII. Dream emotion (5.9); Distinguishes "good" vs. "poor" sleep
Post-sleep questionnaire (PSQ) / Sleep Effects Index (SEI) Zammit, 1988 (161) Level III-V – C	Estimation of sleep parameters of previous night and 28 items assessing effects of sleep on daytime function	90 student volunteers	PSQ: Sleep assessment parameters reliably distinguish "good" vs. "poor" sleep (decreased latency, better maintenance, increased total sleep time); SEI: Four factors identified: I. Dysphoria; II Cognitive inefficiency/sleepiness; III. Motor impairment; IV. Social discomfort; Internal reliability = .958
Sleep Evaluation Questionnaire Parrott and Hindmarch, 1978 (240) Level III – C	10 item single night assessment designed to assess sleep after drug/placebo ingestion	133 normal volunteers; post-hypnotic / placebo condition	Four factors: I. Getting to sleep; II. Quality of sleep; III. Awakening from sleep; IV. Behavior following sleep; Factors I. and II correlate (.57); Factors III. and IV. correlate (.48); small negative correlations of I. and III. or IV.
	7 item diary addresses quality/ease of falling asleep/ continuity/ duration/ease of waking/restorative value	37 Normals	Two factors identified: I. Quality; II. Ease of waking; Factor I forms sleep quality index (SQI); Internal consistency: ? = .74 SQI correlates significantly with TST, SE, SWS

Karolinska Sleep Diary (KSD) Akerstedt, et al., 1994 (241) Level III – C	12 item diary measuring sleep quality, latency, efficiency/ continuity, ease of awakening	16 Normals	Sleep quality, ease of falling asleep, sleep calmness, and sleeping throughout allotted time frame index of sleep quality; item correlations with index: sleep quality (.77) ease of falling asleep (.46), calmness (.72), sleeping throughout allotted time (.47); index items show significant correlation with objective measures.
Sleep Questionnaire Johns, et al. 1971 (242) Level IV - C	27 - 31 item questionnaire measuring latency, awakenings, TST, quality	249 N (students)	Questionnaire demonstrates significant correlations between increased SLat and increased wake time, decreased TST and lower quality ratings.
OTHER INSTRUMENTS			
Reference	Design	Number	Comment
Arousal Predisposition Scale Coren, 1988 (243) Coren & Mah 1993 (244) Hicks, et al. 1992 (245)	12 Item-scale for arousability	239 subjects 249 young adults	Validated against electrodermals and EMG measures of arousability in 9 high/low arousable subjects Against self-rating of stress-related physical symptoms
Hyperarousal Scale Regestein, et.al, 1993 (74)	26 Item scale for assessment of hyperarousal	20 primary insomnia 20 controls	Hyperarousal scores clearly discriminate insomniacs from controls
Beliefs and Attitudes Scale Morin, 1993a (75)	30 Item VAS/dysfunctional beliefs, expectations, and attitudes about sleep	145 older adults (74 chronic insomnia; 71 good sleepers)	Discriminant validity between insomniacs and normal sleepers in clinically-referred sample.
Sleep Behavior Self-Rating Scale Kazarian, 1979 (246)	24 item sleep-incompatible behaviors	81 psychiatric patients (insomnia and non-insomnia); 121 normals	Discriminates insomnia (defined in terms of sleep latency) from non-insomnia group.
Sleep Hygiene Awareness and Practice Scale Lacks, 1986 (247)	13 item sleep hygiene knowledge 19 item sleep hygiene practice	44 sleep onset insomniacs 49 sleep maintenance insomniacs; 50 good sleepers	Insomnia patients differentiated by increased knowledge but lower practice scores from good sleepers.

Sleep Behaviors Scale: 60+ Libman, 1997 (95)	30 item, 4 sub-scales; Active behavior/ relaxation/cognitive arousal/medication	163 good sleepers 49 low distress poor sleepers 28 high distress poor sleepers	Discriminates good sleepers from poor sleepers; High/low distress poor sleepers differ only on cognitive arousal sub-scale (High>Low).
Epworth Sleepiness Scale Johns, 1991 (172)	8 Self-rated items assessing sleepiness tendency	150 Sleep disorder patients 30 Controls	Discriminates insomnia group from other sleep disorders (apnea/narcolepsy/other hypersomnia); insomnia group not different from controls; correlates with MSLT results

# This refers to a book, abstract, or letter that was not peer reviewed, and therefore, no evidence level or grade was assigned.
HR = heart rate; Slat = Sleep latency; RR = Respiratory rate

