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Classification of Sleep Disorders

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Abstract The classification of sleep disorders is necessary to discriminate between disorders and to facilitate an understanding of symptoms, etiology, and pathophysiology that allows for appropriate treatment. The earliest classification systems, largely organized according to major symptoms (insomnia, excessive sleepiness, and abnormal events that occur during sleep), were unable to be based on pathophysiology because the cause of most sleep disorders was unknown. These 3 symptom-based categories are easily understood by physicians and are therefore useful for developing a differential diagnosis. The International Classification of Sleep Disorders, version 2, published in 2005 and currently undergoing revision, combines a symptomatic presentation (e.g., insomnia) with 1 organized in part on pathophysiology (e.g., circadian rhythms) and in part on body systems (e.g., breathing disorders). This organization of sleep disorders is necessary because of the varied nature and because the pathophysiology for many of the disorders is still unknown. The International Classification of Sleep Disorders, version 2 provides relevant diagnostic and epidemiological information on sleep disorders to more easily differentiate between the disorders.

Keywords Classification · ICSD-2 · Sleep disorders · Parasomnias · Insomnia · Hypersomnia

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Introduction

The first major classification of sleep disorders, the Diagnostic Classification of Sleep and Arousal Disorders, published in 1979 [1], organized the sleep disorders into symptomatic categories to form the basis of the current classification systems. In 1990, the *International Classification of Sleep Disorders* (ICSD) was published through the efforts of major international sleep societies at that time, such as the American Sleep Disorders Association (ASDA), European Sleep Research Society, the Japanese Society of Sleep Research, and the Latin American Sleep Society [2]. The ICSD classification, developed primarily for diagnostic, epidemiologic, and at the time, research purposes, has been widely used by clinicians and has allowed improved international communication in sleep disorder research. In 2005, the International Classification of Sleep Disorders underwent minor updates and modifications resulting in version 2 (ICSD-2) (Table 1) [3]. The current classification system is undergoing review and is being updated.

The ICSD-2 classification (Table 1) lists 81 major sleep disorder diagnostic categories, each presented in detail, with a descriptive diagnostic text that includes specific diagnostic criteria. In addition, there are 13 diagnostic items listed in the appendices that include sleep disorders associated with disorders classified elsewhere, and psychiatric disorders frequently encountered in the differential diagnosis of sleep disorders.

The ICSD-2 lists the 81 disorders major sleep disorders in 8 major categories:

1. The insomnias
2. The sleep-related breathing disorders
3. The hypersomnias of central origin
4. The circadian rhythm sleep disorders
5. The parasomnias
6. The sleep-related movement disorders

Table 1 ICSD-2 sleep disorder categories and individual sleep disorders

	ICD-9-CM	ICD-10-CM
Insomnias		
Adjustment sleep disorder (acute insomnia) [4, 5]	307.41	F 51.02
Psychophysiological insomnia [6, 7]	307.42	F 51.04
Paradoxical insomnia (formerly sleep state misperception) [8, 9]	307.42	F 51.03
Idiopathic insomnia [10, 11]	307.42	F 51.01
Insomnia due to mental disorder	307.42	F 51.05
Inadequate sleep hygiene [12, 13]	V69.4	Z72.821
Behavioral insomnia of childhood [14, 15]	307.42	—
Sleep-onset association type	—	z73.810
limit-setting sleep type	—	z73.811
combined type	—	Z73.812
Insomnia due to drug or substance [16, 17]	292.85	G47.02
Insomnia due to medical condition (code also the associated medical condition) [18, 19]	327.01	G47.01
Insomnia not due to a substance or known physiological condition, unspecified [20, 21]	780.52	F51.09
Physiological (organic) insomnia, unspecified; (organic insomnia, NOS) [22, 23]	327.00	G47.09
Sleep-Related Breathing Disorders		
Central sleep apnea syndromes		
Primary central sleep apnea [24, 25]	327.21	G47.31
Central sleep apnea due to Cheyne-Stokes breathing pattern [26, 27]	768.04	R06.3
Central sleep apnea due to high altitude periodic breathing [28, 29]	327.22	G47.32
Central sleep apnea due to a medical condition, not Cheyne-Stokes	327.27	G47.31
Central sleep apnea due to a drug or substance [30, 31]	327.29	F10-19
Primary sleep apnea of infancy [32, 33]	770.81	P28.3
Obstructive sleep apnea syndromes		
Obstructive sleep apnea, adult [34, 35]	327.23	G47.33
Obstructive sleep apnea, pediatric [36, 37]	327.23	G47.33
Sleep-related hypoventilation/hypoxemic syndromes		
Sleep-related nonobstructive alveolar hypoventilation, bidiopathic [38, 39]	327.24	G47.34
Congenital central alveolar hypoventilation syndrome [40, 41]	327.25	G47.35
Sleep-related hypoventilation/hypoxemia due to a medical condition		
Sleep-related hypoventilation/hypoxemia due to pulmonary parenchymal or vascular pathology [42, 43]	327.26	G47.36
Sleep-related hypoventilation/hypoxemia due to lower airways obstruction [44, 45]	327.26	G47.36
Sleep-related hypoventilation/hypoxemia due to neuromuscular or chest wall disorders [46, 47]	327.26	G47.36
Other sleep-related breathing disorder		
Sleep apnea/sleep related breathing disorder, unspecified	320.20	G47.30
Hypersomnias of Central Origin		
Narcolepsy with cataplexy [48, 49]	347.01	G47.411
Narcolepsy without cataplexy [50, 51]	347.00	G47.419
Narcolepsy due to medical condition [52, 53]	347.10	G47.421
Narcolepsy, unspecified	347.00	G47.43
Recurrent hypersomnia [54, 55]	780.54	G47.13
Kleine-Levin Syndrome	327.13	G47.13
Menstrual-related hypersomnia	327.13	G47.13
Idiopathic hypersomnia with long sleep time [56, 57]	327.11	G47.11
Idiopathic hypersomnia without long sleep time [58, 59]	327.12	G47.12
Behaviorally induced insufficient sleep syndrome [60, 61]	307.44	F51.12
Hypersomnia due to medical condition [62, 63]	327.14	G47.14
Hypersomnia due to drug or substance [64–67]	292.85	G47.14
Hypersomnia not due to a substance or known physiological condition [68, 69]	327.15	F51.1
Physiological (organic) hypersomnia, unspecified (organic hypersomnia, NOS)	327.10	G47.10
Circadian Rhythm Sleep Disorders		
Circadian rhythm sleep disorder, delayed sleep phase type [70, 71]	327.31	G47.21
Circadian rhythm sleep disorder, advanced sleep phase type [72, 73]	327.32	G47.22
Circadian rhythm sleep disorder, irregular sleep-wake type [74, 75]	327.33	G47.23
Circadian rhythm sleep disorder, free-running (none trained) type [76, 77]	327.34	G47.24
Circadian rhythm sleep disorder, jet lag type [78, 79]	327.35	G47.25
Circadian rhythm sleep disorder, shift work type [80, 81]	327.36	G47.26
Circadian rhythm sleep disorders due to medical condition [82, 83]	327.37	G47.27
Other circadian rhythm sleep disorder [84, 85]	327.39	G47.29
Other circadian rhythm sleep disorder due to drug or substance	292.85	G47.27
Parasomnias		
Disorders of arousal (from non-REM sleep)		
Confusional arousals [86, 87]	327.41	G47.51
Sleepwalking [88, 89]	307.46	F51.3
Sleep terrors [90, 91]	307.46	F51.4
Parasomnias usually associated with REM sleep		
REM sleep behavior disorder (including parasomnia overlap disorder and status dissociatus) [92, 93]	327.42	G47.52
Recurrent isolated sleep paralysis [94, 95]	327.43	G47.53

