Differential Diagnosis of Insomnia/Sleep Apnea Using Sleep Questionnaires

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Sleep Disturbance is Common

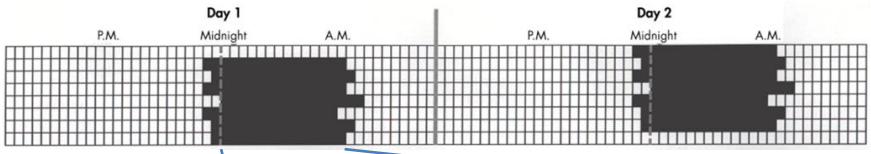
- Epidemiological survey indicates that 15~35% of the adult population complain of sleep quality disturbance.

Karacan et al., 1983; Lugaresi et al., 1983; Welstein et al., 1983; Mellinger et al., 1985

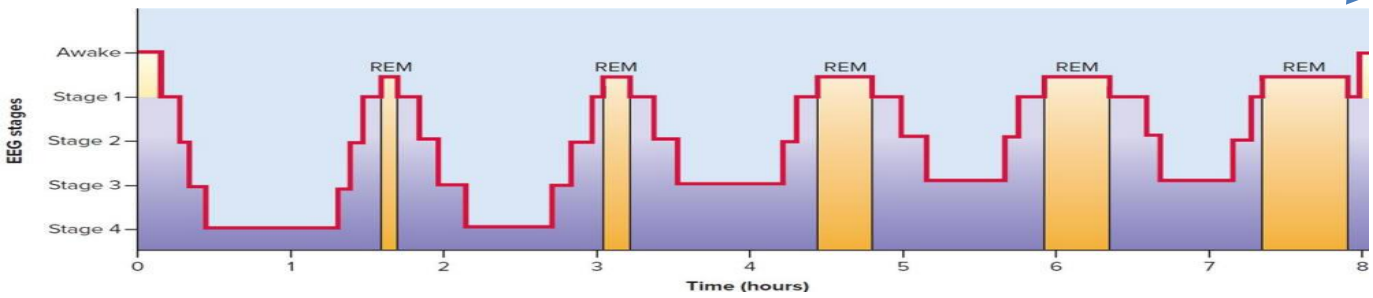
In Taiwan, annual prescription of hypnotics in 2004 is 65 million pills per year (23 million people in total). The prescription increases to 313 million pills in 2014.