Table 8. *Evidence for Psychological Assessments*

Reference	Design	Group	Psychological Measures	Outcome/Comment
Seidel, et al. 1984 (169) Level IV-C	PSG/MSLT /daytime function and psychological assessment; Exclusion: Psychiatric disorder	138 INS (Recruited) 89 C	MMPI/POMS	No significant differences INS vs. N on psychological assessment; trend toward slightly more pathological scores on several MMPI scales in INS group; trend toward increased depression, fatigue, and anger in INS; no correlation of psychometrics with MSLT
Stepanski, et al. 1989 (162) Level V – C	PSG/MSLT/ Psychological assessment; Exclusion: Acute psychiatric or medical illness; shift work	50 INS (Recruited) 50 INS (Referred)	MMPI/POMS	Referred patients score significantly higher than recruited volunteers on HS, D, Hy, Pt and Ma Scales on MMPI; referred group significantly higher on all POMS Scales
Edinger, et al. 1988 (73) Level III – C	Cluster analysis of MMPI and sleep questionnaire Exclusion: Depressive disorder, evidence of sleep apnea, PLMD, "medically-based" disturbance	101 INS (Referred)	MMPI	62/100 patients with ≥ 1 MMPI Scale in pathological range, most frequently D, Hy, Pt; profiles suggest emotional inhibition, internalized affect, rumination/anxiety; cluster analysis suggests: Type 1 – earlier onset, intrusive thoughts, more dread at bed-time, more time in bed awake, greater concern about not sleeping, greater actuation/arousal than Type 2, who demonstrate "defined neurotic profile:" (Hs/D/Hy)
Salin – Pascual, et al. 1992 (28) Level IV – C	PSG/ Psychometrics Exclusion: History of psychiatric disorder, substance abuse	7 objective INS 7 sleep state misperception (Recruited) 7 C	MMPI/POMS	Objective INS shows significantly higher scores on Hs/D scales of MMPI vs. C; similar pattern in SSM who also show higher Hy scores vs. C; POMS scales show no differences among groups

Tan, et al. 1984 (115) Level III – C	PSG/ Psychometrics Exclusion: None reported	100 INS (Referred)	MMPI	81/94 with ≥1/MMPI Scale in pathological range (mean 2.74); D, Hy, Pt, Hs scales most frequently elevated
Bonnet & Arand 1997 (27) Level IV – C	PSG/MSLT/daytime performance/psychometrics Exclusion: Past/current depression or psychiatric hospitalization in past year, substance abuse, evidence of sleep apnea, PLMD, circadian disorder	9 sleep state misperception 9 C (Recruited and referred)	MMPI/POMS	SSM patients show elevated scores vs. C on Hs, Pt, Sc; SSM group significantly higher on POMS depression, tension, anger, fatigue and confusion
Mendelson et al, 1984a (166) Level III – C	PSG, MSLT, cognitive and psychomotor performance, psychological assessment Exclusion: Psychiatric or medical illness, sleep apnea, PLMD, circadian disorder	10 INS (Recruited) 10 C	MMPI SADS	6/10 INS with ≥1 MMPI scale elevation, most frequent F, D, Si
Bonnet & Arand 1996 (176) Level III – C	PSG/MSLT/daytime performance, psychometrics, metabolic rate Exclusion: Past depression / psychiatric hospitalization / substance abuse; evidence of sleep apnea, PLMD, circadian disorder	10 INS (Recruited and referred) 10 yoked controls (Induced sleep disruption to match INS)	MMPI/POMS	MMPI scores in yoked controls show no difference from baseline to conclusion after 1 week of sleep disruption; control pattern differs from the INS; POMS shows increased tension, depression, vigor and anger in controls after one week deprivation
Kalogjera- Sackellares & Cartwright 1997 (273) Level III – C	Psychometric assessment of medical and psychological sub-groups of INS Exclusion: Psychiatric disorder, substance abuse	29 INS –P "psychologically based" 29 INS –M "medically-based" (Referred)	MMPI	No difference between INS-P and INS-M groups with respect to number of elevated scales of individual scale scores; 46/58 subjects had ≥1 scale in pathological range (Hy, D, Pt, most common)
Schneider-Helmert 1987 (170) Level III – C	PSG/cognitive performance/psychometrics Exclusion: None reported	16 INS (Referred) 16 C	MMPI	9/16 INS subjects with ≥1 scale in pathological range; Hs, D, Hy, Pd, Pa, Pt, Sc all significantly elevated compared with C

Hauri 1983 (267) Level V-C	PSG/psychometrics/cluster analysis	89 INS (Referred) 10 C	MMPI/Zung Depression Scale/ Multiple Affect Adjective Checklist/Anxiety Scale	Analysis yields 9 clusters: I. Good sleepers/insomnia with no objective findings II Mild hypomania III Psychophysiologic insomnia IV. Insomnia with unconventional lifestyle V. Insomnia in "depleted" neurotic patients VI. Insomnia with dysthymia VII. Childhood insomnia (moderate) VIII. Childhood insomnia (severe) IX.. Hyperactivity to stress Psychophysiologic, childhood-onset, and psychiatric subgroups clearly identified with mathematical model; sleep state misperception groups not distinguishable from good sleepers
Hauri & Fisher 1986 (72) Level III – C	Comparison of PSG and psychometrics Exclusion: Medically-based insomnia, sleep apnea, PLMD	22 INS (PPI) 19 DD 22 C (Referred and recruited)	MMPI/IPAT Anxiety Scale/POMS/Zung Depression/ Zuckerman Sensation Seeking Scale	PPI group shows elevated Hs (MMPI), overt anxiety (IPAT) and fatigue (POMS) vs. C; significantly less pathological scores vs. DD
Hauri & Olmstead 1980 (101) Level III – C	PSG / psychometrics	22 INS (childhood onset) 39 INS (adult onset) (Referred)	MMPI/IPAT Anxiety Scale/ Zung Depression Scale/Rotters Internal-External Scale/Schedule of Recent Experiences	Two groups (childhood vs. adult onset) not distinguishable on basis of psychological characteristics measured
Shealey, et al. 1980 (260) Level III – C	Assessment of relationship between gender, severity, chronicity and personality variables in insomnia (Treatment) Exclusion: Current psychological treatment, hypnotic use	40 INS (primary sleep-onset) 40 N (Student recruits)	MMPI	INS group shows significantly higher scores on Pt, D, Hy, Hs, Pa, Sc; gender, severity, chronicity not related to MMPI clinical scales, but higher F-scale in acute groups suggests heightened concern during initial course
Kales, et al. 1983 (261) Level V – C	Assessment of personality and relationship to other variables in insomnia Exclusion: None reported	279 INS (chronic) (Referred) 100 C	MMPI	INS group shows higher mean values on MMPI clinical scales vs. C (Ma scale the exception); 225/297 (76%) of INS had > 1 scale in pathological range (Pt, D, Hy, most common); older age groups showed higher percentage of elevated scales

