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# Sleep assessment in orofacial pain

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## Faculty of Dentistry, Oral & Craniofacial Sciences

Tara.renton@kcl.ac.uk

Professor Oral Surgery Kings College London Past President British Association of Oral Surgeons


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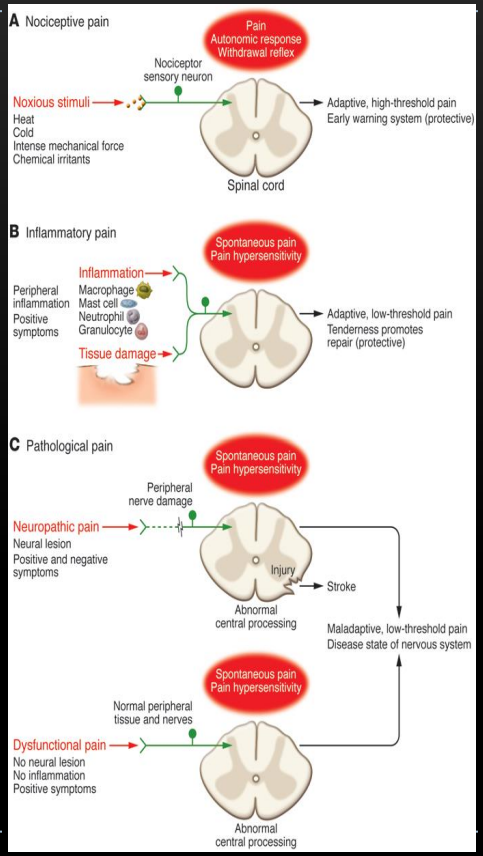
# Objectives

- The attending delegates will:
- - Understand the objectives of sleep questionnaires in sleep quality and quantity
- Limitations of sleep questionnaires
- - Be familiar with sleep assessment in orofacial pain patients
- - Know when to refer or treat.

- Impact sleep quality on orofacial pain to be covered by Amandine Beke

# Types of pain




**Healthy acute pain**

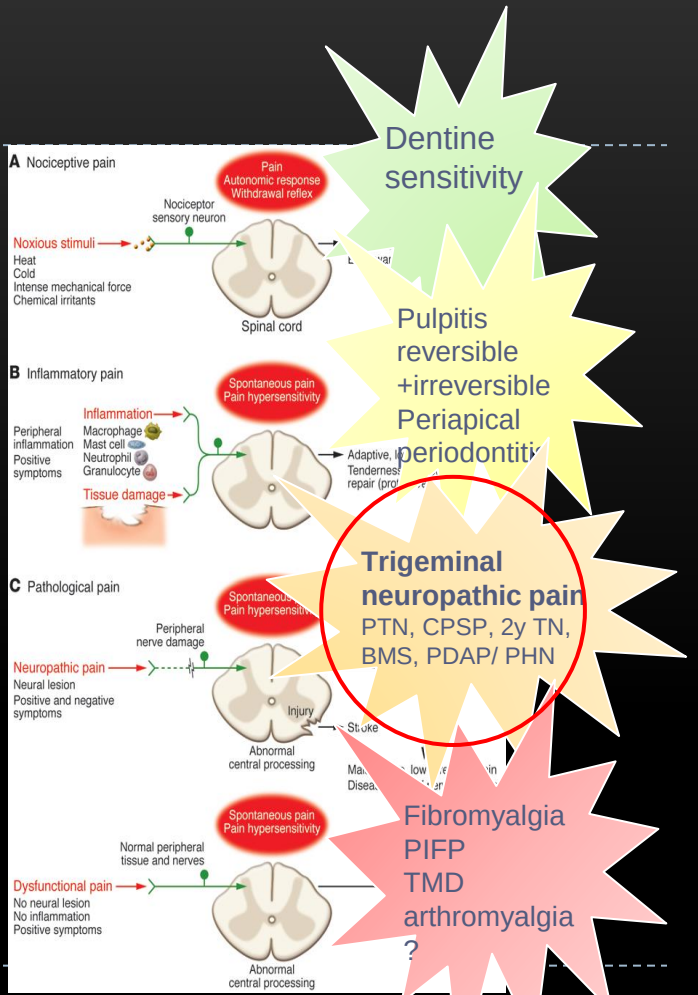
**Nociceptive**
healthy feeling pain 'pain'

