Behavioral Sleep Medicine: A Historical Perspective

Edward J. Stepanski
Sleep Disorder Service and Research Center
Rush–Presbyterian–St. Luke’s Medical Center
Chicago, IL

Behavioral sleep medicine (BSM) has recently emerged as a subspecialty area within the broader field of sleep medicine. Certain commonly used treatment approaches in BSM were first pioneered in the 1930s, and this article traces the developments within BSM to current practice. Important innovations include the expansion of BSM beyond the treatment of insomnia to include treatment of pediatric sleep disorders, circadian rhythm disorders, parasomnias, as well as desensitization procedures for patients undergoing treatment with nasal continuous positive airway pressure (CPAP).

Formally, “behavioral sleep medicine (BSM) addresses behavioral dimensions of normal and abnormal sleep mechanisms and the prevention, assessment, and treatment of sleep disorders and associated behavioral and emotional problems” (see the editorial scope statement of this journal). Treatment for insomnia is the area most identified with BSM, but treatment of pediatric sleep disorders, circadian rhythm disorders, and parasomnias, as well as psychometric assessment of patients with sleep disorders, are also important aspects of this discipline.

The term “behavioral sleep medicine” evolved from discussions between Michael Perlis and myself in the late 1990s. The first official use of the name occurred in 2000, when Dan Buysse, as president of the American Academy of Sleep Medicine, formed a presidential committee on BSM. This committee was given four mandates from the board: (a) develop a mechanism for the accreditation of BSM practitioners, (b) develop guidelines for training programs for BSM practitioners,
(c) develop educational programs on BSM for presentation at professional meetings, and (d) investigate reimbursement for BSM services. The BSM committee is actively engaged in these activities, and the first certification exam for BSM is scheduled for administration in 2003.

The formal subspecialty of clinical sleep medicine has emerged during the past 25 years. This new discipline began with the accreditation of sleep disorder centers in major medical centers and the publication of a nosological system for diagnosing sleep disorders (American Sleep Disorders Center [ASDC], 1979). Polysomnography was the technological cornerstone that facilitated the growth of sleep medicine as a subspecialty within the field of medicine. Sleep medicine has been a multidisciplinary field from its inception, with prominent roles played by psychiatry, neurology, pulmonology, otolaryngology, pediatrics, nursing, and psychology. BSM practices existed prior to the era of modern sleep medicine, as sleep problems were largely under the purview of psychologists and psychiatrists. This article will review the roots of what has become the field of BSM. Because the purpose of this review is a historical perspective, the literature cited is selective and is not intended to be comprehensive.

PIONEERS

The beginning of the modern era of sleep science can be dated to the pioneering work of Kleitman, Laird, and others (Kleitman, 1939; Laird & Muller, 1930). The work of Kleitman is better known to sleep researchers of today because of his role in the discovery of REM sleep, his mentorship of Dement, in addition to his many scientific contributions documented in his text book, *Sleep and Wakefulness* (Kleitman, 1939). However, the efforts of these and other early investigators have to a great extent faded into obscurity. Laird, for example, was a sleep researcher at Colgate University who wrote extensively about the significance of inadequate sleep as it affected workers in occupational settings, the effects of short sleep on learning, the need for sleep in children, and many other topics during the 1920s (Laird & Muller, 1930). These issues are still being “re-discovered” today.

Jacobson’s well-known work on insomnia can arguably be cited as the beginning of BSM (Jacobson, 1934). Jacobson developed the tenets of progressive muscle relaxation (PMR), based on his work with patients he felt to have somatic problems that were stress related. He theorized that heightened arousal contributed to a number of common medical complaints. PMR was a central treatment, but other stress management techniques were included in his treatment programs. The foundation for Jacobson’s work can be traced to his training at Northwestern, Harvard, and University of Chicago, where he trained with such notable figures as William James and Walter Cannon.
TREATMENT OF INSOMNIA

Relaxation Therapies

Jacobson provided a precise description of what would eventually be called “psychophysiological insomnia” in You Can Sleep Well (Jacobson, 1938). Although Jacobson is remembered for developing PMR as his major contribution, his writing also demonstrated a profound understanding of insomnia. In particular, his description of the behavioral and cognitive factors associated with insomnia is quite similar to our current understanding of these dimensions. Jacobson (1938) also described how the exciting seductions of a modern society can lead to heightened arousal at night, and then in turn to insomnia:

What with electric lighting, automobiles, motion pictures, radios and other innovations, life after dark has become so attractive that most of the evening hours up to midnight are commonly occupied by some form of amusement—if only talking things over with friends and neighbors. (p. 182)

Every age has challenges that are in some ways unique, but in a broader sense similar to those faced in every era. Reading Jacobson’s case description of a patient presenting with insomnia from 70 years ago gives substance to the adage from psychotherapy that “the actors change, but the roles remain the same.” In today’s era, we would cite the internet, satellite television, and 24-hr supermarkets as threats to a normal sleep–wake pattern in our version of modern society.

Jacobson reviewed a patient’s use of bromides to improve his sleep, followed by the use of phenobarbital once bromides fell into disfavor. We now know of the failure of barbiturates to provide any lasting benefit for the treatment of insomnia. Concerns about pharmacological treatment for insomnia have not changed much over the years. The following quote begins discussion about use of sleeping pills from a book on insomnia published in 1942 (Alvarez et al.):

Today in most states sleeping medicines can be obtained only on a doctor’s prescription, and this regulation has some merit because there are a few undisciplined persons who, if left to their own devices, would take large doses of these drugs every night without waiting to see if they were necessary for the obtaining of sleep. Many would rather take a drug than to make an effort to control emotions and calm down in the evenings. (p. 25)

Despite Jacobson’s extensive work in the area of relaxation, it is Wolpe (1958) who brought relaxation techniques into the mainstream of American psychology. He developed abbreviated relaxation training regimens, and demonstrated their usefulness in the treatment of anxiety disorders.
Systematic research aimed at understanding mechanisms underlying insomnia produced major advances in the late 1960s. Much of this research took place at the University of Chicago under the direction of Allan Rechtschaffen. Monroe (1967), Hauri (1968), Robinson (1969), and Zimmerman (1967) showed how increased physiological and, to some extent, cognitive arousal contributed to poor sleep. The role of physiological and cognitive hyperarousal as contributing factors in chronic insomnia continues to receive empirical support (Stepanski, Zorick, Roehrs, Young, & Roth, 1988; for a review see Bonnet & Arand, 1997, and Morin, 1993).

There was a struggle during the 1960s and 1970s about whether insomnia was always related to a psychiatric or medical disorder, or could be “learned.” The view that a primary psychiatric disorder was always to blame may be found in the writing of Kales and Kales (1984). Acceptance of insomnia as a learned behavior was signified in the original nosological system published by the ASDC (1979). The term “psychophysiological insomnia” was used to denote an association between increased arousal and poor sleep, similar to the prevailing view that arousal might lead to hypertension or ulcers.

The work of Wolpe and Jacobson led the way for empirical studies of relaxation-based treatments for insomnia during the 1970s and early 1980s. Progressive muscle relaxation was the intervention most often studied. Studies using self-report measures of sleep tended to find a greater magnitude of change (Haynes, Sides, & Lockwood, 1977; Lacks, Bertelson, Gans, & Kunkel, 1983; Nicassio & Bootzin, 1974), than did those studies obtaining EEG measures of sleep (Borkovec, Grayson, O’Brien, & Weerts, 1979; Borkovec & Weerts, 1976; Coursey, Frankel, Gaarder, & Mott, 1980). Use of a hypnotic relaxation approach was also shown to be effective (Stanton, 1989). However, relaxation treatments generally did not show large effect sizes, and were not better than placebo in some trials (Borkovec & Fowles, 1973; Nicassio, Boylan, & McCabe, 1982). The American Academy of Sleep Medicine (AASM) practice parameter paper for chronic insomnia rated PMR as empirically validated and well-established (Chesson et al., 1999).

Borkovec made important contributions to this area through his studies to explore the mechanism that allowed relaxation training to produce therapeutic benefit for insomnia (Borkovec & Hennings, 1978). He was particularly interested in determining if the therapeutic effect was related to psychological or physiological mechanisms. That is, would insomnia improve because the patient is focusing on the sensations associated with relaxation, or because of the muscular relaxation itself. The findings from those studies were equivocal, but suggested that the muscle tension-release component was critical for the success of progressive muscle relaxation (Borkovec, 1982).