Kales, et al. 1976 (266) Level V – C	Description of personality patterns in insomnia Exclusion: None reported	124 INS (Referred and recruited)	MMPI	105/124 INS subjects showed > 1 clinical MMPI scale in pathological range (D, Hy, Pd, Pt most common)
Pailhous, et al. 1998 (268) Level V – C	PSG/MMPI and severity in insomnia Exclusion: Psychiatric disorder/recent psychotropic usage	45 INS (Recruited)	MMPI	MMPI analysis yields three groups: G1 – normal G2 – depression and anxiety G3 – psychopathic traits/somatic disorders; severity of sleep disturbance increases G1 to G3; G1 viewed as more influenced by external factors, G3 by more serious internal conflict
Piccione, et al. 1981 (262) Level III – C	Personality differences between insomniac and non-insomniac psychiatry patients Exclusion: Psychosis, history of major psychiatric disorder or hospitalization	49 psychiatry outpatients (25 INS/14 non-INS controls)	MMPI	Clinical MMPI Scales show elevations in both INS and non-INS groups, but only Pt scale distinguishes the groups (Hs, D, Pd, Pt scales most elevated in both groups)
Kales, et al. 1984a (269) Level V-C	PSG/MMPI variables as discriminators of insomnia sub-groups Exclusion: None reported	150 INS (chronic) (Referred) 100 N	MMPI	Severity of sleep disturbance (PSG) related to degree of psychopathology (MMPI); discriminant function analysis indicates MMPI variables improve discriminant function beyond PSG variables
Roth, et al. 1976 (89) Level V – C	PSG and psychological profile of clinic population	50 INS (Referred)	MMPI	42/50 (83%) show ≥1 MMPI scale pathologically elevated (mean 2.5 scales); D (60%), Hs (50%), Hy (46%) most commonly elevated
Freedman & Sattler 1982 (181) Level II – B	Assessment of physiological and psychological factors in insomnia Exclusion: Medical or psychiatric disorder, substance abuse, sleep apnea, PLMD	12 INS (sleep onset / chronic) (Recruited) 12 C	MMPI	Significant elevation on scales Hy, Pt, Sc compared to normals, although few scales pathologically elevated
Monroe, 1967 (263) Level III – C	Assessment of psychological and physiological differences between good and poor sleepers Exclusion: None reported	16 INS ("poor sleepers") (Recruited) 16 C ("good sleepers")	MMPI	Poor sleepers show significantly higher scores on MMPI clinical scales Hs, D, Pa, Pt, Sc

Corsey, et.al., 1975 (264) Level III – C	Assessment of personality and evoked responses in insomnia Exclusion: Psychiatric or medical disorder, substance abuse	18 INS Chronic (Recruited) 18 C	MMPI/Byrne Repression-Sensitization/ Taylor Manifest Anxiety/Edwards Social Desirability/ Eysenck Neuroticism/ Time Competence/ Zung Depression/ Depression adjective checklist	INS group demonstrates significantly higher scores for MMPI D scale, Taylor Anxiety, Neuroticism, Zung Depression, Repression-Sensitization, MMPI Pt, and lower social desirability; factor analysis yields significant Factor I – "anxious worrier," characterized by mild, chronic depression, anxiety, obsessive worry, greater sensitization and less socially desirable answers
Kales, et al. 1984b (71) Level III – C	Analysis of biopsycho-behavioral aspects of insomnia Exclusion: Medication use	214 INS (Referred) 94 C	MMPI (Individual item analysis	INS group endorse individual items regarding "taking things hard", "something wrong with my mind", "worry", "anxiety", and "high strung" at significantly higher rates than C
Carskadon, et al. 1976 (24) Level V – C	PSG and self-report findings in chronic insomnia Exclusion: Sleep apnea, PLMD	65 INS (22 referred, 43 recruited)	MMPI	38/65 (58%) on INS show ≥1 clinical MMPI scale in pathological range; D scale elevated in 25/65, Hs in 6/65; no clear relationship to other variables
Roehrs et al. 1982 (271) Level II – B	Analysis of psychological disturbance in elderly vs. young insomniacs Exclusion: Hospitalized or institutionalized patients	18 INS (Recruited) (mean age 43.8) 18 INS (Recruited) (mean age 68.3) 18 C (mean age 71.3)	MMPI	Young group demonstrates average of 2.5 elevated clinical scales, older group 0.7; older INS group does not differ from C
Morgan, et al. 1989 (93) Level V – C	Psychological assessment in older insomniacs Exclusion: None reported	96 INS (Random selection of recruits, age 65-74) 96 C (age 65-74)	Eysenck Personality Questionnaire, Spielberger State-Trait Anxiety and Depression Scales	No significant difference between INS and C on introversion/extroversion or psychoticism; INS significantly higher on neuroticism, state and trait anxiety
Bliwise, et al. 1985 (270) Level V – C	Relationship of psychological variables to age in insomnia Exclusion: None reported	335 INS (Referred) Grouped by age	MMPI	No evidence of increased psychopathology in older patients; older group shows significantly lower scores on Pd, Pa, Ma scales