**Inflammatory pain**
healthy short lived after insult

***Chronic pain = disease of neuromatrix***

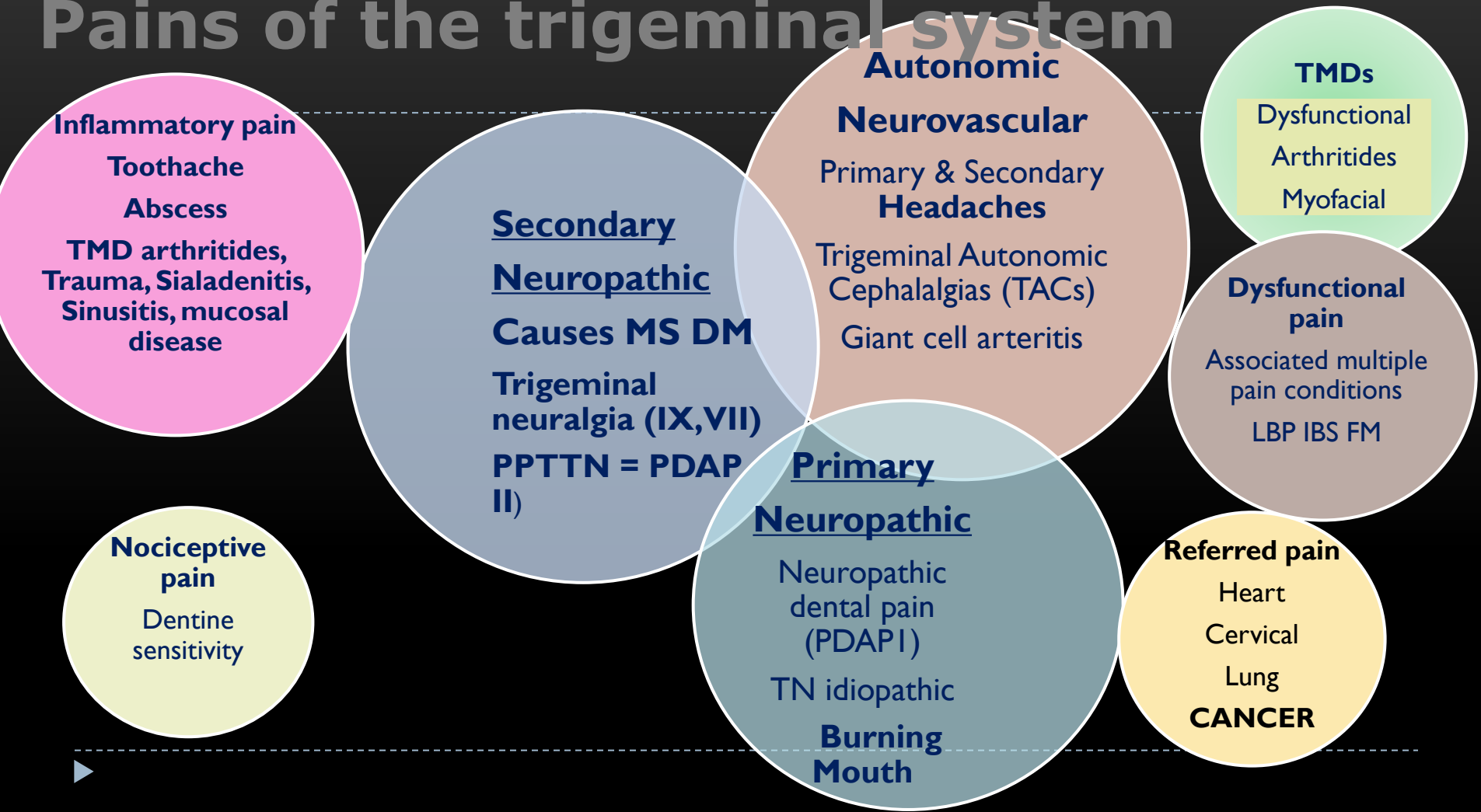
**<u>Neuropathic pain</u>**
<u>Associated with nerve lesion</u>