Sleep Disorders

Sleep Disorders



Circadian Rhythm Disorders



Psychological

Insomnia
Substance-induced
Sleep disorders

Physiological

Sleep-breathing
Disorders

Neurological

Restless Leg Syndrome
Parasomnia
Narcolepsy

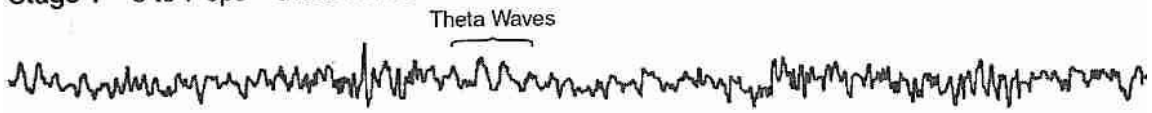
Objective Sleep Measures

Polysomnography

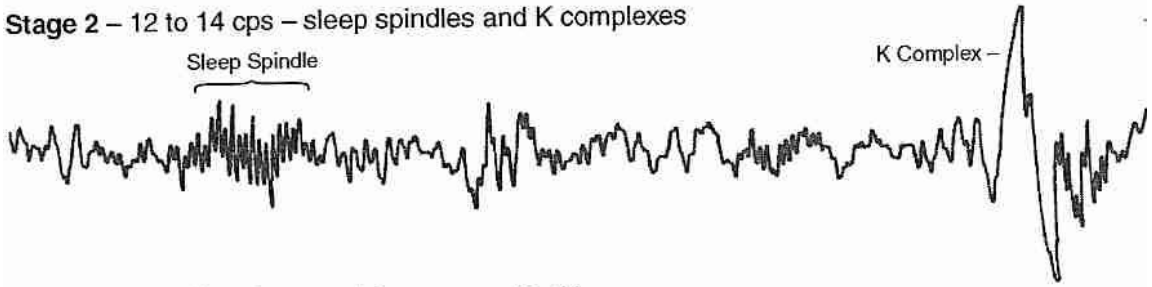
Awake – low voltage – random, fast

Drowsy – 8 to 12 cps – alpha waves

Stage 1 – 3 to 7 cps – theta waves

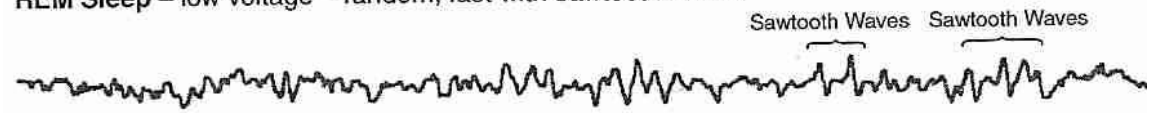


Stage 2 – 12 to 14 cps – sleep spindles and K complexes

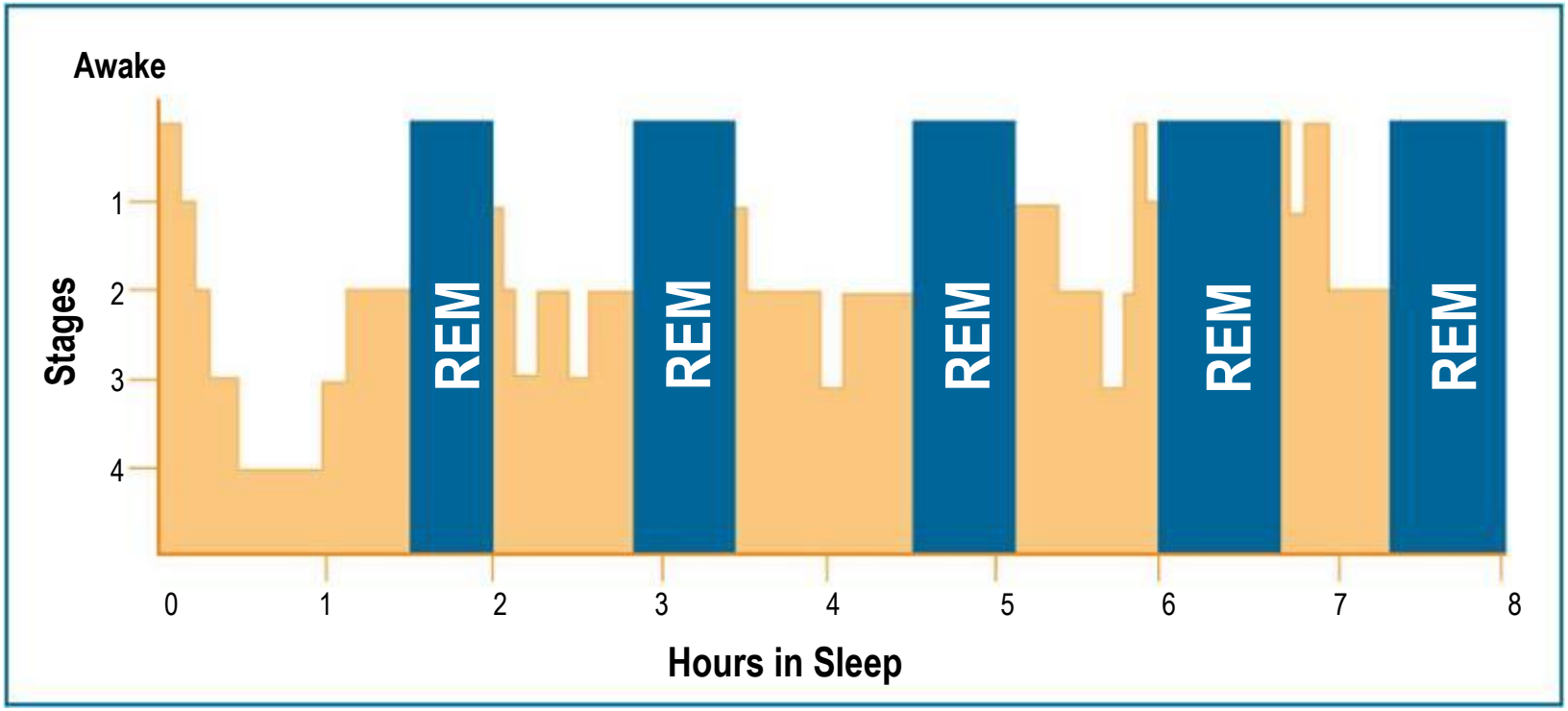


Delta Sleep – 1/2 to 2 cps – delta waves >75 μV

REM Sleep – low voltage – random, fast with sawtooth waves



The Sleep Cycle in Adults



National Sleep Foundation

Wake/Arousal is a Marker for Insomnia

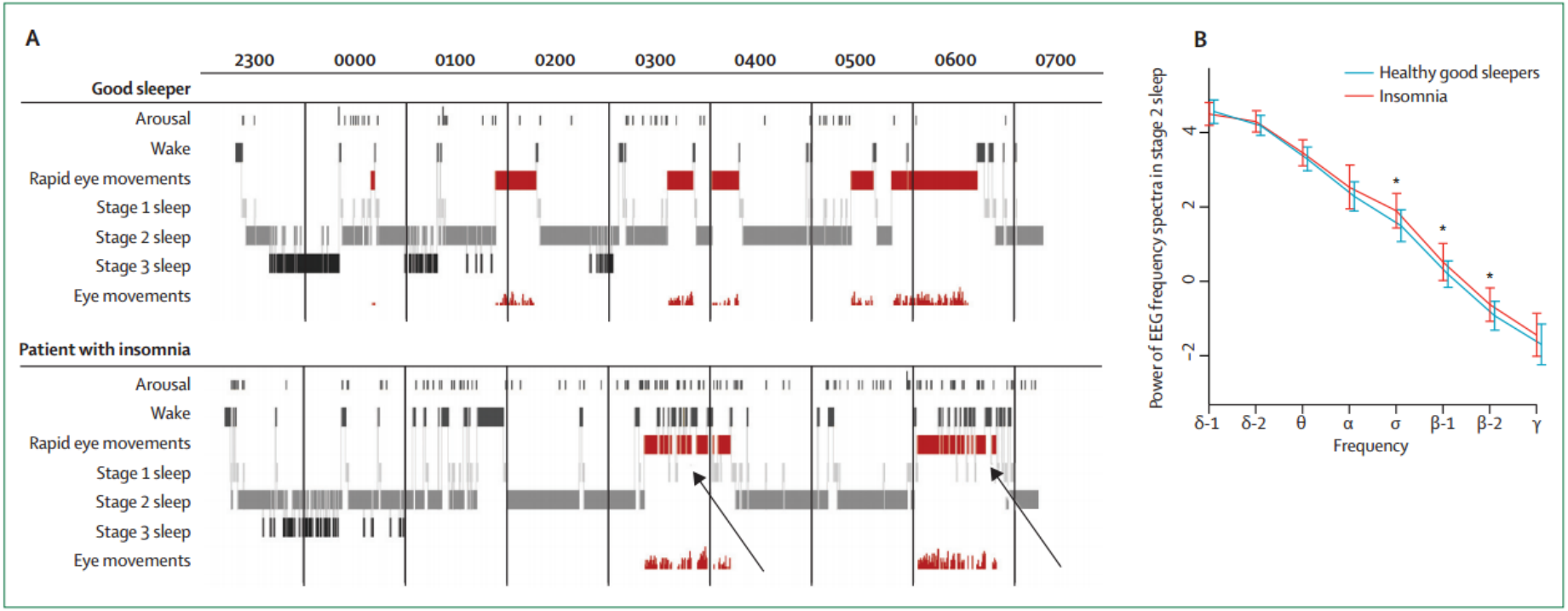


***Figure 3*: Polysomnographic and power density differences between good and poor sleepers**

(A) Comparison of the polysomnogram of a good sleeper and a patient with insomnia. With respect to the macrostructure of sleep, the