Table 1 (continued)

	ICD-9-CM	ICD-10-CM
Nightmare disorder [96, 97]	307.47	F51.5
Other Parasomnias		
Sleep-related dissociative disorders [98, 99]	300.15	F44.9
Sleep enuresis [100, 101]	788.36	N39.44
Sleep-related groaning (catathrenia) [102, 103]	327.49	G47.59
Exploding head syndrome [104, 105]	327.49	G47.59
Sleep-related hallucinations [106, 107]	368.16	R29.81
Sleep-related eating disorder [108, 109]	327.49	G47.59
Parasomnia, unspecified [110]	227.40	G47.50
Parasomnia due to a drug or substance [111]	292.85	G47.54
Parasomnia due to a medical condition [112]	327.44	G47.54
Sleep-Related Movement Disorders		
Restless legs syndrome (including sleep-related growing pains) [113, 114]	333.49	G25.81
Periodic limb movement sleep disorder [115, 116]	327.51	G47.61
Sleep-related leg cramps [117, 118]	327.52	G47.62
Sleep-related bruxism [119, 120]	327.53	G47.63
Sleep-related rhythmic movement disorder [121, 122]	327.59	G47.69
Sleep-related movement disorder, unspecified	327.59	G47.90
Sleep-related movement disorder due to drug or substance	327.59	G47.67
Sleep-related movement disorder due to medical condition	327.59	G47.67
Isolated Symptoms, Apparently Normal Variants, and Unresolved Issues		
Long sleeper [123]	307.49	R29.81
Short sleeper [124]	307.49	R29.81
Snoring [125, 126]	786.09	R06.83
Sleep talking [127, 128]	307.49	R29.81
Sleep starts, hypnic jerks [129, 130]	307.47	R25.8
Benign sleep myoclonus of infancy [131, 132]	781.01	R25.8
Hypnagogic foot tremor and alternating leg muscle activation during sleep [133, 134]	781.01	R25.8
Propriospinal myoclonus at sleep onset [135, 136]	781.01	R25.8
Excessive fragmentary myoclonus [137, 138]	781.01	R25.8
Other Sleep Disorders		
Other physiological (organic) sleep disorder	327.8	G47.8
Other sleep disorder not due to a known substance or physiological condition	327.8	G47.9
Environmental sleep disorder [139, 140]	307.48	F51.8
Sleep disorders associated with conditions classifiable elsewhere		
Fatal familial insomnia [141,142]	046.8	A81.8
Fibromyalgia [143]	729.1	M79.7
Sleep-related epilepsy [144,145]	345	G40.5
Sleep-related headaches [146,147]	784.0	R51
Sleep-related gastroesophageal reflux disease [148,149]	530.1	K21.9
Sleep-related coronary artery ischemia [150,151]	411.8	I25.6
Sleep-related abnormal swallowing, choking, and laryngospasm [152]	787.2	R13.1
Other psychiatric/behavioral disorders frequently encountered in the differential diagnosis of sleep disorders		
Mood disorders	—	—
Anxiety disorders	—	—
Somatoform disorders	—	—
Schizophrenia and other psychotic disorders	—	—
Disorders usually first diagnosed in infancy, childhood, or adolescence	—	—
Personality disorders	—	—

ICD-9 International Classification of Diseases, Ninth Revision; *ICD-10* International Classification of Diseases, Tenth Revision; *ICSD-2* International Classification of Sleep Disorders, Second Revision. Courtesy of the American Academy of Sleep Medicine, Chicago, IL; *NOS* not otherwise specified

7. Isolated symptoms, apparently normal variants and unresolved issues
8. Other sleep disorders

Insomnias

Insomnia complaints typically include difficulty initiating and/or maintaining sleep, and they usually include extended periods of nocturnal wakefulness and/or insufficient amounts of nocturnal sleep. Both a symptom and a diagnostic category, the insomnia diagnoses are best referred to by their subcategory terms. These diagnoses are defined by various combinations of repeated difficulties with sleep initiation, duration, consolidation, or quality that occurs despite adequate time and opportunity for sleep, and they result in some form of daytime impairment. Insomnia complaints, when characterized by the perception of poor quality, or nonrestorative, sleep, even though the amount and quality of the usual sleep episode is perceived to be "normal" or adequate, can be an associated feature of many of the insomnias.

The definition of insomnia as being a complaint of sleep onset, sleep maintenance, waking too early, or unrestorative sleep is less precise than that required for research in insomnia. Specific research criteria have been developed for insomnia disorder [154]. The criteria includes not only a

primary complaint of difficulty initiating sleep, maintaining sleep, waking too early, or unrestorative or poor quality sleep, but also that the sleep difficulty occurs despite adequate opportunity and circumstances for sleep, and that one or more complaints of daytime impairment are due to the sleep difficulty. Specific research diagnostic criteria have been developed for the following: primary insomnia, insomnia due to a mental disorder, psychophysiological insomnia, paradoxical insomnia, idiopathic insomnia, insomnia related to periodic limb movement disorder, insomnia related to sleep apnea, insomnia due to a medical condition, and insomnia due to a drug or substance, as well as diagnostic criteria for normal sleepers.