**Dysfunctional or centralised pain**
Unknown cause




*J Clin Invest. 2010 Nov 1; 120(11): 3742–3744.* ***What is this thing called pain?*** *Clifford J. Woolf*

# Pains of the trigeminal system



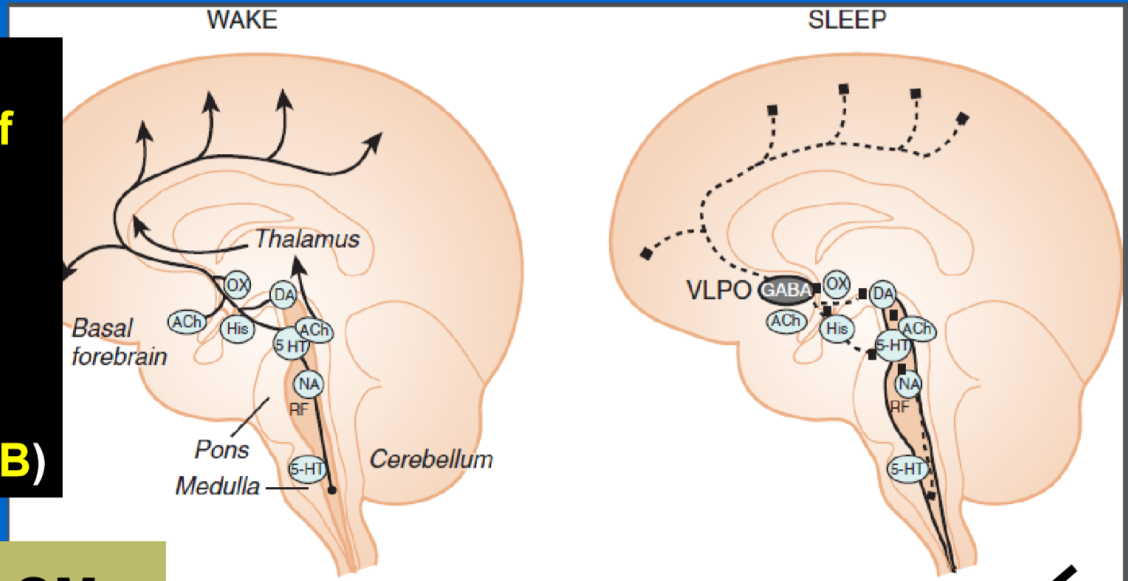
# Orofacial pain and sleep

- Quantity of sleep
  - Sleep interruption (elicited neuralgia)
  - Prevention of getting to sleep
  - Difficulty getting back to slee after interuption
- Poor quality sleep
  - Above
  - Less REM
  - Less restorative sleep

# Why do we need sleep?

- Recovery from fatigue
- Re energiser
  - Brain role of deep sleep (stages 3 and 4)
  - Heart metabolic rest
- Immune protection
- Memory consolidation
- dreams and well being ( we dream in all sleep stages / rem dreams are more vivid

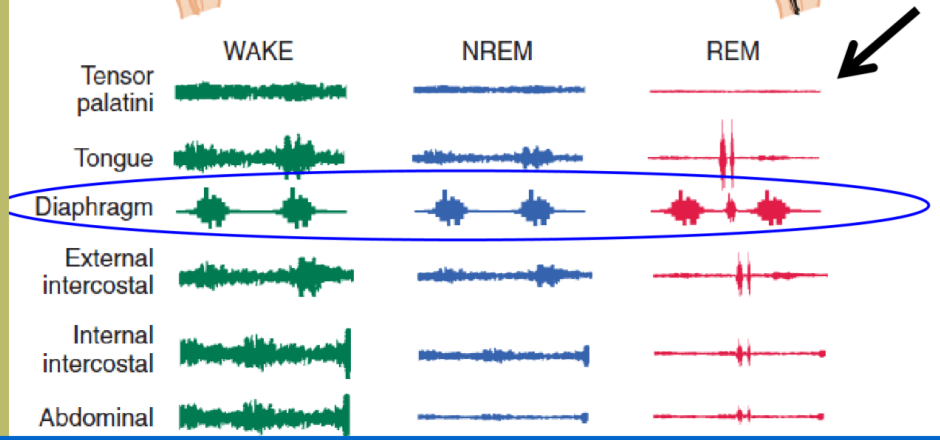
Sleep is a **bottom up cut-off** process & **Several Neurochemicals** modulate wake and sleep (?**candidates for SB**)