sleep pattern of this patient with insomnia is mostly intact—the disturbance is mainly expressed through an increased frequency of stage shifts and increased brief waking periods and microarousals (arrows) as previously reported in our studies.[31] Data are taken from the database of the University of Freiburg Sleep Laboratory (Freiburg, Germany). (B) Asterisks show significant ($p<0{\cdot}05$) alterations in the sleep electroencephalogram of patients with insomnia as compared with healthy good sleepers, as shown by enhanced power in fast frequencies (derived from spectral analysis). Redrawn from Spiegelhalder and colleagues.[33]

***Lancet Neurol* 2015; 14: 547–58**

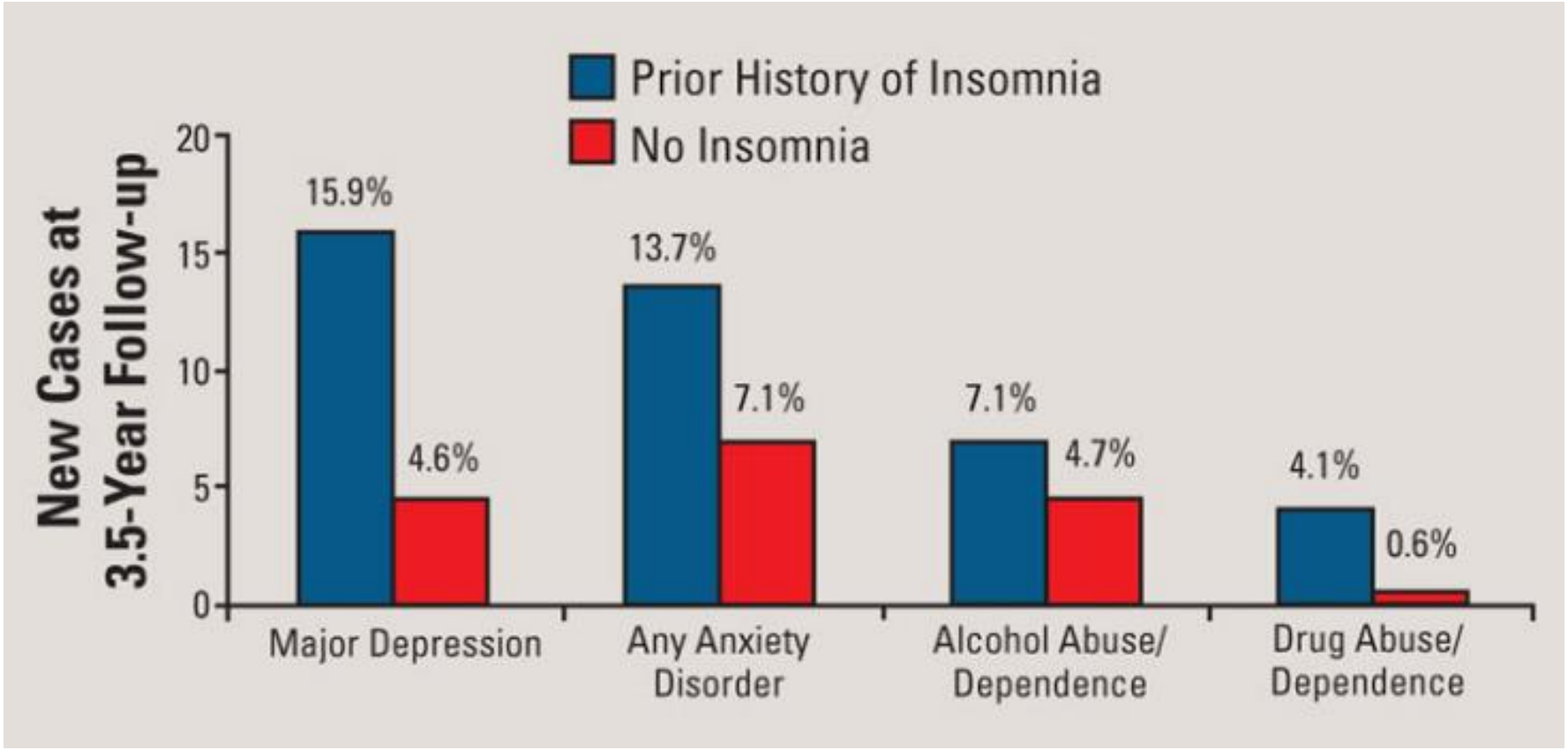
Insomnia and Mortality

- **All Cause Mortality**
  - Difficulty initiating sleep (25%)
  - Unrefreshed sleep (24%)
  - Difficulty maintaining sleep (9%)
  - Early morning awakening (4%)

- **Cardiovascular-related Mortality**
  - Difficulty initiating sleep (55%)
  - Unrefreshed sleep (32%)
  - Early morning awakening (9%)
  - Difficulty maintaining sleep (N/A)