The insomnia disorders can be either primary or secondary. Primary insomnias can have both intrinsic and extrinsic factors involved in their etiology, but they are not regarded as being secondary to another disorder. Secondary forms occur when the insomnia is a symptom of a medical or psychiatric illness, another sleep disorder, or substance abuse. A 2004 National Institutes of Health consensus development conference on insomnia led to the promotion of the term "comorbid insomnia" to distinguish primary insomnia from insomnia due to other primary sleep disorders, medical and psychiatric disorders, and insomnia due to medication or drug use [155, 156]. Comorbid insomnia does not indicate whether the associated medical disorder is causative or coincidental. The term primary insomnia is used in both the International Classification of Diseases (ICD-10) (Table 2) and the *Diagnostic and Statistical Manual of Mental Disorders, fourth edition* (DSM-IV) classifications and has the benefit of being more of a global classification of insomnia. The proposed DSM-V edition of the classification of the sleep disorders changes the categories to a listing of primary sleep disorders, with a subheading of insomnia disorder (Table 3) [157].

The ICSD-2 uses a more detailed subtyping of the insomnias than either the DSM or ICD. The term secondary insomnia is still appropriate for use when there is clear causality with the underlying medical or psychiatric disorder, such as one might see in insomnia secondary to pain disorders.

In the ICSD, there are 6 types of primary insomnia. Adjustment insomnia [4, 5] is the insomnia that is associated with a specific stressor. The stressor can be psychological, physiologic, environmental, or physical. This disorder exists for a short period of time, usually days to weeks, and it usually resolves when the stressor is no longer present. Psychophysiological insomnia [6, 7] is a common form of insomnia that is present for at least 1 month (the DSM-V minimum duration criteria for insomnia disorder is proposed to be changed from 1-3 months) and is characterized by a heightened level of arousal with learned sleep-preventing

Table 2 ICD-10-CM sleep disorders

F51	Sleep disorders not due to a substance or known physiological condition
F51.01	Primary insomnia
F51.02	Adjustment insomnia
F51.03	Paradoxical insomnia
F51.04	Psychophysiologic insomnia
F51.05	Insomnia due to other mental disorder
F51.09	Other insomnia not due to a substance or known physiological condition
F51.1	Hypersomnia not due to a substance or know physiological condition
F51.11	Primary hypersomnia
F51.12	Insufficient sleep syndrome
F51.13	Hypersomnia due to other mental disorder
F51.19	Other hypersomnia not due to a substance or known physiological condition
F51.3	Sleepwalking (somnambulism)
F51.4	Sleep terrors (night terrors)
F51.5	Nightmare disorder
F51.8	Other sleep disorders not due to a substance or known physiological condition
F51.9	Sleep disorder not due to a substance or known physiological condition, unspecified
G47	Organic sleep disorders
G47.0	Insomnia, unspecified
G47.01	Insomnia due to medical condition
G47.09	Other insomnia
G47.1	Hypersomnia, unspecified
G47.11	Idiopathic hypersomnia with long sleep time
G47.12	Idiopathic hypersomnia without long sleep time
G47.13	Recurrent hypersomnia
G47.14	Hypersomnia due to medical condition
G47.19	Other hypersomnia
G47.20	Circadian rhythm sleep disorder, unspecified type
G47.21	Circadian rhythm sleep disorder, delayed sleep phase type
G47.22	Circadian rhythm sleep disorder, advanced sleep phase type
G47.23	Circadian rhythm sleep disorder, irregular sleep wake type
G47.24	Circadian rhythm sleep disorder, free running type
G47.25	Circadian rhythm sleep disorder, jet lag type
G47.26	Circadian rhythm sleep disorder, shift work type
G47.27	Circadian rhythm sleep disorder in conditions classified elsewhere
G47.29	Other circadian rhythm sleep disorder
G47.30	Sleep apnea, unspecified
G47.31	Primary central sleep apnea
G47.32	High altitude periodic breathing
G47.33	Obstructive sleep apnea (adult) (pediatric)
G47.34	Idiopathic sleep-related nonobstructive alveolar hypoventilation
G47.35	Congenital central alveolar hypoventilation syndrome

Table 2 (continued)

G47.36	Sleep related hypoventilation in conditions classified elsewhere
G47.37	Central sleep apnea in conditions classified elsewhere
G47.39	Other sleep apnea
G47.4	Narcolepsy and cataplexy
G47.41	Narcolepsy
G47.411	Narcolepsy with cataplexy
G47.419	Narcolepsy without cataplexy, NOS
G47.42	Narcolepsy in conditions classified elsewhere
G47.421	Narcolepsy in conditions classified elsewhere with cataplexy
G47.429	Narcolepsy in conditions classified elsewhere without cataplexy
G47.50	Parasomnia, unspecified
G47.51	Confusional arousals
G47.52	REM sleep behavior disorder
G47.53	Recurrent isolated sleep paralysis
G47.54	Parasomnia in conditions classified elsewhere
G47.59	Other parasomnia
G47.6	Sleep-related movement disorders
G47.61	Periodic limb movement disorder
G47.62	Sleep-related leg cramps
G47.63	Sleep-related bruxism
G47.69	Other sleep-related movement disorders
G47.8	Other sleep disorders
G47.9	Sleep disorder, unspecified
Z72.820	Problems related to sleep
Z72.820	Sleep deprivation
Z72.821	Inadequate sleep hygiene
Z73.8	Other problems related to life management difficulty
Z73.810	Behavioral insomnia of childhood, sleep-onset association type
Z73.811	Behavioral insomnia of childhood, limit setting type
Z73.812	Behavioral insomnia of childhood, combined type
Z73.819	Behavioral insomnia of childhood, unspecified type

ICD-10-CM International Classification of Diseases, Tenth Revision, Clinical Modification; *NOS* not otherwise specified

associations. There is an over-concern with the inability to sleep. Paradoxical insomnia [8, 9] is a complaint of severe insomnia that occurs without evidence of objective sleep disturbance and without daytime impairment to the extent that would be suggested by the amount of sleep disturbance reported. The patient often reports little or no sleep on most nights. It is believed to occur in ≤5 % of insomniac patients. Idiopathic insomnia [10, 11] is a longstanding form of insomnia that appears to date from childhood and has an insidious onset. Typically, there are no factors associated with the onset of the insomnia, which is persistent and without periods of remission.