Johnson & Spinweber 1983 (42) #	PSG/performance/psychological assessment Exclusion: None reported	78 naval personnel (student volunteers) (55% "good /very good" sleepers; 35% "average"; 10% "poor/very poor" by subjective report	POMS	Strong linear relationship between sleep quality and POMS Scales (worsening subjective quality associated with increased tension, depression, anger, fatigue, confusion, and decreased vigor); Objectively poor sleepers show significantly higher tension, fatigue and confusion than objectively good sleepers
Sugerman, et al. 1985 (31) Level III – C	PSG/MSLT /daytime performance/POMS Exclusion: Psychiatric or medical disorder, sleep apnea, PLMD, circadian disorder	8 Objective INS 8 Subjective INS 8 Normals Recruited	POMS Beck Depression Scale	No significant differences among groups on any POMS scales; Beck scores: OI = 4.9 SI = 4.4 C = 1.1
Morgan, et al. 1988 (94) Level V – C	Characteristics of older insomniacs Exclusion: None reported	1023 general survey respondents	Symptoms of Anxiety and Depression Scale	Anxiety score most influential variable in identifying insomniacs
Shaver, et al. 1991 (274) Level V – C	Subtypes of sleep quality, psychological and somatic distress in mid-life women Exclusion: Major medical or psychiatric illness; medication for insomnia/depression	82 women (Mid-life/recruited) (19 subjective poor sleep, 63 subjective good sleep; 23 objective poor sleep, 59 objective good sleep)	Symptom Checklist-90	Significantly higher psychological distress by SCL-90 for subjective poor sleepers vs. subjective good sleepers; no significant difference in psychological distress for objective poor sleepers vs. good sleepers; subjective poor sleepers without objective findings show highest psychological distress
Bliwise 1992 (275) Level III – C	Factors related to sleep quality in elderly women Exclusion: PLMD, sleep apnea	38 women (Elderly/recruited) (16 poor sleepers, 22 good sleepers)	Symptom Checklist-90	Poor sleepers show significantly higher scores on phobic anxiety, paranoia, and psychoticism; trend toward higher anxiety, depression, obsessive-compulsive scores
Frankel, et al. 1973 (265) Level III – C	PSG, MMPI (including derived scales) and other psychological measures in primary insomniacs vs. controls Exclusion: Psychiatric history or current disorder	18 INS (primary) ("Patients") 18 C	MMPI/Taylor Anxiety/Edward's Social Desirability /Byrne Repression /Sensitization; Zung Depression, Zuckerman Sensation Seeking, Eysenck Neuroticism, Shostrom Time Competence	Insomnia group shows significantly higher (more pathological) scores on 5 sub-scales (Hs, D, Hy, Pt, SI), MMPI derived scales, Zung, Eysenck, Zuckerman, Shostrom; suggests anxious, hypochondrical, depressed, and complaining worriers with low assertiveness

Beutler, et al. 1978 (23) #	Psychological assessment of insomniacs	22 INS (Referred) 22 C	MMPI State-Trait Anxiety Locus of Control POMS	Insomnia group shows higher scores on MMPI scales Hs, D, Hy
Vgontzas, et.al. 1994 (272) Level III – C	Assessment of PSG criteria vs. MMPI in identification of insomnia	375 INS (Referred) 15 OC	MMPI	MMPI values show higher sensitivity (49.3%) than PSG criteria (36.3%) in identification of insomniacs; specificities comparable (95.4% vs. 90.2%): MMPI positive predictives value = 73.1%; D, Hy, Ma, Hs scales show greatest discrimination
Adam, et.al. 1986 (183) Level III – C	PSG, psychophysiologic assessment, psychological evaluation Exclusion: CNS active drug use	18 INS (Recruited) 18 C	MMPI Multiple Adjective checklist Eysenck Personality Questionnaire Taylor Manifest Anxiety	INS and C on MMPI Scales; elevated state/trait anxiety in INS; increased neuroticism

INS = Insomnia group; C = Controls; PSG = polysomnography; MSLT = multiple sleep latency test; MMPI = Minnesota Multiphasic Personality Inventory; POMS = Profile of Mood States; MMPI scales: Hy = hysteria; D = depression; Hs = hypochondriasis; Pt = psychosthenia; Ma = mania; Sc = schizophrenia; Si = Social introversion; Pd = psychopathic deviant; Pa = paranoia; PLMD = periodic limb movement disorders; SSM = sleep state misperception; DD = dysthymic disorder; IPAT = Institute for Personality and Ability Testing Anxiety Scale

Table 9. Psychological screening instruments in evaluation of insomnia

Instrument	Variable / Construct	Validation sample	# Items	Summary of properties
Beck Depression Inventory (278)	Global measure of depressive symptoms	Psychiatric patients	21	Internal consistency: å =.86 Concurrent validity: rs =.65, .67 with depression
Brief Symptom Inventory (Derogatis and Melisatoros, 1983) (279)	General screen for psychopathology	Psychiatric outpatients	53	Internal consistency: å =.71 (psychoticism) to .85 (depression)
Eysenck Personality Inventory (280)	Psychological traits (e.g. introversion/extroversion)	Normal and clinical samples	57	Internal consistency: å =.70-.80 for various scales
Profile of Mood States (McNair et al., 1971) (281)	State measures mood disturbance	Psychiatric outpatients	65	High correlations between POMS and a variety of other scales which purport to measure emotional state
State-Trait Anxiety Inventory (Spielberger et al. 1970) (282)	Global measure of anxiety	Medical and psychiatric patients; normal adults; military recruits; students	40	Internal consistency: State = .86 - 95; Trait = .89 - .91