Hauri published well-controlled studies demonstrating the efficacy of biofeedback in the treatment of insomnia in the early 1980s (Hauri, 1981; Hauri, Percy, Hellekson, Hartmann, & Russ, 1982). This research was particularly notable because differential treatment efficacy depended on the match between patient charac-
teristics and type of treatment. For example, increased arousal, measured by EMG levels, predicted successful treatment with EMG biofeedback, but not with a type of EEG biofeedback. This remains the only study to show that treatment can be successfully tailored to patient characteristics. Other attempts to match treatment to features of the insomnia have not been successful, and some have even shown that the treatment modality predicted to perform poorly provided greater benefit than the predicted treatment (Espie, Lindsay, Brooks, Hood, & Turvey, 1989). The AASM practice parameter paper rated biofeedback as empirically validated and probably efficacious as a treatment for chronic insomnia (Chesson et al., 1999).

Over the past 15 years, relaxation therapies have gradually been incorporated into or replaced by other behavioral approaches and multi-component cognitive behavioral therapy (CBT) programs as described later. Biofeedback in particular appears to have fallen out of favor and is little used today. This is probably due to the time-intensive nature of this treatment, with 15–62 one-hour sessions of training required for successful treatment (Hauri, 1981).

Stimulus Control Therapy

Systematic intervention research investigating treatments for chronic insomnia had a renaissance in the 1970s. Principles of behavioral theory were applied to the problem of insomnia, and many new treatment approaches were formulated at this time. Bootzin used learning theory to create stimulus control therapy (SCT) for insomnia (Bootzin, 1972). This innovative approach was based on principles of operant conditioning and proscribed sleep-incompatible behaviors and lying awake in bed as key targets of treatment. Many investigators included SCT in their outcome research on treatment efficacy, and showed significant improvement using self-report measures of sleep initiation and maintenance (Lacks, Bertelson, Gans, & Kunkel, 1983; Lacks, Bertelson, Sugerman, & Kunkel, 1983). SCT continues to be one of the most commonly used behavioral treatments for insomnia, and is included in multi-component treatment programs. The AASM practice parameter recommendations for behavioral treatment of insomnia found that SCT had strong empirical evidence to support its efficacy, and rated it as empirically validated and well-established (Chesson et al., 1999).

Sleep Hygiene

A list of rules to follow to promote better sleep in patients with insomnia was published and called “sleep hygiene” (SH) by Hauri (1977). This approach is extremely popular, and SH education is almost universally recommended for the treatment of insomnia (Buysse et al., 1997). The rules considered to constitute SH have evolved over the years. There are few studies of SH as a “stand-alone” treatment, and, instead, it appears to be considered a necessary, but not sufficient, ap-
Paradoxical Intention

The principles of paradoxical intention were used to formulate a treatment approach to insomnia (Ascher & Turner, 1979). With paradoxical intention, patients are instructed to stay awake for as long as possible after going to bed at night. Several studies reported positive results with paradoxical intention on subjective outcome measures (Ascher & Turner, 1979; Ladouceur & Gros-Louis, 1986; Turner & Ascher, 1979). In fact, the AASM practice parameter statement rated this treatment as empirically validated and well established based on an analysis of the literature (Morin, Hauri, et al., 1999). However, research on this treatment has disappeared from the recent literature, and it does not appear to be commonly used at this time. It is not included in CBT programs for insomnia. Research on paradoxical intention as a treatment for insomnia suggests a highly variable treatment response across patients.

Sleep Restriction Therapy

In the 1980s, sleep restriction therapy (SRT) was developed by Spielman and colleagues (Spielman, Saskin, & Thorpy, 1987). This behavioral treatment systematically reduces time in bed in order to increase homeostatic drive for sleep, and then increases time in bed once sleep efficiency improves. SRT has become a widely used treatment, and is routinely included as part of CBT treatment programs for insomnia. SRT was rated as empirically validated and probably efficacious according to the AASM practice parameter paper (Chesson et al., 1999). This somewhat lesser rating occurred because most of the studies of SRT are of multi-component programs, and there is limited empirical support for SRT as a single treatment approach (Morin, Hauri, et al., 1999).