Table 3 DSM-V proposed sleep disorders diagnostic criteria

Sleep-Wake Disorders	
M 00	Insomnia disorder
M 01	Hypersomnolence disorders
M 02	Narcolepsy/hypocretin deficiency
M 03	Obstructive sleep apnea hypopnea syndrome
M 04	Central sleep apnea
M 05	Sleep-related hypoventilation
M 06	Circadian rhythm sleep-wake disorder
M 07	Disorder of arousal
M 08	Nightmare disorder
M 09	Rapid eye movement sleep behavior disorder
M 10	Restless legs syndrome
M 11	Substance-induced sleep disorder

Sleep-wake disorders not elsewhere classified

Insomnia disorder not elsewhere classified

Major somnolence disorder (hypersomnia not elswhere classified)

DSM-V the Diagnostic and Statistical Manual of Mental Disorders, fifth edition)

Inadequate sleep hygiene [12, 13] is a disorder associated with common daily activities that are inconsistent with good-quality sleep and full daytime alertness. Such activities include irregular sleep onset and wake times, stimulating and alerting activities before bedtime, and substances (e.g., alcohol, caffeine, cigarette smoke) ingested near to sleep time. These practices do not necessarily cause sleep disturbance in other people. For example, an irregular bedtime or wake time that produces insomnia in one person may not be important in another.

Behavioral insomnia of childhood [14, 15] includes limit-setting sleep disorder and sleep-onset association disorder. Limit-setting sleep disorder is stalling or refusing to go to sleep that is eliminated once a caretaker enforces limits on sleep times and other sleep-related behaviors. Sleep-onset association disorder occurs when there is reliance on inappropriate sleep associations, such as rocking, watching television, holding a bottle or other object, or requiring environmental conditions, such as a lit room or an alternative place to sleep.

There are several secondary insomnias. Insomnia due to a drug or substance [16, 17] is applied when there is dependence on or excessive use of a substance, such as alcohol, a recreational drug, or caffeine that is associated with the occurrence of the insomnia. The insomnia may be associated with the ingestion or discontinuation of the substance. Excessive use or dependency is not a feature of this diagnosis. Insomnia due to a medical condition [18, 19] is applied when a medical or neurological disorder gives rise to the insomnia. The medical disorder and the insomnia type are given when a patient is diagnosed. Insomnia not due to a substance or known physiological condition [20, 21] is the

diagnosis applied when an underlying mental disorder is associated with the occurrence of the insomnia, and when the insomnia constitutes a distinct complaint or focus of treatment. Physiologic (organic) insomnia, unspecified, is applied when insomnia is due to a medical condition or substance use not specified elsewhere [22, 23].

Inadequate sleep hygiene, and other insomnia due to a substance, requires some discussion of the differentiation between the 2 diagnoses. Caffeine ingestion in the form of coffee or soda can produce a disorder of inadequate sleep hygiene, if the intake amount is normal and within the limits of common use, but the timing of ingestion is inappropriate. On the other hand, ingestion of caffeine in an amount that is considered excessive by normal standards can lead to a diagnosis of other insomnia due to a substance.

Sleep-Related Breathing Disorders

Disordered ventilation during sleep is the characteristic feature of the disorders in this article. Central apnea syndromes [24, 25] include those in which respiratory effort is diminished or absent in an intermittent or cyclical fashion as a result of central nervous system dysfunction. Other central sleep apnea forms are associated with underlying pathologic or environmental causes, such as Cheyne-Stokes breathing pattern [26, 27] or high-altitude periodic breathing [28, 29].

Primary central sleep apnea is a disorder of unknown cause characterized by recurrent episodes of cessation of breathing during sleep without associated ventilatory effort. A complaint of excessive daytime sleepiness, insomnia, or difficulty breathing during sleep is reported. The patient must not be hypercapnic (P_{CO_2} greater than ≥45 mm Hg). This diagnosis requires that 5 or more apneic episodes per hour of sleep be seen by polysomnography. Central sleep apnea due to Cheyne-Stokes breathing pattern is characterized by recurrent apneas and/or hypopneas alternating with prolonged hyperpnea in which tidal volume waxes and wanes in a crescendo–decrescendo pattern. This pattern is characteristically seen in non-rapid eye movement (NREM) sleep and does not occur in rapid eye movement (REM) sleep. The pattern is typically seen in medical disorders, such as heart failure, cerebrovascular disorders, and renal failure. Central sleep apnea due to high-altitude periodic breathing [28, 29] is characterized by sleep disturbance that is caused by cycling periods of apnea and hyperpnea without ventilatory effort. The cycle length is typically between 12 and 34 seconds. Five or more central apneas per hour of sleep are required to make the diagnosis. Most people will have this ventilatory pattern at elevations greater than 7600 meters, and some at lower altitudes. A secondary form of central sleep apnea due to drug or substance (substance abuse) [30, 31] is most commonly associated with users of long-term opioid use. The substance causes a respiratory depression by acting on the mu receptors of the ventral medulla. A central apnea index of >5 is required for the diagnosis.

Primary sleep apnea of infancy [32, 33] is a disorder of respiratory control most often seen in preterm infants (apnea of prematurity), but it can occur in predisposed infants (apnea of infancy). This may be a developmental pattern, or it may be secondary to other medical disorders. Respiratory pauses of 20 seconds or longer are required for the diagnosis.