Table 10. *Evidence for Psychophysiological Assessment*

Reference	Description	Subjects	Measures	Results/Comment
TEMPERATURE				
Monroe, 1967 (263) Level III – C	Physiologic differences between good and poor sleepers	16 recruited, questionnaire-defined "very good" sleepers 16 "moderately/very poor sleepers"	Core temperature/HR/ vasoconstrictions / skin resistance	Temperatures increased in poor sleepers at all measures, significantly in sleep
Adam, et al. 1986 (183) Level III – C	Physiologic differences between good and poor sleepers	18 recruited, questionnaire-defined "very good/good" sleepers 18 "very poor/poor" sleepers	Core temperature/ HR/cortisol/ catecholamines	Temperatures increased in poor sleepers at multiple day/evening measures
Bonnet & Arand, 1996 (176) Level III – C	Physiologic differences between insomniacs and normals with experimentally-induced sleep disturbance	10 referred/recruited, questionnaire-defined insomniacs 10 matched normals with induced "insomnia"	Core temperature 24 hr metabolic rate	Increased body temperature differentiates true insomniacs from yoked controls
Johns, et al. 1971 (242) Level V – C	Physiologic differences between good and poor sleepers	7 student volunteer, questionnaire-defined "good" sleepers 7 "poor" sleepers	Core temperature 11-OH corticosteriods	No difference in self-recorded rectal temperature – pre-sleep or morning
Mendelson, et al. 1984a (166) Level III – C	Daytime/nighttime function in insomnia	10 recruited self-defined insomniacs 10 C	Core temperature	Non-significant trend toward elevated temperatures at sleep onset in insomniacs
HEART RATE				
Haynes, et al. 1981 (91) Level III – C	Effects of pre-sleep stress	10 student volunteer, self-defined sleep onset insomniacs 10 C	Heart rate	Insomniacs show increased HR in response to pre-sleep stress compared to Cs; HR increased both pre- and post-stress
Johns, et al. 1976 (283) Level III – C	Correlations of HR and SLat	15 student volunteers – normals	Heart rate	Significant correlation between pre-sleep HR and SLat (.57) and between change in HR and SLat (.40)
Freedman & Sattler, 1982 (181) Level II – B	Physiological differences between sleep-onset insomniacs and normals	12 PSG-defined, sleep-onset insomniacs 12 C	Heart rate, Frontalis EMG, Finger temperature, Respiratory rate	Non-significant trend toward increased HR and RR during pre-sleep period in insomniacs

Adam, et al. 1986 (183) Level III – C	See above			No significant difference in HR
Monroe, 1967 (263) Level III – C	See above			Non-significant trend toward increased HR in insomniacs
Stepanski, 1989b (284) Level III – C	Physiological reactivity in chronic insomnia	24 INS (chronic) 25 C	Heartrate Vasoconstriction	HR significantly increased in INS (pre-sleep and through night)
EMG				
Freedman & Sattler, 1982 (181) Level II – B	See above			Significantly increased frontalis EMG in insomniacs
VASOCONSTRICTION / FINGER TEMPERATURE				
Monroe, 1967 (263) Level III – C	See above			Increased number of vasoconstrictions and increased skin resistance in insomniacs during sleep
Freedman & Sattler, 1982 (181) Level II – B	See above			No significant difference in number of vasoconstrictions or skin resistance in insomniacs; decreased finger temperature
METABOLIC RATE				
Bonnet & Arand, 1997 (27) Level IV – C	Assessment of physiologic activation in Sleep State Misperception	9 Sleep State Misperception 9 C	24 hr. metabolic rate	Insomnia subjects show significantly increased metabolic rate compared with normals
Bonnet & Arand, 1996 (176) Level III – C	See above		24 hr. metabolic rate	Insomnia subjects show significantly increased metabolic rate compared with experimentally-induced "insomnia" normals
Bonnet & Arand, 1995 (191) Level III – C	Assessment of mood, performance and metabolic measures in insomnia	10 Objective insomniacs 10 C	24 hr. metabolic rate	Insomnia subjects show significant increase in day and night metabolic rate vs. Cs

Table 11. *Evidence for Associated Diagnoses*

	Buysse, et al. 1994a (110) Level V - C Clinical diagnosis Multi-site/N = 216 ICSD %	Roehrs, et al. 1983 (111) Level V - C Clinical diagnosis Single-site/N = 563 ASDA %	Coleman, et al. 1982 (112) Level IV - C Clinical diagnosis Multi-site/N = 4698 ASDA %	Hattori 1991 (289) Level V - C Clinical diagnosis Psychiatry practice/N = 100 DSM-III-R %	Edinger, et al. 1996 a (288) Level III - C Clinical /PSG diagnosis Single-site/N = 113 DSM-III-R %	ICSD %	Jacobs, et al. 1988 (113) Level V - C Clinical /PSG diagnosis Single-site/N = 123 ASDA %
PRIMARY SLEEP DISORDERS				39	26.8		
Intrinsic						11.3	18.7
Psychophysiologic	12.5	15	15.3				
Sleep State misperception	0.4						
Idiopathic (childhood-onset)	2.5		0.3				
Narcolepsy/idiopathic hypersomnolence	0.8						4.1
Sleep-related respiratory NOS		8	6.2				8.9
Obstructive sleep apnea	4.7						
Central/hypoventilation	0.8						
Restless legs/Periodic limb movement	1.2	18	12.2			17.6	15.5
Intrinsic/NOS	1.2						
Extrinsic							
Inadequate sleep hygiene	6.2					10.6	
Adjustment sleep disorder	2.3						
Substance-dependent	3.1	7	12.4	4			7.3
Extrinsic/NOS	1.2						
Circadian rhythm		5	[a]				
Delayed Sleep Phase Syndrome	7.0						
Other	1.9						
SECONDARY							
Secondary to psychiatric NOS		17	34.9	4	22.5		
Psychosis	1.6						
Cognitive impairment				9			
Mood disorder	32.3			34.		22.5	29.3