Another important contribution from Spielman at about the same time was a theoretical model for understanding the development of chronic insomnia and its evolution over time (Spielman, 1986). This model classified factors contributing to chronic insomnia as predisposing, precipitating, or perpetuating. These factors play a role in the formation and maintenance of insomnia, and their relative importance changes over the course of the insomnia. The least understood are predisposing factors, although, as discussed earlier, physiological hyperarousal appears to be one of the strongest candidates. Precipitating factors might be medical conditions or symptoms (e.g., pain), psychological reactions (e.g., acute anxiety), environmental situations (e.g., noise in the bedroom), or anything else (e.g., work stress, shift work) that would reasonably disrupt sleep acutely. Precipitating fac-
tors are the focus of the nosological system for diagnosing sleep disorders (ICSD, 1990). Perpetuating factors are behavioral and cognitive features of insomnia that typically develop once an individual has been struggling with insomnia for days or weeks. Examples include increasing time in bed in order to achieve more sleep, increasing use of caffeine to counteract daytime fatigue, self-medicating with alcohol, and ruminating throughout the day about the need to obtain additional sleep. This model is important because it provides a framework for understanding what is otherwise a disparate set of features associated with the causes and consequences of insomnia. Additionally, it can serve to organize clinical interventions by targeting the appropriate set of factors based on the status of an individual patient.

Cognitive Therapy

The dread of being awake during the night and the fretful anticipation of daytime impairment are common worries of patients with insomnia and have long been appreciated by clinicians (Jacobson, 1962, p. 182). Patients themselves are also more likely to attribute their sleep difficulty to heightened cognitive arousal, rather than somatic arousal (Lichstein & Rosenthal, 1980). A book on insomnia written by an editorial board of physicians (Alvarez et al., 1942) for lay people notes that

Relaxation is more likely to come if the would-be sleeper hasn’t any fear of insomnia; hence the physician does well when he keeps reminding a patient that nothing terrible need happen to him if he does not sleep. There are thousands of persons working hard and enjoying fair health who haven’t had a good night’s sleep for years. They do not go insane or come to any bad end. (p. 16)

The interaction between cognitive and behavioral factors was also acknowledged in a 1938 book (Millet) on insomnia:

Nostrums, then, in insomnia are those pet schemes or remedies by whose aid the insomniac thinks to outwit his enemy, without realizing that often through his devoted attention to them he is setting up a ritual for himself which is fully calculated to keep the enemy in power. For these nostrums represent an attempt to defeat wakefulness or to avoid the anxiety incidental to lying awake, and as such signify that the individual is attempting to escape his anxiety through the use of some semi-magical device, thus turning his back on the need for understanding the problem and working out its solution along informed and intelligent lines. (pp. 134–135)

Although the cognitive component of insomnia has been noted for decades, a formal structure of cognitive therapy for insomnia is an innovation from the 1990s. A formal description of programmatic cognitive therapy designed for patients with insomnia is well described by Morin (1993). Morin explains how misattributions,
unrealistic expectations, and various cognitive errors contribute to emotional arousal and, ultimately, to insomnia. He then applies cognitive restructuring techniques that have been effective in the treatment of anxiety disorders and depression to changing these maladaptive cognitions that accompany insomnia. Cognitive restructuring teaches the patient to evaluate their response to sleeplessness with a more realistic perspective. Integrating cognitive therapy with the behavioral therapies described previously is essential because many of the cognitive features inherent to insomnia lead to the behavioral changes that exacerbate the insomnia. For example, fearing that he or she is getting fewer than 8 hr of total sleep time, the patient may spend excessive time in bed.

The AASM practice parameter paper found that there was insufficient evidence to establish the efficacy of cognitive therapy for the treatment of chronic insomnia as single treatment (Chesson et al., 1999). Cognitive therapy has most often been studied as part of a multi-component therapy program.