The obstructive sleep apnea syndromes include those in which there is an obstruction in the airway resulting in increased breathing effort and inadequate ventilation. Upper airway resistance syndrome has been recognized as a manifestation of obstructive sleep apnea syndrome and therefore is not included as a separate diagnosis. Adult and pediatric forms of obstructive sleep apnea syndrome are discussed separately because the disorders have different methods of diagnosis and treatment. Obstructive sleep apnea in adults [34, 35] is characterized by repetitive episodes of cessation of breathing (apneas) or partial upper airway obstruction (hypopneas). These events are often associated with reduced blood oxygen saturation. Snoring and sleep disruption are typical and common. Excessive daytime sleepiness or insomnia can result. Five or more respiratory events (apneas, hypopneas, or respiratory effort-related arousals) per hour of sleep are required for diagnosis. Increased respiratory effort occurs during the respiratory event. Obstructive sleep apnea in pediatrics [36, 37] is characterized by features similar to those seen in the adult, but cortical arousals may not occur, possibly because of a higher arousal threshold. At least 1 obstructive event, of at least 2 respiratory cycles of duration per hour of sleep, is required for diagnosis.

Sleep-related hypoventilation/hypoxemic syndromes comprise 5 disorders associated with hypoventilation or hypoxemia during sleep. Sleep-related nonobstructive alveolar hypoventilation, idiopathic, refers to decreased alveolar hypoventilation resulting in sleep-related arterial oxygen desaturation in patients with normal mechanical properties of the lungs [38, 39]. Congenital central alveolar hypoventilation syndrome [40, 41] is a failure of automatic central control of breathing in infants who do not breathe spontaneously or whose breathing is shallow and erratic. It is a failure of the central automatic control of breathing. The hypoventilation begins in infancy and it is worse in sleep than in wakefulness. Hypoventilation/hypoxemic disorders are related to elevated arterial carbon dioxide tension (Pa_{CO_2}) or reduced oxygen saturation during sleep. Sleep-related hypoventilation/hypoxemia due to a medical condition is a subgroup of 3 disorders of impaired lung function or chest wall mechanics. Sleep-related hypoventilation/

hypoxemia related to pulmonary parenchymal or vascular pathology [42, 43] is due to disorders of interstitial lung disease, such as interstitial pneumonitis, or disorders such as sickle-cell anemia or other hemoglobinopathies. Sleep-related hypoventilation/hypoxemia due to lower airway obstruction is seen in patients with lower airway disease, such as chronic obstructive lung disease and emphysema, bronchiectasis, alpha1-antitrypsin deficiency [44, 45]. Sleep-related hypoventilation/hypoxemia is due to neuromuscular and chest wall disorders, such as neuromuscular disease or kyphoscoliosis [46, 47].

Hypersomnia of Central Origin

The hypersomnia disorders are those in which the primary complaint is daytime sleepiness and the cause of the primary symptom is not disturbed nocturnal sleep or misaligned circadian rhythms. Daytime sleepiness is defined as the inability to stay alert and awake during the major waking episodes of the day, resulting in unintended lapses into sleep. The term hypersomnia has been used differently in the different diagnostic classifications. In the ICSD, the term hypersomnia is diagnostic, with the preferred term for the complaint being daytime sleepiness or excessive daytime sleepiness. In the proposed DSM-V, the term hypersomnia is used as a symptom defined as a prolonged nocturnal sleep episode or daily sleep amounts >9 hours, and hypersomnolence is used as the group name (i.e., hypersomnolence disorders), as well as a symptom description [157].

Other sleep disorders may be present with the hypersomnias, but they must be effectively treated first before a hypersomnia diagnosis can be made. The hypersomnias of central origin are not due to a circadian rhythm sleep disorder, sleep-related breathing disorder, or other cause of disturbed nocturnal sleep.

Narcolepsy with cataplexy [48, 49] requires the documentation of a definite history of cataplexy or the documentation of a cerebrospinal fluid hypocretin level less than one third of control values. The diagnosis of narcolepsy with cataplexy is based on the belief that most cases are due to loss of hypocretin possibly on an autoimmune basis. However, ≤10 % of patients with narcolepsy and cataplexy have normal hypocretin levels, suggesting either a downstream problem with hypocretin (e.g., at the receptor level) or an alternative pathophysiological mechanism [158]. In the proposed DSM-V, narcolepsy with cataplexy is differentiated from other forms of narcolepsy by the term, narcolepsy/hypocretin deficiency. Narcolepsy without cataplexy [50, 51] is the diagnosis when cataplexy is not present, but when there is sleep paralysis, hypnagogic hallucinations, and supportive evidence in the form of a positive multiple sleep latency test with a mean sleep latency of ≤8 minutes and 2 or more sleep-onset REM periods. Whether narcolepsy without cataplexy is the same disorder as narcolepsy with cataplexy, or if it is a disorder based on an entirely different pathophysiology is not clear. Most cases of narcolepsy without cataplexy have intact hypocretin levels. Narcolepsy due to a medical condition [52, 53] is the diagnosis applied to a patient with sleepiness who has a significant neurological or medical disorder that accounts for the daytime sleepiness.

Recurrent hypersomnia [54, 55], also known as periodic hypersomnia is comprised of 2 subtypes: 1) Kleine-Levin Syndrome and 2) menstrual-related hypersomnia. Kleine-Levin Syndrome is associated with episodes of sleepiness together with binge eating, hypersexuality, or mood changes. Menstrual-related hypersomnia is having recurrent episodes of hypersomnia that occurs in association with the menstrual cycle. Episodes usually last approximately 1 week and resolve at the time of menses.

Idiopathic hypersomnia with long sleep time [56, 57] is the classic form of idiopathic hypersomnia, characterized by a major sleep episode that is at least 10 hours in duration, whereas idiopathic hypersomnia without long sleep time [58, 59] is the more commonly seen disorder of excessive sleepiness with unintended naps that are typically unrefreshing. Idiopathic hypersomnia, whether with sleep time or without it, is still poorly understood because there is no clear pathophysiological mechanism [158]. The genetic basis of the disorders needs to be determined. Whether idiopathic hypersomnia without long sleep time is a variant of narcolepsy without cataplexy is not yet determined. In the proposed DSM-V, narcolepsy without cataplexy is categorized with primary hypersomnia into 1 diagnostic category as primary hypersomnia/narcolepsy without cataplexy [157].

Behavioral-induced insufficient sleep syndrome [60, 61] occurs in patients who have a habitual short sleep time episode and who sleep considerably longer when the habitual sleep episode is not maintained.

Hypersomnia due to a medical condition [62, 63] is hypersomnia that is caused by a medical or neurological disorder. Cataplexy or other diagnostic features of narcolepsy are not present. Hypersomnia due to a drug or substance [64–67] is diagnosed when the complaint is believed to be secondary to current or past use of drugs. Hypersomnia not due to a substance or known physiological condition [68, 69], is excessive sleepiness that is temporally associated with a psychiatric diagnosis.