**The DIAPHRAGM muscle never sleep**

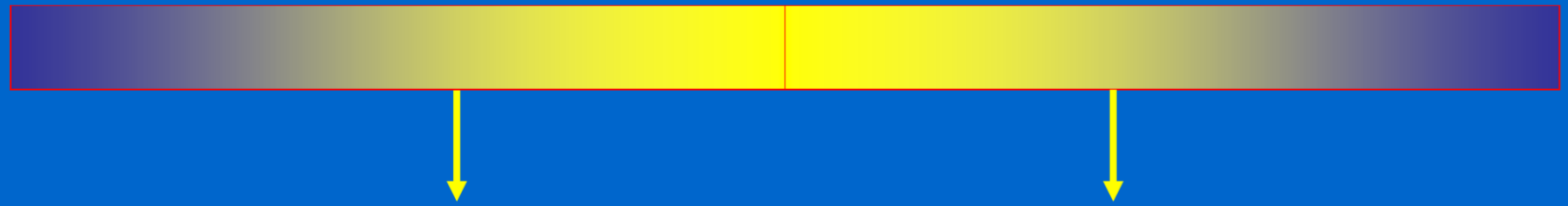
(Horner, PPSM 2011-6)

**TONGUE and PALATE muscle tone drop during sleep**



# Sleep pressure

- Sleep pressure reach it max 2 times / 24 hrs



2-4 h AM

2-4 PM

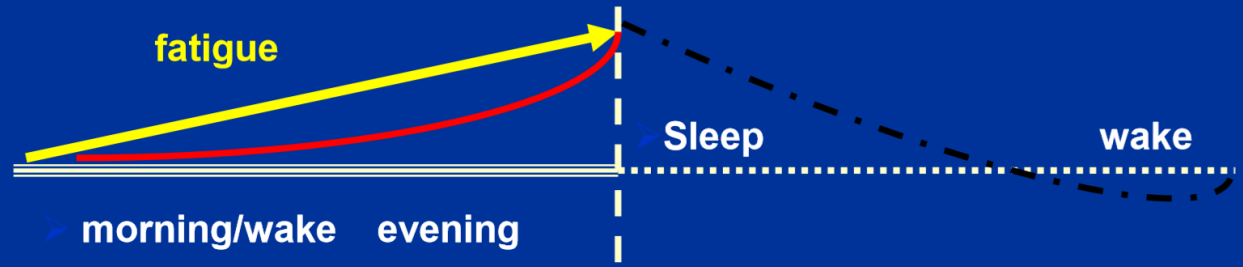
Or before if sleep are sleep deprived,

if large meal and alcohol

# Sleep Cycles

- Biological clock / hypothalamic suprachiasmatic nucleus (Gene clock/gene cycle)

- Temperature drop in sleep
- ± 24 h (≈ 25 h) / normal lag over 7-10 days
- Increase of fatigue during wake period = increase in sleep pressure



# Normal Sleep

| | |
|---|---|
| Baby | : ≈ 16 to 18 hours |
| Child before 14 yo | : more than 9 hours |
| Teenager | : variable duration / deprivation and recovery under mood influences |
| Adult | : ≈ 7 to 9 hours |
| > 70 years old | : ≈ 7 hours with NAPs-siesta |