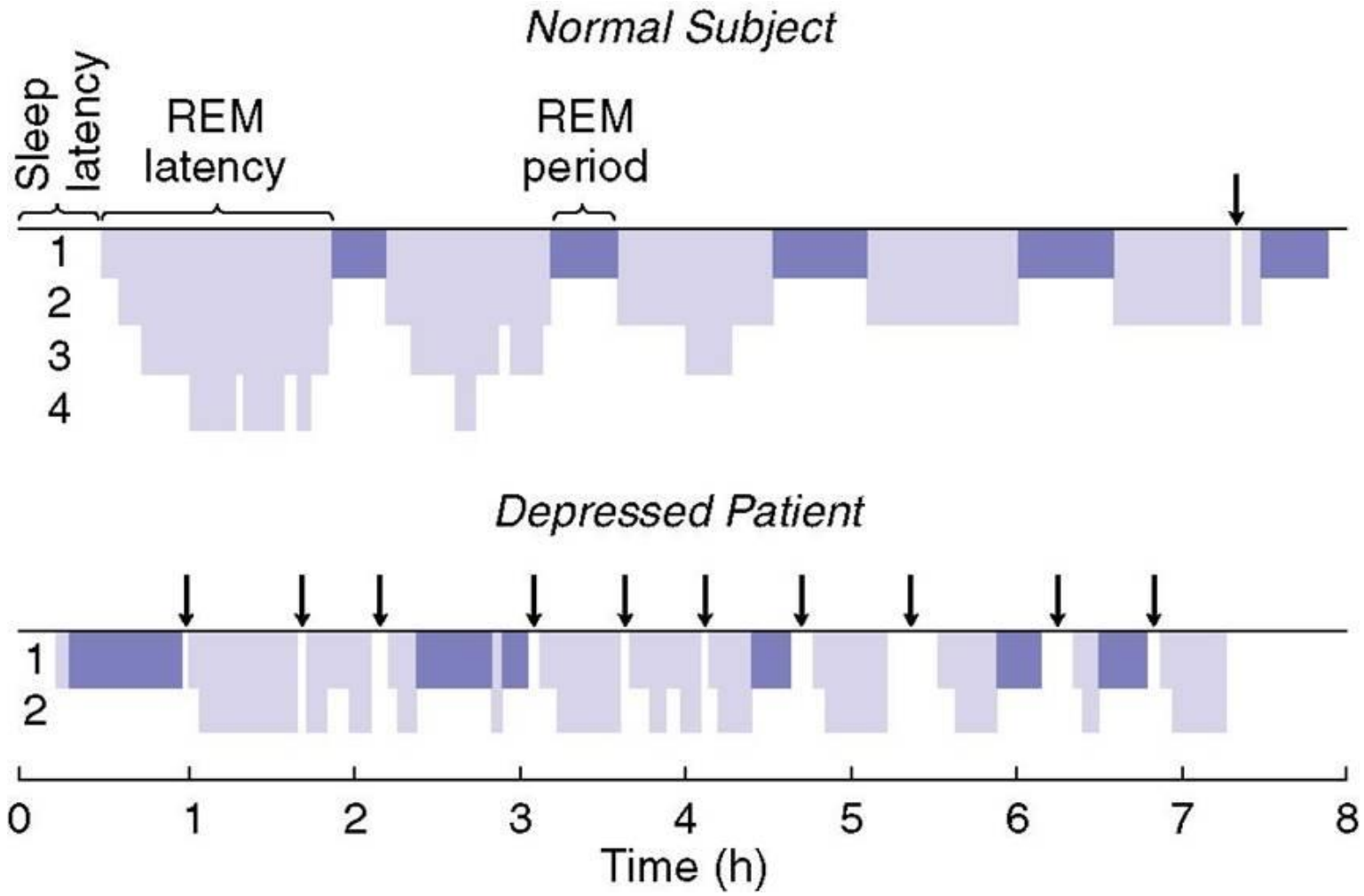
Li et al., Circulation 2014

Insomnia Predicts Psychiatric Disorders



Breslau N, et al. *Biol Psychiatry*. 1996;39:411-418.

Polysomnographic Findings in Major Depression



Symptom of Insomnia May Indicate Other Conditions

Difficulty initiating sleep

- Anxiety, depression, or restless leg syndromes

Unrefreshed sleep

- Sleep apnea

Difficulty maintaining sleep

- Anxiety, depression, or restless leg syndromes

Early morning awakening

- Anxiety or depression

Sleep Apnea

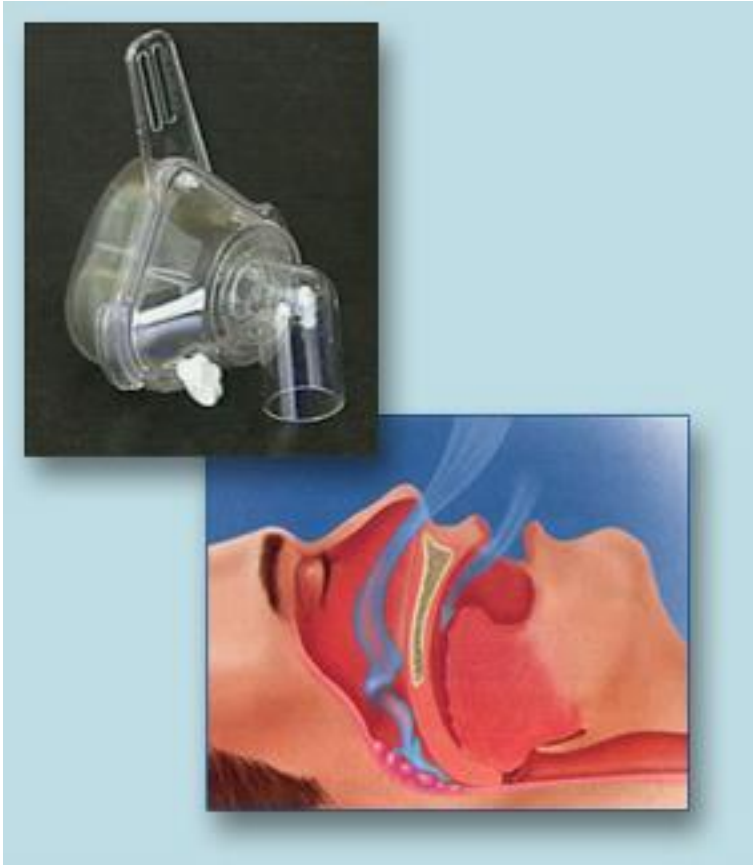
Sleep Apnea

- Increases as we age: affecting 4% and 2% of middle-aged men and women and close to 27% and 19% of older men and women