Circadian Rhythm Sleep Disorders

The circadian rhythm sleep disorders have a specific diagnostic category because they share a common underlying chronophysiologic basis. The major feature of these disorders is a persistent or recurrent misalignment between the

patient's sleep pattern and the pattern that is desired or regarded as the societal norm. Maladaptive behaviors influence the presentation and severity of the circadian rhythm sleep disorders. The underlying problem in the majority of the circadian rhythm sleep disorders is that the patient cannot sleep when sleep is desired, needed, or expected. The wake episodes can occur at undesired times as a result of sleep episodes that occur at inappropriate times, and therefore, the patient may complain of insomnia or excessive sleepiness. For several of the circadian rhythm sleep disorders, once sleep is initiated, the major sleep episode is normal in duration with normal REM and NREM cycling.

The delayed sleep phase type [70, 71], which is more commonly seen in adolescents, is characterized by a delay in the phase of the major sleep period in relation to the desired sleep time and wake time. The advanced sleep phase type [72, 73], which is more commonly seen in older adults, is characterized by an advance in the phase of the major sleep period in relation to the desired sleep time and wake time. An alteration in the homeostatic regulation of sleep may be responsible. However, the delayed and advanced sleep phase types can have a predominant influence caused by the individual's choice to remain awake late into the night or by going to bed earlier, which is associated with behavioral, social, or professional demands. The irregular sleep–wake type [74, 75], a disorder that involves a lack of a clearly defined circadian rhythm of sleep and wakefulness, is most often seen in institutionalized older adults and is associated with a lack of synchronizing agents, such as light, activity, and social activities. The free running type [76, 77], or non-trained type (formerly known as the non-24-h sleep–wake syndrome), occurs because there is a lack of entrainment to the 24-h period, and the sleep pattern often follows that of the underlying free-running pacemaker with a sequential shift in the daily sleep pattern.

The jet lag type [78, 79], or jet lag disorder, is related to a temporal mismatch between the timing of the sleep–wake cycle generated by the endogenous circadian clock produced by a rapid change in time zones. The severity of the disorder is influenced by the number of time zones crossed and the direction of travel, with eastward travel usually being more disruptive. Shift work type [80, 81] is characterized by complaints of insomnia or excessive sleepiness that occurs in relation to work hours being scheduled during the usual sleep period. Circadian rhythm sleep disorders due to a medical condition [82, 83] is related to an underlying primary medical or neurological disorder. A disrupted sleep–wake pattern leads to complaints of insomnia or excessive daytime sleepiness.

Another circadian rhythm sleep disorder not due to a known physiological condition is an irregular or unconventional sleep–wake pattern that can be the result of social, behavioral, or environmental factors [84, 85]. Noise, lighting, or other factors can predispose an individual to developing this disorder.

The appropriate timing of sleep within the 24-h day can be disturbed in many other sleep disorders, particularly those associated with the complaint of insomnia. Patients with narcolepsy may have a pattern of sleepiness that is identical to that described as being caused by an irregular sleep–wake type. However, because the primary sleep diagnosis is narcolepsy, the patient should not receive a second diagnosis of a circadian rhythm sleep disorder unless the disorder is unrelated to the narcolepsy. For example, a diagnosis of jet lag type could be stated along with a diagnosis of narcolepsy, if appropriate. Similarly, patients with mood disorders or psychoses can, at times, have a sleep pattern similar to that of delayed sleep phase type. A diagnosis of delayed sleep phase type would be coded only if the disorder is not directly associated with the psychiatric disorder.

Some disturbance of sleep timing is a common feature in patients who have a diagnosis of inadequate sleep hygiene. Only if the timing of sleep is the predominant cause of the sleep disturbance and is outside the societal norm, then the patient would be given a diagnosis of a circadian rhythm sleep disorder. Limit-setting sleep disorder is also associated with an altered time of sleep within the 24-h day. If the setting of limits is a function of the caretaker, then the sleep disorder is more appropriately diagnosed as a limit-setting sleep disorder.

Parasomnias

The parasomnias are undesirable physical or experiential events that accompany sleep. These sleep disorders are not abnormalities of the processes responsible for sleep and awake states per se, but are undesirable phenomena that occur predominantly during sleep. The parasomnias consist of abnormal sleep-related movements, behaviors, emotions, perceptions, dreaming, and autonomic nervous system functioning. They are disorders of arousal, partial arousal, and sleep-stage transition. Many of the parasomnias are manifestations of central nervous system activation. Autonomic nervous system changes and skeletal muscle activity are the predominant features. The parasomnias often occur in conjunction with other sleep disorders, such as obstructive sleep apnea syndrome. It is not uncommon for several parasomnias to occur in 1 patient.

Three parasomnias have typically been associated with arousal from non-REM sleep, the disorders of arousal. Confusional arousals [86, 87] are characterized by mental confusion or confusional behavior that occurs during or after arousal from sleep. These arousals are common in children and can occur not only from nocturnal sleep but also from daytime naps. They sometimes occur in association with obstructive sleep apnea syndrome. Sleepwalking

[88, 89] is a series of complex behaviors that occur from sudden arousals from slow wave sleep and result in walking behavior during a state of altered consciousness. Sleep terrors [90, 91] also occur from slow wave sleep and are associated with a cry or piercing scream accompanied by autonomic system activation and behavioral manifestation of intense fear. Individuals may be difficult to arouse from the episode and when aroused can be confused and subsequently amnestic for the episode. These 2 disorders, sleepwalking and sleep terrors, often coexist together, and sometimes 1 form blends into the other or is difficult to distinguish from the other.

Several parasomnias are typically associated with the REM sleep stage. Some common underlying pathophysiologic mechanism related to REM sleep may underlie these disorders. REM sleep behavior disorder [92, 93] involves abnormal behaviors that occur in REM sleep and result in injury or sleep disruption. The behaviors are often violent with dream enactment that is action filled. The disorder can occur in narcolepsy, and many patients with Parkinson's disease have REM sleep behavior disorder. The delayed emergence of a neurodegenerative disorder can occur, especially in men >50 years of age. Recurrent isolated sleep paralysis [94, 95] can occur at sleep onset or on awakening, and is characterized by an inability to perform voluntary movements. Ventilation is usually unaffected. Hallucinatory experiences often accompany the paralysis. Nightmare disorder [96, 97] is characterized by recurrent nightmares that occur in REM sleep and result in an awakening with intense anxiety, fear, or other negative feelings.