Anxiety	6.2			6		1.6[b]
Medical NOS		6	3.8			11.4
Medical	1.2					
Neurological	1.6					
Related to organic condition					21.1	
Other	4.3	5			10.6	1.6
No objective findings		19	5.6			0.8
No sleep diagnosis	6.2		9.2	0.8	27.5[c] 27.5	0.8

Classification systems: ICSD = International Classification of Sleep Disorders; ASDA = American Sleep Disorders Association nosology; DSM = Diagnostic and Statistical Manual of Mental Disorders

a. Circadian rhythm disorders calculated separately from insomnia analysis
b. No DSM-III-R primary diagnosis
c. This diagnosis (DSM-III-R) primary

Glossary: *Diagnosis associated with insomnia complaint*

Diagnoses	Characteristics	References
Intrinsic Disorders		
Primary Insomnia		Sub-typing primary insomnia (26)
Psychophysiologic	(Learned/conditioned) insomnia Evidence of conditioned arousal in response to efforts to sleep May be primary or occur in association with other primary conditions	Comparison to childhood onset insomnia (102) Comparison to subjective insomnia (29) Structured interview and ambulatory monitoring (250) Analysis of cognitive activity (349) Polysomnography (350) Cluster analysis of insomnia (267) Comparison to dysthymic disorder and normals (72)
Sleep State Misperception	Subjective complaint without objective findings Diagnosis requires polysomnography for confirmation Possibly a variant of psychophysiological and other insomnias	Sleep in sleep state misperception (28) Daytime alertness in subjective insomnia (31) Factors of subjective insomnia in the elderly (93) Discussion of diagnostic validity (351)
Idiopathic	Childhood onset Symptoms largely unrelenting over decades Poorly characterized entity	Comparison to psychophysiologic insomnia (102) Comparison to adult-onset insomnia (101)

Glossary: *Diagnosis associated with insomnia complaint*

Diagnoses	Characteristics	References
Periodic Limb Movement (PLM) Restless Legs Syndrome (RLS)	Difficulty initiating sleep secondary to unpleasant sensations (RLS) Frequent sleep interruptions secondary to PLM Non-restorative sleep/daytime fatigue/sleepiness in some	Correlation of PLM findings with clinical presentation (105) Sleep-wake complaints in patients with PLM (323) Insomnia and sleepiness complaints among PLM patients: PSG findings (352) Telephone survey of RLS patients: epidemiology, clinical characteristics, and correlates (353) Clinical and polysomnographic characteristics of RLS patients (104) Clinicoetiologic correlates of RLS; familial/neuropathic groups (354) RLS in elderly; insomnia complaints; Fe deficiency findings (355) RLS in end-stage renal disease (356) Fluoxetine and PLMD (357) Alcohol and PLM (358) RLS and caffeinism (359)
Sleep apnea (obstructive/central)	Either variety can be associated with frequent sleep interruptions / nonrestorative sleep Obstructive type includes snoring, nocturnal respiratory events (e.g. gasping) and daytime somnolence	Initial description of insomnia complaint with sleep apnea (360) Sleep apnea presenting as insomnia (345) Analysis of symptoms (insomnia/sleepiness) in sleep apnea patients: central vs. obstructive (109) Analysis of correlation between apnea severity and sleep-related (subjective) complaints (117) Periodic breathing (Cheyne-Stokes) during sleep in congestive heart failure (review)(361) Prevalence of apnea in outpatient insomniacs (272)

Glossary: *Diagnosis associated with insomnia complaint*

Diagnoses		Characteristics	References
Extrinsic Disorders			
Substances			
Stimulants		Caffeine/amphetamine/ methylphenidate/pemoline/ bronchodilators/cocaine	Caffeine metabolism in caffeine-induced insomnia (362) Pharmacological responses to caffeine in poor sleepers vs. normals (229) Symptoms of caffeinism (363) Caffeine as a factor in subjective insomnia (elderly) (364) Caffeine consumption as a model for acute and chronic insomnia (68) Subjective and objective sleep changes related to caffeine consumption at various dosages (365) Insomnia in cocaine/polydrug withdrawal (366) Insomnia in cocaine withdrawal (367)
Alcohol		May represent self-medicating for insomnia or other primary condition (e.g. anxiety disorder); mid-cycle / early morning awakening most common secondary to acute withdrawal Long term use may produce irreversible sleep changes	Persistent insomnia in alcoholics related to maximum habitual consumption (368) Insomnia-related to late alcohol withdrawal (66) Association between alcohol and sleep duration (369) Alcohol use and periodic limb movement disorder (358)
Nicotine			Increased awakening associated with tobacco withdrawal (67) Smoking associated with difficulty falling asleep and sleep fragmentation (survey data) (370) Tobacco withdrawal and sleep fragmentation (371)