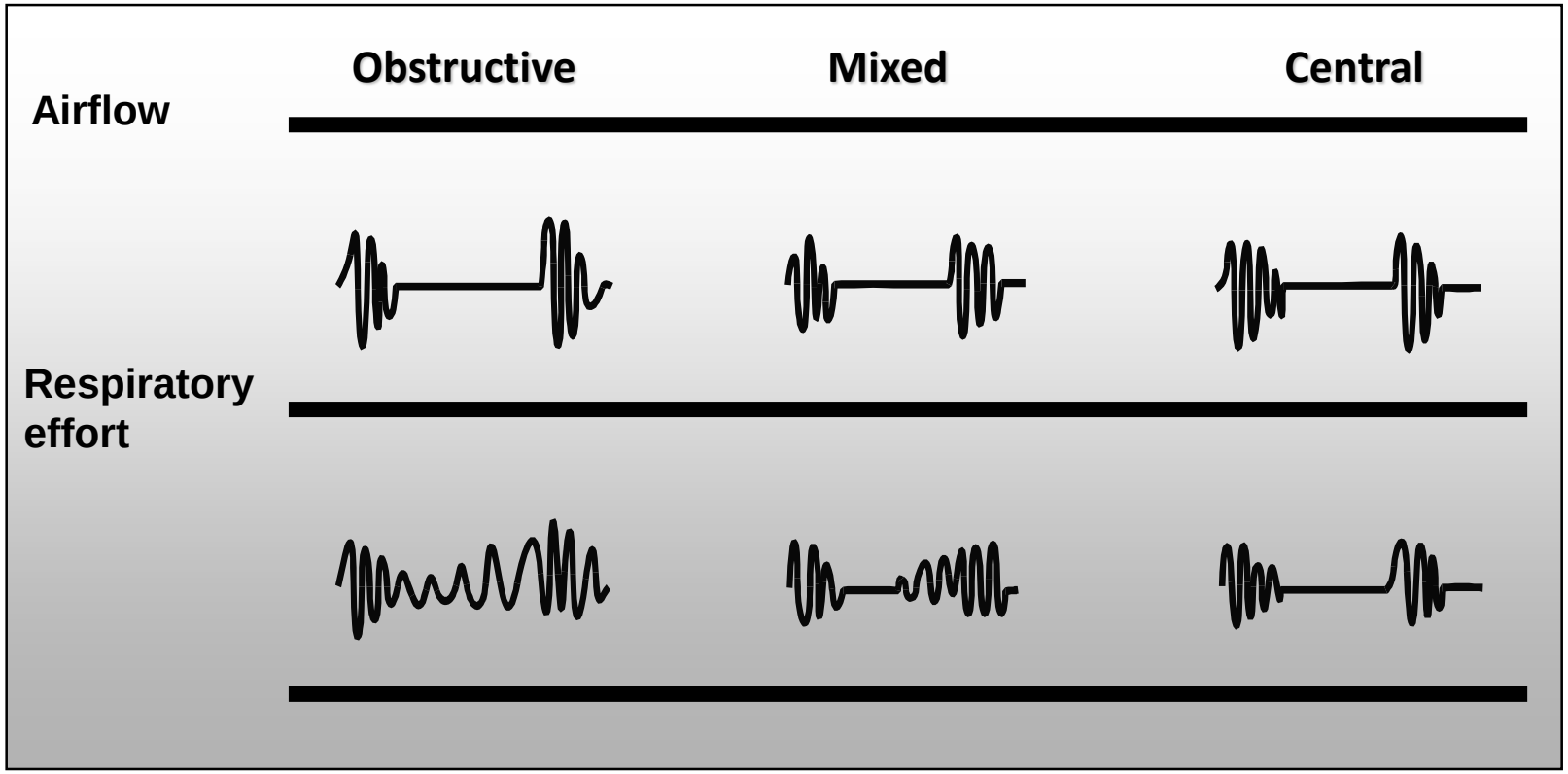
- Characterized by pauses or gaps in breathing due to an obstruction of the airway

Sleep Apnea

- Signs and Symptoms
  - Loud, regular snoring
  - Daytime sleepiness
  - Hypertension
- Associated with major medical conditions
- Most common treatment
  - CPAP



Apnea Patterns



The Fundamentals of Sleep and Obstructive Sleep Apnea

Event Type

Normal Breathing
Breaths are characterized by a semi-sinusoidal wave-like pattern. Transitions from inspiration to expiration, and vice versa, are rounded and smooth.

Flow Limitation
The rounded inspiratory portion of the breath starts to flatten.