Sleep-related dissociative disorders [98, 99] involve a disruption of the integrative features of consciousness, memory, identity, or perception of the environment. This disorder can occur in the transition from wakefulness to sleep or after an awakening from stage 1 or 2 sleep. A history of physical or sexual abuse is common in such patients. These patients fulfill the DSM-IV criteria for dissociative disorder. Sleep enuresis [100, 101] is recurrent involuntary voiding that occurs during sleep. Enuresis is considered primary in a child who has never been dry for 6 months or longer, whereas otherwise, it is called secondary enuresis. Sleep-related groaning (catathrenia) [102, 103] is an unusual disorder in which there is a chronic, often nightly, expiratory groaning that occurs during sleep. The affected person is often unaware of the groaning. The disorder is rare and the pathophysiology is unknown. It has been suggested that catathrenia is a variant of a sleep-related breathing disorder because treatment by means of continuous positive airway pressure has been reported to be successful [159]. Exploding head syndrome [104, 105] is characterized by a loud imagined noise or sense of a violent explosion that occurs in the head as the patient is falling asleep or during waking in the night.

Sleep-related hallucinations [106, 107] are hallucinatory experiences that occur at sleep onset or upon awakening. They may be difficult to distinguish from vivid dreams or nightmares, and are usually complex images that occur when the patient is clearly awake.

Sleep-related eating disorder [108, 109] involves recurrent eating and drinking episodes during arousals from nocturnal sleep. The eating behavior is uncontrollable and often the patient is unaware of the behavior until the next morning. It can be associated with sleepwalking and can be medication-induced. Parasomnia due to a drug or substance [110] is a parasomnia that has a close temporal relationship between exposure to a drug, medication, or biological substance. Parasomnia unspecified [111] occurs as a manifestation of an underlying psychiatric disorder. Parasomnia due to a medical condition [112] is the manifestation of a parasomnia associated with an underlying medical or neurological disorder.

Sleep-Related Movement Disorders

The sleep-related movement disorders are characterized by relatively simple, usually stereotyped movements that disturb sleep. Disorders such as periodic limb movement disorder and restless legs syndrome are classified in this section.

Restless legs syndrome [113, 114] is characterized by the complaint of a strong, nearly irresistible urge to move the legs, often accompanied by uncomfortable or painful symptoms. The sensations are worse at rest and occur more frequently in the evening or during the night. Walking or moving the legs relieves the sensation. Periodic limb movement disorder [115, 116] is an independent disorder of repetitive, highly stereotyped limb movements that occur during sleep. Periodic leg movements are often associated with restless legs syndrome. Sleep related leg cramps [117, 118] are painful sensations that are associated with sudden intense muscle contractions, usually of the calves or small muscles of the feet. Episodes commonly occur during the sleep period and can lead to disrupted sleep. Relief is usually obtained by stretching the affected muscle. Sleep related bruxism [119, 120] is characterized by clenching of the teeth during sleep and can result in arousals. Often the activity is severe or frequent enough to result in symptoms of temporomandibular joint pain or wearing down of the teeth. Sleep related rhythmic movement disorder [121, 122] is a stereotyped, repetitive rhythmic motor behavior that occurs during drowsiness or light sleep and results in large movements of the head, body, or limbs. Typically seen in children, the disorder can also be seen in adults. Head and limb injuries can result from violent movements. Rhythmic movement disorder can also occur during full wakefulness and alertness, particularly in individuals who are mentally retarded.

Sleep-related movement disorder, unspecified, is a movement disorder that occurs during sleep, which is diagnosed before a psychiatric disorder can be ascertained. Sleep-related movement disorder due to a medical disorder appears to have a neurological or medical basis. Sleep-related movement disorder due to a drug or substance is a sleep disorder that appears to have a substance or drug as its basis.

Isolated Symptoms, Apparently Normal Variants, and Unresolved Issues

This section lists sleep-related symptoms that are in the borderline between normal and abnormal sleep, such as disorders due to sleep length and snoring.

Long sleeper [123] is a person who sleeps more in the 24-h day than the typical person. Sleep is normal in architecture and quality. Usually, sleep lengths of 10 h or greater qualify for this diagnosis. Symptoms of excessive sleepiness occur if the person does not get that amount of sleep. A short sleeper [124] is a person with a routine pattern of obtaining 5 h or less of sleep in a 24-h day. In children, this sleep length can be 3 h or less than the norm for the appropriate age group. Snoring [125, 126] is diagnosed when a respiratory sound is disturbing to the patient, a bed partner, or others. This diagnosis is made when the snoring is not associated with either insomnia or excessive sleepiness. Not only can snoring lead to impaired health, but it may also be a cause of social embarrassment and can disturb the sleep of a bed partner. Snoring associated with obstructive sleep apnea syndrome is not diagnosed as snoring.

Sleep talking [127, 128] can be either idiopathic or associated with other disorders, such as REM sleep behavior disorder or sleep-related eating disorder. Sleep starts (hypnic jerks) [129, 130] are sudden brief contractions of the body that occur at sleep onset. These movements are associated with a sensation of falling, a sensory flash, or a sleep-onset dream. Benign sleep myoclonus of infancy [131, 132] is a disorder of myoclonic jerks that occur during sleep in infants; this typically occurs from birth to 6 months of age, and is benign and resolves spontaneously. Hypnagogic foot tremor and alternating leg muscle activation [133, 134] occurs at the transition between wake and sleep or during light NREM sleep; this is demonstrated by recurrent electromyography (EMG) potentials in 1 or both feet that are in the myoclonic range of >250 msec. Propriospinal myoclonus at sleep onset [135, 136] is a disorder of recurrent sudden muscular jerks in the transition from wakefulness to sleep. The disorder may be associated with severe sleep-onset insomnia. Excessive fragmentary myoclonus [137, 138] is described as small muscle twitches in the fingers, toes, or the corner of the mouth that do not cause actual movements across a joint. The myoclonus is usually a finding during polysomnography that is often asymptomatic or can be associated with daytime sleepiness or fatigue.