# 2- Map: Differential Dx of Sleep Disorders

**Insomnia** *(e.g. idiopathic, psychophysiological)*

**Sleep-related breathing disorders** *(e.g. obstructive sleep apnea)*

Hypersomnia *(e.g. narcolepsy)*

**Circadian Rhythm sleep disorders** *(e.g. jet lag, Brain Trauma phase delay 2 hrs)*

**Parasomnias** *(e.g. sleepwalking, sleep enuresis, nightmares & REM BEHAVIOUR DISORDER patient enacte their dream – no hypotonia = Major Health Hazard Risk)*

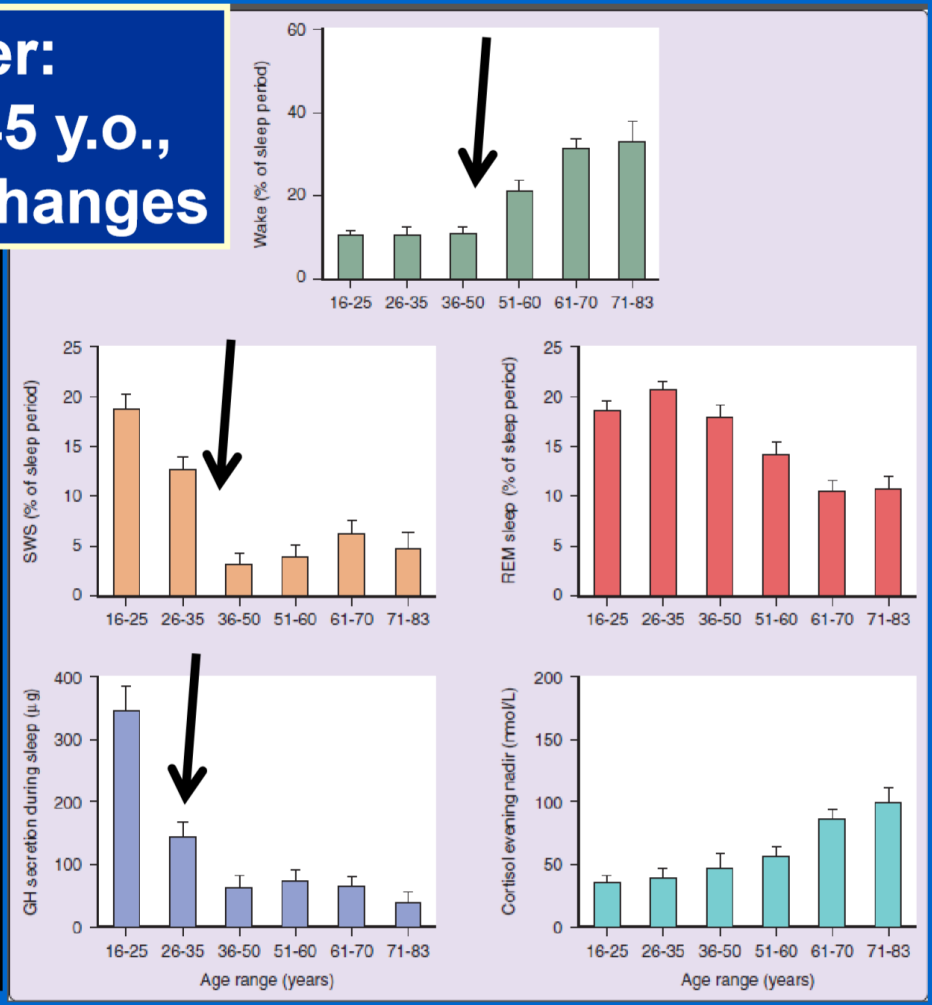
**Sleep-related movement disorders** *(e.g. periodic limb movement sleep disorder, sleep bruxism, restless leg syndrome)*