Obstructive Hypopnea
A reduction in airflow of ≥ 50% of baseline with a 3% desaturation **OR** a reduction in airflow of ≥ 30% with a 4% desaturation **AND** lasting for at least 10 seconds.*

Obstructive Apnea
A reduction in airflow of ≥ 90% of baseline lasting for at least 10 seconds.*

Airway Cross-section

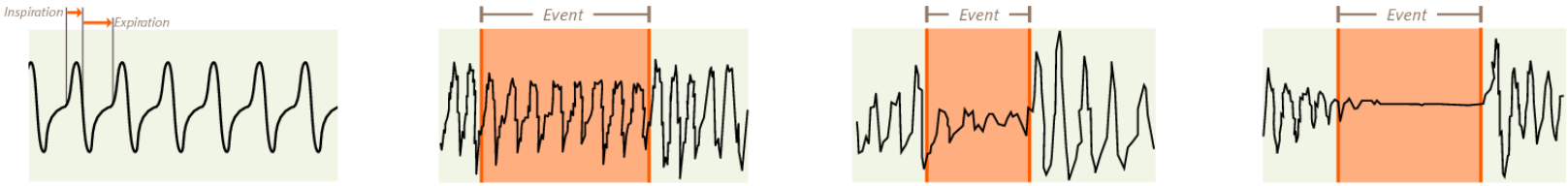
Flow Through Airway

No obstruction	Partially obstructed airway	Increasingly obstructed airway	Completely obstructed airway

Inspiratory Flow Shape

Semi-sinusoidal – unobstructed flow	Flattening & reduced flow	Flattening & *further* reduced flow	Flat – minimal or zero flow

Flow Tracing



* Iber et al., *The AASM Manual for the scoring of sleep and associated events: Rules, Terminology and Technical Specifications, 1st ed.: Westchester, Illinois: American Academy of Sleep Medicine, 2007.*

Fisher&Paykel HEALTHCARE

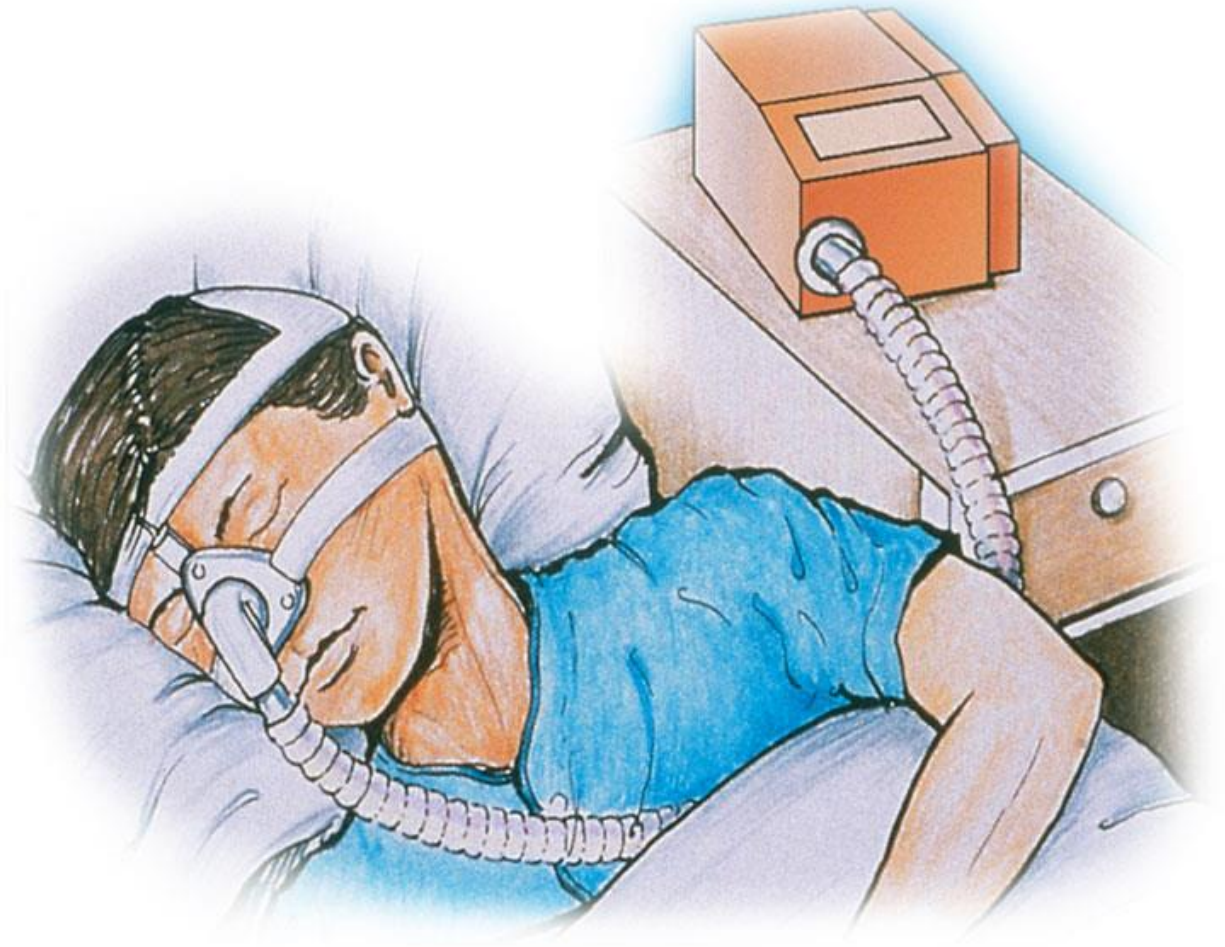
Apnea Hypopnea Index (AHI)

- # apneas + hypopneas per hour of sleep

- Key components
  - Air flow (pressure sensor and/or thermistor)
  - Respiratory effort (thoracic/abdominal movement)
  - Oxygen saturation

- Severity
  - AHI < 5: Normal
  - 5 <= AHI < 15: Mild SA
  - 15 <= AHI < 30: Moderate SA
  - 30 <= AHI: Severe SA