There is a classification of sleep-related sexual disorders and abnormal sexual behaviors [158]. Many of the disorders occur out of sleep and are related to the parasomnias, particularly, confusional arousals; however, other sleep-related sexual behavior is associated with seizure disorders, or other sleep disorders, such as the Kleine-Levin Syndrome, insomnia, or restless legs syndrome. Some abnormal sexual behaviors occur in narcolepsy, sleep-related dissociative disorders, and nocturnal psychotic disorders. Sleep-related painful erections, which has been well-described in the literature, and sleep exacerbation of persistent sexual arousal syndrome, which is a rare condition with widely diverse causes, are 2 other sexual behaviors that are rare but not included in the ICSD-2 [160].

Other Sleep Disorders

These 3 categories allow for disorders that are difficult to fit into any other classification section. Other physiological (organic) sleep disorder, and other sleep disorders not due to substance or known physiological condition are 2 such categories. Environmental sleep disorder [139, 140] is a sleep disturbance that is caused by a disturbing environmental factor, which disrupts sleep and leads to a complaint of either insomnia or excessive sleepiness.

Other Organic Disorders Frequently Encountered in the Differential Diagnosis of Sleep Disorders

Fatal familial insomnia [141, 142] is a progressive disorder characterized by difficulty in falling asleep and maintaining sleep that develops into enacted dreams or stupor. Autonomic hyperactivity with pyrexia, excessive salivation, and hyperhidrosis leads to cardiac and respiratory failure. The disease is caused by a prion that eventually leads to death. Fibromyalgia is a disorder of widespread pain and muscle tenderness. It is usually associated with light and unrefreshing sleep [143]. Sleep-related epilepsy [144, 145] is diagnosed when epilepsy occurs during sleep. Several epilepsy types are associated with sleep, including nocturnal frontal lobe epilepsy, benign epilepsy of childhood with centrotemporal spikes, and juvenile myoclonic epilepsy. Sleep-related headaches [146, 147] are headaches that occur during sleep or on awakening from sleep. Chronic paroxysmal hemicrania, hypnic headache, or cluster headaches can all occur during sleep. Sleep-related gastroesophageal reflux [148, 149] is characterized by regurgitation of stomach contents into the esophagus during sleep. Shortness of

breath or heartburn can result, but occasionally the disorder is asymptomatic. Sleep-related coronary artery ischemia [150, 151] is ischemia of the myocardium that occurs at night. Sleep-related abnormal swallowing, choking, and laryngospasm is a disorder in which patients report choking and difficulty breathing at night that may be due to pooling of saliva in the upper airway [152].

Other Psychiatric/Behavioral Disorders Frequently Encountered in the Differential Diagnosis of Sleep Disorders

This final section of the ICSD-2 lists the psychiatric diagnoses that are often encountered during an evaluation of sleep complaints. Many psychiatric disorders are associated with disturbances of sleep and wakefulness. The main sleep-related features are presented in this section. Psychiatric diagnoses that are discussed include mood disorders, anxiety disorders, somatoform disorders, schizophrenia, and other psychotic disorders (i.e., disorders first diagnosed in childhood or adolescence), and personality disorders [153].

Future Directions

The process of revising the DSM-IV to produce DSM-V was initiated in 2010 and an implementation date of 2013 is proposed [157]. In 2011, the process was initiated to revise the ICSD-2 to produce ICSD-3, which should also be produced in late 2012 or 2013. The major changes that are expected in both classifications, although they may be modified by the time the final versions are completed, include a single entry for the insomnia disorders called "insomnia disorder." On pathophysiological grounds it makes sense to have a single entry for the insomnia disorders, however, subtypes with some description of the initiating and perpetuating factors would be helpful in the text as treatment often depends on these factors. The recognition that narcolepsy with cataplexy has a deficiency of hypocretin has led to the isolation of hypocretin-deficient narcolepsy in both classifications (type 1 narcolepsy in ICSD-3, and narcolepsy/hypocretin deficiency in DSM-V). Idiopathic hypersomnia and Kleine-Levin syndrome are each listed as 1 rather than 2 disorders in both classifications (i.e., as a subtype of hypersomnolence disorders in DSM-V and as an individual disorder in ICSD-3). The sleep-related breathing disorders (i.e., circadian rhythm disorders and movement disorders) are expected to have minor changes in ICSD-3. DSM-V will list each of the following as primary sleep-wake disorders: disorder of arousal, nightmare disorder, REM sleep behavior disorder, restless legs syndrome. In ICSD-3 it is expected that sleep-related eating disorders and sexualized behaviors from sleep will be subtypes of sleepwalking.

In the past, the sleep disorders were not well known by psychiatrists and a listing in the DSM-IV seemed appropriate for educational purposes. However, with the widespread knowledge of sleep disorders across all fields of medicine, the usefulness of 2 classification systems (i.e., the ICSD-3 and DSM-V) is less apparent and can only serve to confuse. Hopefully, in the future both the American Academy of Sleep Medicine (AASM) and the American Psychiatric Association (APA) can come to a consensus of developing and using 1 generally accepted classification of the sleep disorders.

Conclusion

The classification of sleep disorders allows accurate diagnosis, improved communication between physicians, and standardization of data for research purposes. New sleep disorders have been recognized and previous sleep disorders have been clarified with a better understanding of their diagnostic and epidemiological features. Further research on the validity of sleep disorders classification is necessary. A study of the inter-observer reliability of the diagnostic criteria included in the 1997 revised version of the ICSD-I showed that the diagnostic criteria were less precise for the following parasomnias: sleepwalking, sleep terrors, nightmares, REM sleep behavior disorder (RBD) and sleep starts [161]. Sleep terrors, nightmares, and RBD had a weak agreement mainly because of the first criterion that defines the phenomenon. In sleepwalking, the disagreement was due to the inclusion of amnesia in the criteria. The ICSD-2 (i.e., the second version) increases the refinement of sleep disorder diagnoses because of recent advances in sleep research. Referral to the ICSD-2 will help clinicians establish a rational differential diagnosis when evaluating patients. Further evolution of the sleep disorders will produce improvements in both the ICSD-3 and DSM-V.

Required Author Forms Disclosure forms provided by the authors are available with the online version of this article.

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