Multi-Component CBT Programs

The current state of the art in the cognitive–behavioral treatment of insomnia is to provide a program that combines SH, SCT, SRT, and cognitive therapy (Morin, Colecchi, Stone, Sood, & Brink, 1999; Edinger, Wohlgemuth, Radtke, Marsh, & Quilian, 2001). This approach recognizes the difficulty of predicting which treatment will benefit a particular patient, and it avoids this problem by providing all treatment components to each patient. With improved understanding of the mechanisms that contribute to insomnia, it is expected that eventually clinicians will be able to match specific aspects of cognitive–behavioral therapies to a given patient based on individual patient characteristics.

The efficacy of the multi-component programs has been shown using polysomnographic outcome measures (Edinger et al., 2001; Morin, Colecchi, et al., 1999), and the CBT program has been shown to be superior to pharmacotherapy (Morin, Colecchi, et al., 1999). These studies were conducted with older adults with primary insomnia. Another application of CBT is for populations with what has been termed “secondary insomnia.” Preliminary research shows that CBT is effective in the treatment of patients with insomnia associated with medical and psychiatric illness (Lichstein, Wilson, & Johnson, 2000) or periodic limb movement disorder (Edinger, Fins, Sullivan, et al., 1996). A recent study utilized the multi-component program in general practice and found that two thirds of those patients had sleep in the normal range at the end of treatment (Espie, Inglis, & Harvey, 2001). The AASM practice parameter paper rates multi-component treatment packages as empirically validated and probably efficacious for chronic insomnia (Chesson et al., 1999).

Several studies using meta-analysis have shown that behavioral treatments for insomnia produce reliable improvement at posttreatment for sleep onset latency and time awake after sleep onset (Morin, Culbert, & Schwartz, 1994; Murtagh &
Greenwood, 1995). These gains are maintained at follow-up, conducted an average of 6 months after treatment. Another meta-analysis study compared CBT to pharmacological treatment for primary insomnia and found that both approaches were equally effective for short-term treatment (Smith et al., 2002).

**Bright Light Therapy**

Exposure to bright light has been shown to improve sleep in patients with seasonal affective disorder (Lewy et al., 1998). Use of appropriately timed exposure to bright light may also be used to treat insomnia when it is associated with a circadian rhythm disorder. Evening exposure to bright light in patients with an advanced sleep phase was shown to delay the time of the final awakening by more than an hour (Lack & Wright, 1993). However, bright light exposure for a group of older adults with sleep maintenance insomnia did not improve sleep despite causing a shift in circadian phase (Suhner, Murphy, & Campbell, 2002). This suggests that bright light treatment will only be effective when matched to a specific circadian rhythm abnormality.

**Withdrawing Patients From Use of Hypnotic Medication**

Assisting patients who are withdrawing from hypnotic medication is another area of interest for BSM specialists. It has been shown that introducing relaxation training, in conjunction with medication withdrawal, leads to less reliance on the medication (i.e., greater reduction in amount of medication used) as well as improved sleep (Lichstein et al., 1999). More research is needed to further refine treatment regimens to assist with tapering and discontinuing use of hypnotic medication.

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**SLEEP AND SLEEP DISORDERS IN CHILDREN**

**Enuresis**

The behavioral treatment of enuresis was developed by Mowrer, who presented his findings using the bell and pad treatment at the American Orthopsychiatric Meeting in 1937 (Mowrer, 1938). This technique used the principles of classical conditioning to train children to awaken when they needed to urinate during the night. Bladder distention was the conditioned stimulus for the response of awakening to a bell (the unconditioned stimulus). Mowrer provided a fascinating description of this work, and the significance of it to practitioners at the time, in his 1976 address to the American Psychological Association (Mowrer, 1980). The immediate need to develop an effective treatment arose when he joined the staff of a residential institution for children with various emotional disorders. Half of the children suf-
ffered from enuresis, which had a considerable negative impact on the institution. The scope of the problem was such that news of an effective treatment for enuresis was welcomed enthusiastically by clinicians around the country.

Empirical research has shown that the bell and pad approach is effective in greater than 70% of cases of enuresis (Rushton, 1989). There are pharmacological treatments, most commonly imipramine or intranasal DDAVP, that are also commonly used (Gimpel, Warzak, Kuhn, & Walburn, 1998). However, although these treatments are effective, there is immediate relapse upon discontinuation of the medication. Given the immediate relief and low-side-effect profile of DDAVP, it is most useful for short-term as needed use (e.g., summer camp; Mindell, 1993). More than 60 years after its initial development, the bell and pad treatment is still the single most effective treatment for long-term control of enuresis.