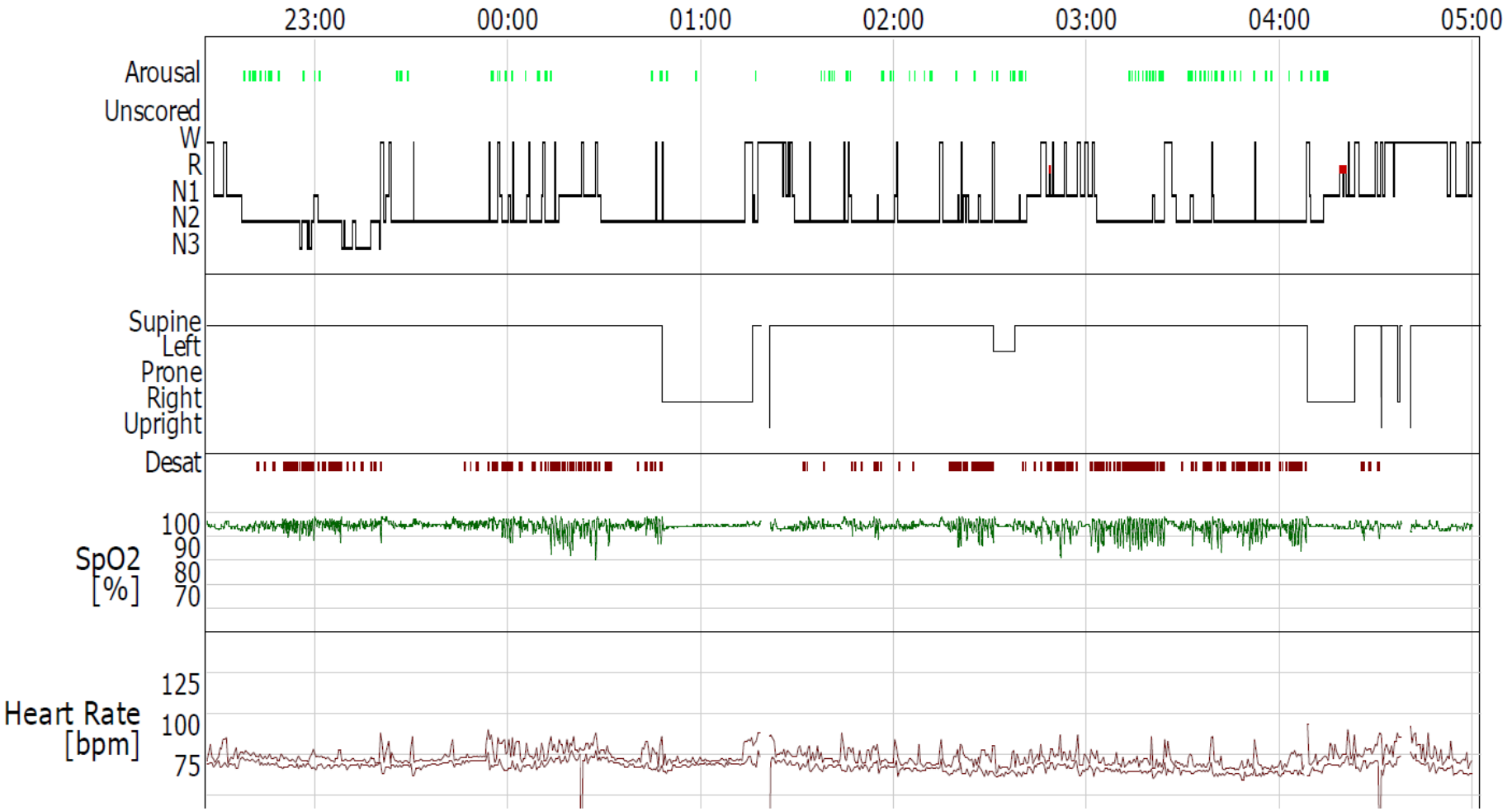
Positive Airway Pressure



Normal Sleep

Primary Insomnia

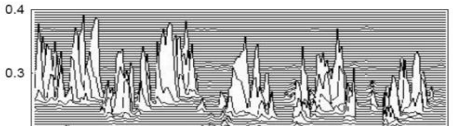
Sleep Apnea


23:00
00:00
01:00
02:00
03:00
04:00
05:00
Arousal
Unscored
W
R
N1
N2
N3
Supine
Left
Prone
Right
Upright
Desat
SpO2 [%]
100
90
80
70
Heart Rate [bpm]
125
100
75