Glossary: *Diagnosis associated with insomnia complaint*

Diagnoses		Characteristics	References
Rebound insomnia		Associated primarily with discontinuation of short-acting sedative-hypnotics	Likelihood of hypnotic self-administration in response to rebound insomnia (372) Effect of duration of use on likelihood of rebound (373) Effect of dose on rebound (374) Effect of half-life on likelihood of rebound (375)
Other		Steroids/anti-hypertensives/ bronchodilators/other	Profile of symptoms in treated and untreated hypertensives (376) Comparison of side-effects of beta-blocker versus calcium channel blocker (377) Comparison of selective vs. non-selective beta-blocker side effects (378) Beta-blocker side-effects (379) Comparison of side-effects with ACE inhibitor vs. multiple therapy (380) Comparison of selective vs. non-selective beta-blocker side-effects (381) Theophylline and steroid side-effects in asthmatic population (382) Side-effects related to IV theophylline (383)
Inadequate sleep hygiene		Frequent complicating factor with other primary etiologies; overlap with psychophysiological insomnia	Role of sleep hygiene factors in insomnia diagnoses (384) Sleep Hygiene Awareness and Practice Scale (385) Improvement of sleep hygiene with shift work alteration (386)
Adjustment sleep disorder			Negative life events and frequency of sleep disorders (387) Role of stress in onset of insomnia (70)

Glossary: *Diagnosis associated with insomnia complaint*

Diagnoses	Characteristics	References
Circadian rhythm disorder		121 schedule disorders (90 DSPS; 13 non-24hr; 6 long sleep) (388)
Jet lag syndrome		See references – Section 3.3
Shift work disorder		See references – Section 3.3
Delayed sleep phase (DSPS)	May present as difficulty falling asleep; ability to sustain normal sleep at abnormal hours key to diagnosis More common in younger age groups	Characteristics of 33 DSPS patients (96) Characteristics of 14 DSPS patients (with PSG) (97) PSG study of DSPS (98) DSPS in adolescents (99) Initial description of DSPS (100)
Advanced sleep phase	Early evening drowsiness/early morning awakening; predominantly seen in older age groups	
Insomnia secondary to psychiatric disorders		Psychiatric co-morbidity in chronic insomnias (general practice) (76) Cross-sectional and prospective association between sleep disturbance and psychiatric disorder (47) Incidence of psychiatric disorders among insomnia patients (248)
Mood disorders	May account for 40% or more of chronic insomnia disorders; sleep maintenance problems most evident	Insomnia a primary symptom of major depression (multi-site international study) (389) Frequency of insomnia in major depression across four age groups (390) Sleep-related symptoms associated with onset of major depression (multi-site/NIMH-ECA) (391) Frequency of symptoms in depression (392) Clinical/PSG findings in dysthmia/generalized anxiety (393)

Glossary: *Diagnosis associated with insomnia complaint*

Diagnoses		Characteristics	References
Anxiety disorders		Generalized anxiety disorder; panic disorder; post-traumatic stress disorder; others	Sleep impairment in patients with social phobias (PSQI) (221) Clinical features and ambulatory sleep recording in generalized anxiety (300) Sleep events in PTSD (394) See additional references on panic disorder –Section 4.2
Personality disorders			
Insomnia secondary medical/neurological disorder			
Cardiac (angina / congestive heart failure / other)		Nocturnal angina may create awakening/sleep anxiety; CHF can be associated with apnea/paroxysmal dyspnea	Sleep changes in patients with myocardial ischemia (395) Sleep changes in patients with angina (396) Periodic breathing (Cheyne-Stokes) during sleep in congestive heart failure (review) (361) Recorded sleep in hospitalized cardiac patients (397)

Glossary: *Diagnosis associated with insomnia complaint*

Diagnoses		Characteristics	References
Pulmonary		Nocturnal dyspnea/cough/anxiety	Quality of sleep in hypoxemic COPD patients (subjective and PSG data) (398) Arousal from sleep related to hypoxemia in COPD (399) PSG in COPD patients; milder patients show greater disruption (400) Survey of sleep-related complaints in chronic lung disease patients (401) Effect of sleep quality on pulmonary function (elderly) (402) Difficulty maintaining sleep in COPD (survey) (4) Insomnia in asthmatic patients (English abstract) (403) Relationship of sleep disturbances to obstructive airway disease (404) Sleep disturbance in asthmatic patients (405) PSG in asthmatic patients - impaired sleep quality (406)
Thyroid			Frequencies of insomnia in patients with hyperthyroidism (407)
Gastro-intestinal reflux		Repeated awakening with chest discomfort	See section 4.2
Pain		Chronic pain problems; rheumatoid arthritis and related connective tissue disease	See Section 4.2

Glossary: *Diagnosis associated with insomnia complaint*

Diagnoses		Characteristics	References
Fibromyalgia			Subjective and objective sleep evaluation in fibromyalgia patients (408) Relationship between subjective sleep quality and pain reports in fibromyalgia (133) Relationship between sleep disturbance and fatigue in fibromyalgia (409)
Neurological			
Degenerative disease		Alzheimer's/Parkinson's/other: Light/fragmented sleep Loss of circadian rhythm/possibly increased incidence of apnea	Evaluation of sleep-wake cycle and sleep quality in dementia patients (actigraphy)(410) Assessment of relationship among sleep problems, behavioral disturbance, and cognitive impairment in Alzheimer's (328) Review of sleep disorders in degenerative brain diseases (411) Role of sundowning in dementia (325) Sleep disturbance in Parkinson's disease (PD) (subjective reports) (327) Relationship between depression/anxiety and sleep in PD (412) Actigraphic monitoring of sleep in PD - role of disease severity and medication (413) Prevalence and etiology of sleep disturbance in PD (329) Sleep disturbance, pain and depression in PD (414)
Headache		Nocturnal migraine/cluster/other	See references - Section 4.2