Bedtime Refusal

It is fitting that the originator of behaviorism wrote about behavioral treatment for pediatric sleep disorders. Watson wrote about the proper approach to establishing a regular sleep–wake schedule in young children (Watson, 1928). He recommended establishing a consistent set of nighttime rituals, including a bath and quiet play, followed by bedtime. Some obsolete advice includes a recommendation that the parent take a final look around the room to make sure the chamber pot is under the bed, and that there is a flashlight on the nightstand for a child to use upon awakening during the night. After this ritual, the parent leaves the room for the night.

If he howls, let him howl. A week of this regime will give you an orderly bedtime. (Watson, 1928, p. 120)

In essence, Watson has described two treatments for bedtime refusal: positive bedtime routines and an extinction procedure. Sixty years after this terse description by Watson, several empirical studies have shown that extinction procedures are efficacious as a treatment for bedtime refusal (Adams & Rickert, 1989; France & Hudson, 1990). According to standard criteria for judging the adequacy of empirical data, extinction is rated as a “well-established” treatment approach (Mindell, 1999). A modification of this approach allows the parents to enter the bedroom to briefly reassure the child, but with longer and longer intervals between bedroom visits until they are discontinued altogether. This approach, called graduated extinction, is considered “probably efficacious” (Adams & Rickert, 1989; Mindell, 1999). Few studies of positive bedtime routine as a treatment for bedtime refusal have been completed, and this approach is graded as a “promising intervention” (Mindell, 1999).
Nighttime Awakenings/Sleep-Onset Association Disorder

The contemporary understanding of pediatric sleep disorders in behavioral terms made a giant leap forward with the publication of Ferber’s book in 1985 (Ferber, 1985). He provided a model that discriminated among causes of sleep disturbance in children and also matched treatment regimens to specific disorders. His subtypes of disorders that lead to difficulty initiating or maintaining sleep in infants and children include sleep-onset association disorder and limit-setting disorder. Ferber describes how the most common pediatric sleep disorders are established through classical conditioning (sleep-onset association disorder) or are maintained because of reinforcement from the parents (limit-setting disorder). Sleep-onset association disorder occurs because the infant becomes conditioned to fall asleep in conjunction with certain circumstances that it cannot recreate during the night upon awakening (e.g., being rocked by a parent). Therefore, the parent must again rock the child with each awakening to get the infant to return to sleep. Once understood in these terms, the treatment is intuitive: The infant must learn to fall asleep on his or her own to start the night.

In addition to extinction and graduated extinction procedures, another approach to eliminate nighttime awakenings is the use of scheduled awakenings (Rickert & Johnson, 1988). With this treatment approach, the child is awakened by the parent slightly before the usual time of the problematic awakening. The child is reassured and allowed to return to sleep. The scheduled awakenings are subsequently reduced in frequency and then discontinued. The empirical data to support this approach is rated as “probably efficacious” (Mindell, 1999).

Parasomnias

A systematic approach to understanding and treating parasomnias has been proposed by the group at the Minnesota Regional Sleep Disorders Center, headed by Mahowald (Mahowald & Schenck, 1996; Schenck & Mahowald, 1996). Categorization of parasomnias according to sleep state (NREM vs. REM), as well as on the basis of whether they are primary, or occur as secondary to other precipitants, has greatly improved clinical evaluation and treatment.

Non-REM parasomnias in children, such as sleep walking and confusional arousals, may be managed with behavioral treatment (Mahowald & Rosen, 1990). General behavioral changes include establishing a regular sleep–wake schedule and maintaining sufficient time in bed to avoid sleep deprivation. Sleep deprivation will increase the likelihood of a NREM parasomnia because of the increased slow-wave sleep observed with recovery sleep. Scheduled awakenings or scheduled nap interventions may also be useful since these will be followed by lighter stages of sleep. Measures to ensure the safety of the patient by removing obstacles from the bedroom
and taking steps to keep the patient away from windows and stairs must also be a routine component of any behavioral treatment program for sleepwalking.