Polysomnography

EEG Sleep Staging

Autonomic Functions



Saturation, Respiration
Sleep Position

Limb Movement /EMG

Insomnia

Sleep-Breathing Disorders

Neurological-Related Sleep Disorders

傳統睡眠中心是人力密集產業

睡眠危機與商機／到醫院睡一晚自費6千起、健保有的得排一年

可攜式睡眠檢測儀器，患者在家檢測由雲端傳輸給醫療人員，將是未來趨勢

黃筱珮／專題報導 2017-06-16 10:08

醫院睡眠檢查
精確但費時耗力 – 適合確診

居家睡眠檢查
簡便但較不精確 – 適合篩檢

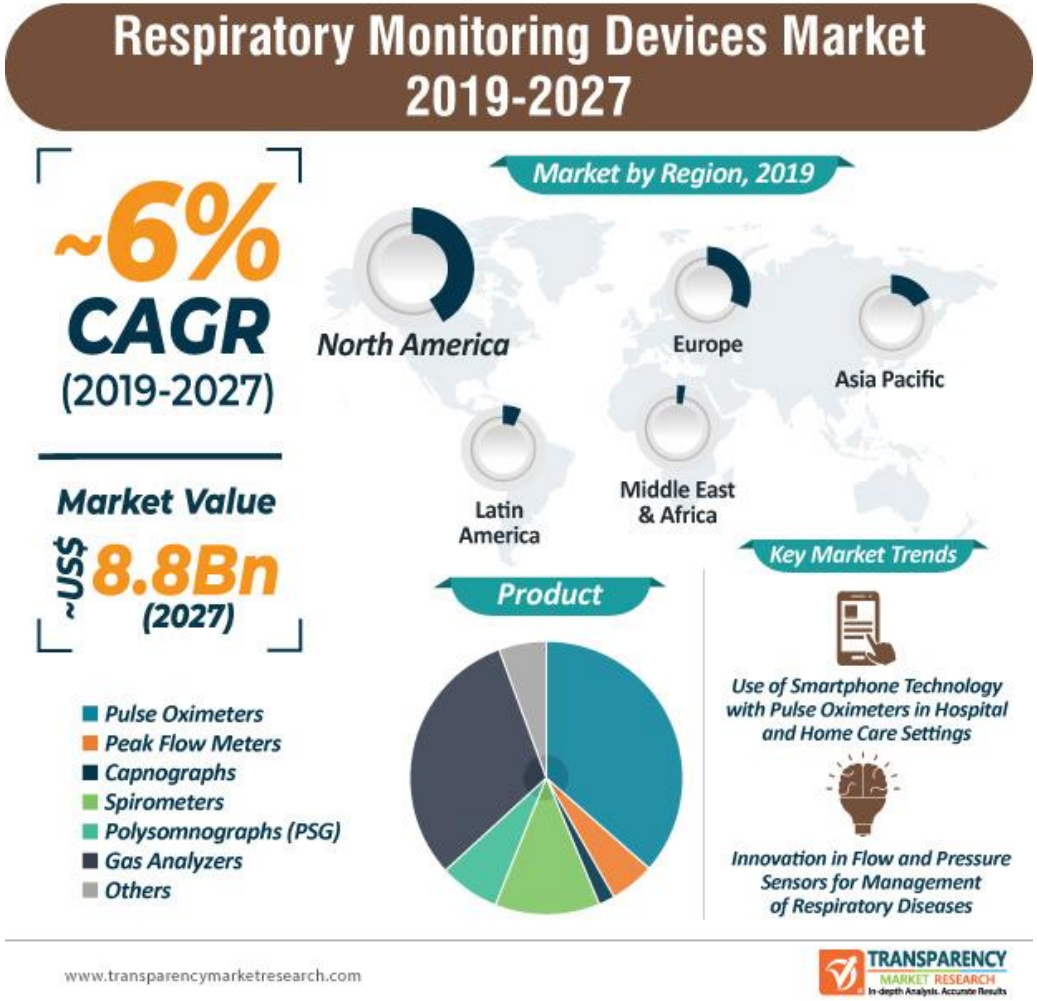
Classification of Sleep Monitoring Devices

Table 2. Delineation of operational rules used to classify monitors in sleep studies.

Type or Level	Portability	Indicative $N_{channels}$	Indicative signals	≥2 airflow /effort channels	Identifies sleep /wake	AHI
I	Facility-based	~14-16	EEG, EOG, EMG, ECG/HR, airflow, effort, SaO_2	Yes	Yes	Yes
II	Portable	≥7	(may have EEG), HR*, EOG, chin EMG, ECG/HR, airflow, effort, SaO_2	Yes	Yes	Yes
III	Portable	≥4	Airflow and/or effort, ECG/HR, SaO_2	Yes	No	No
IV	Portable	~1-3**	[All monitors not qualifying for type III]	No	No***	No

Home diagnosis of Obstructive Sleep Apnea-Hypopnea Syndrome, August 2007

Diverting Hospital-Based PSG to Home Sleep Monitoring



Challenges

- **How do we decide who undergoes hospital-based PSG and who receives home-based sleep monitoring?**

- **Can we diagnose patients based on sleep questionnaires?**

Sleep Quality Assessment

Psychiatry Res. 1989 May;28(2):193-213.

The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research.

Buysse DJ[1], Reynolds CF 3rd, Monk TH, Berman SR, Kupfer DJ.

Author information

Abstract

Despite the prevalence of sleep complaints among psychiatric patients, few questionnaires have been specifically designed to measure sleep quality in clinical populations. The Pittsburgh Sleep Quality Index (PSQI) is a self-rated questionnaire which assesses sleep quality and disturbances over a 1-month time interval. Nineteen individual items generate seven "component" scores: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. The sum of scores for these seven components yields one global score. Clinical and clinimetric properties of the PSQI were assessed over an 18-month period with "good" sleepers (healthy subjects, n = 52) and "poor" sleepers (depressed patients, n = 54; sleep-disorder patients, n = 62). Acceptable measures of internal homogeneity, consistency (test-retest reliability), and validity were obtained. A global PSQI score greater than 5 yielded a diagnostic sensitivity of 89.6% and specificity of 86.5% (kappa = 0.75, p less than 0.001) in distinguishing good and poor sleepers. The clinimetric and clinical properties of the PSQI suggest its utility both in psychiatric clinical practice and research activities.

PMID: 2748771 DOI: 10.1016/0165-1781(89)90047-4

The Pittsburgh Sleep Quality Index (PSQI)

Instructions: The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. Please answer all questions. During the past month,

1. When have you usually gone to bed? _____
2. How long (in minutes) has it taken you to fall asleep each night? _____
3. When have you usually gotten up in the morning? _____
4. How many hours of actual sleep do you get at night? (This may be different than the number of hours you spend in bed) _____

5. During the past month, how often have you had trouble sleeping because you…	Not during the past month (0)	Less than once a week (1)	Once or twice a week (2)	Three or more times week (3)
a. Cannot get to sleep within 30 minutes				
b. Wake up in the middle of the night or early morning				
c. Have to get up to use the bathroom				
d. Cannot breathe comfortably				
e. Cough or snore loudly				
f. Feel too cold				
g. Feel too hot				
h. Have bad dreams				
i. Have pain				
j. Other reason(s), please describe, including how often you have had trouble sleeping because of this reason(s):				
6. During the past month, how often have you taken medicine (prescribed or "over the counter") to help you sleep?				
7. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?				
8. During the past month, how much of a problem has it been for you to keep up enthusiasm to get things done?				
	Very good (0)	Fairly good (1)	Fairly bad (2)	Very bad (3)
9. During the past month, how would you rate your sleep quality overall?				

Clinical Workflow