Appendix A: Methodology

Search Terms	Description/Criteria	# of Studies
Short sleep$	Prevalence or characteristics of short sleepers	5
Sleep State Misperception Subjective insomnia Insomnia without objective findings	Polysomnographically established diagnosis; all data regarding clinical characteristics, psychological characteristics or daytime function	6
Insomnia and course Insomnia and longitudinal	Retrospective or longitudinal analysis of course of insomnia	10
Acute insomnia Short-term insomnia Adjustment sleep disorder	All data regarding evaluation/assessment	0
Insomnia and epidemiol$ Insomnia and prevalence	Primary epidemiologic studies of insomnia; N>1000; includes operational definition of insomnia; age groups >15 and <65; age groups >65	22 6
Insomnia and diagnosis Insomnia and practice Insomnia and evaluation Insomnia and assessment Insomnia and history	Analysis of current diagnostic practices with respect to evaluation of insomnia by physicians or other healthcare professionals; relationship of history to process of evaluation or outcome; practitioner attitude regarding elements of evaluation	8
Insomnia and restless legs Insomnia and periodic limb movement	Analysis of relationship of RLS or PLMD to insomnia complaints	5
Insomnia and respiratory Insomnia and apnea Insomnia and obstructive pulmonary Insomnia and obstructive lung Insomnia and asthma	Epidemiology: association with insomnia Diagnosis of sleep-related breathing disorder in insomnia Relationship of PSG findings of breathing disturbance to insomnia	7 6 3

Appendix A: Methodology

Search Terms	Description/Criteria	# of Studies
Insomnia and panic Sleep and panic	Documentation of sleep disturbance / insomnia in patients with panic disorder; controlled studies	8
Insomnia and pain	Epidemiology: association with insomnia	4
	Association with specific pain disorders/groups	3
	Controlled	5
	Uncontrolled	6
	Polysomnographic studies	
Insomnia and headache	All data regarding relationship of insomnia to headache	5
Insomnia and gastro-esophageal reflux Insomnia and reflux Insomnia and GERD	All data regarding relationship of insomnia to GERD	5
Sleep and bed partner Sleep and spouse	Validity of spouse / bed partner reports:	
	in insomnia:	3
	other sleep disorders:	4
Insomnia and performance Insomnia and neuropsych$ Insomnia and consequence Insomnia and daytime	Evaluation of cognition, vigilance, psychomotor function or other relevant daytime consequences of insomnia	
	Controlled	17
	Uncontrolled/other comparisons	2
Insomnia and Multiple Sleep Latency Insomnia and MSLT	MSLT findings in insomnia patients vs controls	9
Insomnia and pupillometry	Pupillometry findings in insomnia patients vs controls	3
Insomnia and sleepiness Insomnia and Epworth Insomnia and Stanford Sleepiness Scale	Identification of subjective sleepiness in insomnia: Epidemiologic	4
	Subjective rating scales	10
Sleep log Sleep diary	Discrimination of insomniacs from controls	5
	Assessment of insomniacs (no controls)	5
	Comparison to objective assessment of	

Appendix A: Methodology

Search Terms	Description/Criteria	# of Studies
	sleep	11
	Comparison to global / retrospective assessment	3
Sleep and questionnaire Insomnia and questionnaire	Correlation of questionnaire measures in insomnia / poor sleep with objective measure	2
	Validation / reliability, assessment in insomnia vs controls	5
	Validation / reliability, factor analysis, assessment in other sleep disorders/normals	9
Pittsburgh Sleep Quality Index (PSQI)	Reliability / validity determination	2
	All other assessment of sleep quality	18
Insomnia and psycholog$ Insomnia and MMPI Insomnia and Profile of Mood States / POMS Insomnia and Speilberger Insomnia and Beck Insomnia and Hamilton	Psychometric assessment of insomniacs: Controlled/referred patients Controlled/recruited subjects Uncontrolled/other comparisons	 13* 14 10
Insomnia and physical exam$ Insomnia and lab$ Insomnia and diagnostic Insomnia and serum	Assessment of utility of physical examination, medical diagnostic procedures / laboratory studies in evaluation of insomnia	0
Insomnia and psychophysiologic$ Insomnia and heart rate Insomnia and temperature Insomnia and EMG Insomnia and skin conductance / electrodermal Insomnia and metabolic	Psychophysiologic evaluation of insomniacs including physiologic assessment of heart rate, respirations, temperature, EMG, skin conductance, or metabolic rate: Heart rate Temperature EMG Metabolic rate	 6 5 1 3
Insomnia and ambulatory	Diagnostic application of ambulatory	5

Appendix A: Methodology

Search Terms	Description/Criteria	# of Studies
Sleep and ambulatory Insomnia and home record$ Insomnia and portable	recording in evaluation of insomnia	
Insomnia and static charge sensitive bed / SCSB	Validation of SCSB data Correlation of sleep scoring with SCSB application of SCSB in assessment of disturbed sleep	8

$ - Truncated term includes all derivative endings
*Includes mixed referred/recruited samples