Nightmares can also be treated behaviorally. Use of imagery rehearsal therapy has been shown to be effective in the treatment of nightmares in patients with posttraumatic stress disorder (Krakow et al., 2001).

**BIOLOGICAL RHYTHMS AND CIRCADIAN RHYTHM DISORDERS**

Circadian rhythm disorders occur when there is desynchrony between the biological and environmental clocks in the timing of the sleep–wake schedule. The most common of these disorders encountered in clinical practice is delayed sleep phase syndrome (DSPS). This disorder is marked by a biological sleep rhythm that is not prepared for sleep at the desired bedtime and promotes sleep during a time period later than the desired schedule. Further treatment advances in this area are expected given that the understanding of circadian physiology in normal individuals is an area that has shown remarkable progress over the last two decades and continues to evolve.

Chronotherapy was the first behavioral treatment developed to realign the biological and environmental sleep–wake schedules (Weitzman et al., 1981). This approach required that the patient delay their bedtime by 1–3 hr each night until the desired schedule was reached. The approach was based on the assumption that the cycle length of the intrinsic circadian rhythm was a little more than 25 hr, and therefore it would be much easier for individuals to delay, rather than advance, their sleep phase. Discoveries since the initial description of chronotherapy suggest how this treatment, as initially conceived, might have limited efficacy. First, we now know that the intrinsic rhythm is about 24.2 hr, so the daily tendency to delay is slight (Czeisler et al., 1999). Second, and more important, the impact of exposure to bright light can be profound depending on its placement according to the phase response curve (Czeisler & Khalsa, 2000). Treatment with standard chronotherapy instructions, without regulating an individual’s exposure to sunlight, would not be expected to produce a predictable shift in phase given the robustness of bright light in regulating circadian phase. An individual could potentially be exposed to sunlight upon arising, which would precipitate a phase advance, instead of a delay. For this reason and the practical difficulties of conducting chronotherapy, this treatment has been supplanted by bright light therapy in the morning to accomplish the same goals for patients with DSPS.

Research is needed to elucidate the contributions of behavioral factors and circadian rhythm regulation in DSPS. Landmark research in this area suggests that adolescents have developmental changes in their circadian regulation that predisposes them to become phase delayed (Carskadon, Labyak, Acebo, & Seifer, 1999). It is also possible that decreasing homeostatic sleep drive contributes to the ten-
tendency to phase delay in adolescent individuals (Carskadon, Acebo, & Seifer, 2001). Understanding this issue has great public health implications since adolescents start school earlier than they did 20 years ago and display evidence of chronic sleep deprivation (Carskadon, Wolfson, Acebo, Tzischinsky, & Seifer, 1998).

Another circadian rhythm disorder encountered in clinical practice is Shift Work Disorder. This disorder can also be treated behaviorally or with bright light therapy to try and achieve better regulation of the sleep–wake pattern (Eastman & Martin, 1999). This disorder also has significant public health implications given the large number of workers performing shift work, and the expectation that the proportion of workers engaged in shift work will continue to increase.

**SLEEP DISORDERS IN OLDER ADULTS**

The prevalence of insomnia, as well as other sleep disorders, increases with age (Foley, Monjan, Brown, & Simonsick, 1995). Older patients with primary insomnia have been shown to respond to CBT in controlled clinical trials (Morin, Colecchi, et al., 1999; Edinger et al., 2001). Use of CBT in these patients is preferred since older adults are at increased risk for side effects when treated with hypnotic medication (Culebras, 1996). A comprehensive review of treatment issues for older adults with insomnia can be found in the book edited by Lichstein and Morin (2000).

Evaluation of sleep complaints in this population is complicated because “normal” aging is associated with an increased prevalence of primary sleep disorders. A population-based study of adults over the age of 65 using an apnea–hypopnea index of greater than 5 as a cutoff found that 24% of the sample had OSA (Ancoli-Israel, Kripke, Klauber, et al., 1991a). The prevalence of periodic limb movements is also increased. Forty-five percent of a community-based sample of adults over the age of 65 had a periodic limb movement index of greater than 5 (Ancoli-Israel, Kripke, Klauber, et al., 1991b). In addition to the effects of normal aging, older patients often have medical disorders that may further contribute to their disturbed sleep. For example, patients with cardiopulmonary disease, stroke, Parkinson’s Disease, and many other conditions are all at increased risk for sleep-disordered breathing (Stepanski, Rybarczyk, Lopez, & Stevens, in press).

Another consideration for evaluating poor sleep in older adults is to assess if they are functioning as caregivers. It has been shown that older adults acting as caregivers for family members who either had Alzheimer’s disease or who had undergone a liver transplant experience significantly worse sleep on objective testing (Hall, Martire, Buysse, Dew, Schulz, & Kupfer, 2002). Further, these caregivers had higher levels of intrusive thoughts, and this correlated significantly with poor sleep. Sleep disturbance may be one factor contributing to the increased morbidity found in caregivers.
ADHERENCE TO USE OF NASAL CPAP

An emerging area related to behavioral sleep medicine services is that of improving adherence to use of nasal CPAP in patients with obstructive sleep apnea. A landmark study from 1994 used covert sensors to objectively monitor the time of CPAP use, and found that treatment adherence was significantly lower than what patients self-reported (Kribbs et al., 1994). Although the level of adherence to CPAP regimens appears to be similar to that found for other chronic medical treatments, the need to increase rates of adherence has been targeted as a critical goal within the field of sleep disorders medicine. Psychological factors were found to predict poor compliance (Kribbs et al., 1994) and further work to address this in improving adherence is warranted. Patients with OSA who are unable to comply with medical treatment often benefit from CBT-type interventions that range from additional clinician support and education (Aloia et al., 1999) to desensitization procedures that target patient’s phobic reactions to the use of CPAP (Speer & Fayle, 1997). Formulation of other psychological interventions to target patients with poor compliance are needed (Zozula & Rosen, 2001).

SUMMARY

BSM has a long tradition and has become increasingly useful in the understanding and treatment of a wide range of sleep disorders. This article has provided much greater detail about insomnia than other clinical domains. This is not a statement about the relative importance of insomnia versus pediatric sleep disorders or circadian rhythm abnormalities, but rather reflects that intervention research for the latter areas is scarce in comparison to that for insomnia. The past 30 years has seen a vast improvement in the understanding of the cognitive and behavioral factors that contribute to adult and pediatric sleep disorders. Additionally, the efficacy of CBT for insomnia has been established. However, a great deal of work remains in the application of CBT approaches to sleep disorders. Every area described earlier still has many challenges before treatment regimens will be optimal. BSM is in a period of exceptional growth, with a marked expansion of interest beyond insomnia, to include pediatric sleep disorders and circadian rhythm disorders.

Establishing the efficacy of CBT in younger patients with insomnia, and in patients with secondary insomnia, is needed. Also, effectiveness studies that establish the portability of these treatments to various health care settings will be essential if these treatments are to be delivered to large numbers of patients in a cost-effective manner (e.g., Espie, Inglis, & Harvey, 2001). An improved understanding of the mechanisms of insomnia across patient subtypes may yet lead to effective strategies for tailoring treatment recommendations to further enhance treatment effectiveness and reduce the time required for treatment. Research that assesses if CBT can be combined effectively with pharmacological treatment is
needed. The indications and limitations of combined treatment approaches may yield improved outcomes over current strategies that rely on either CBT or pharmacological treatments alone.

More empirical work to establish the effectiveness of behavioral treatments for pediatric sleep disorders is needed. Many of the commonly used behavioral treatments have few empirical studies on which to base clinical guidelines to optimize treatment efficacy. The need for effective treatments is enormous given the prevalence of parent reports of sleep-related disorders in their children (Mindell, 1999).

The body of science underlying our understanding of biological rhythms is steadily growing, and regimens to treat the related sleep disorders continue to develop. However, a consensus on optimal treatments for common disorders such as DSPS or shift work disorder is still needed.

Finally, an intriguing area for research is identifying behavioral or psychological strategies that improve adherence to nasal CPAP treatment for patients with OSA. This disorder is commonly encountered in sleep disorder centers, and is associated with well-established behavioral and cardiopulmonary morbidity.

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