# To remember:
# Around 26 and 45 y.o., MAJOR SLEEP changes

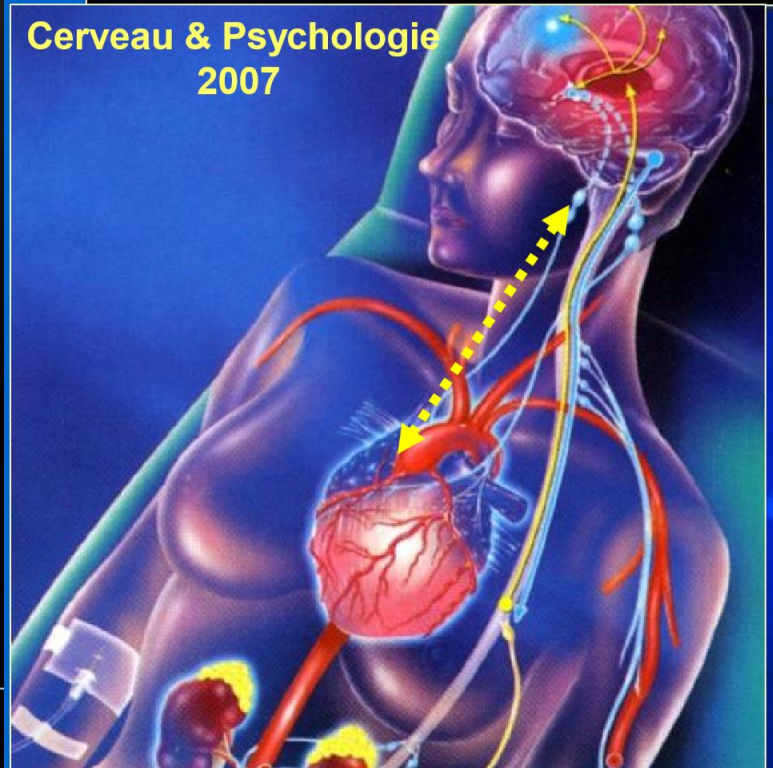
## Changes in sleep variables with aging:

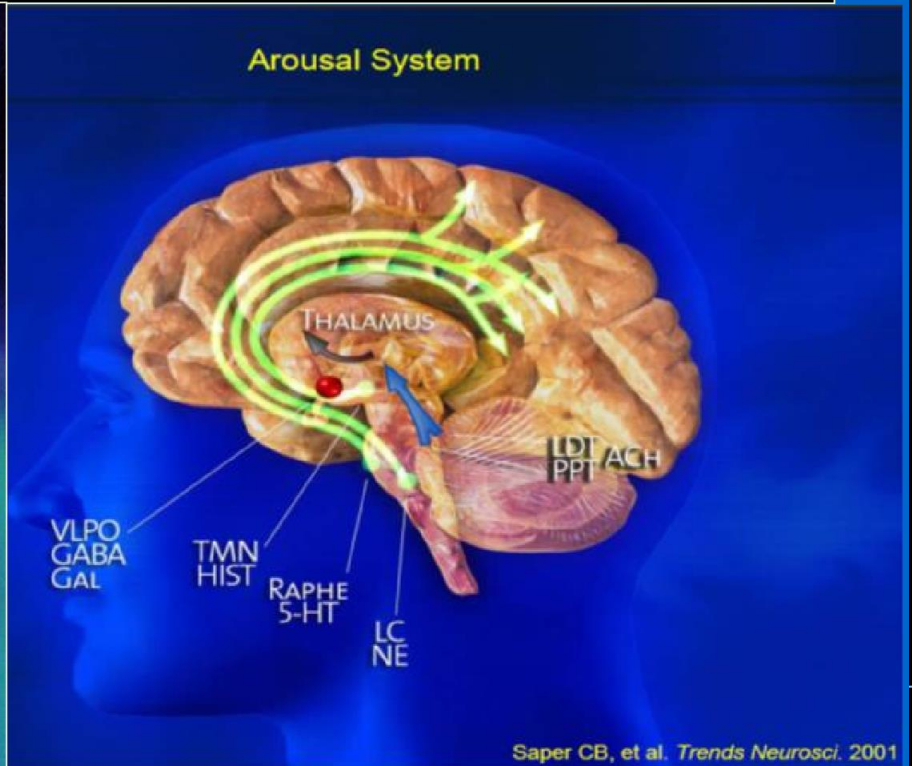
## Decrease in
## Slow wave sleep
## Growth hormone

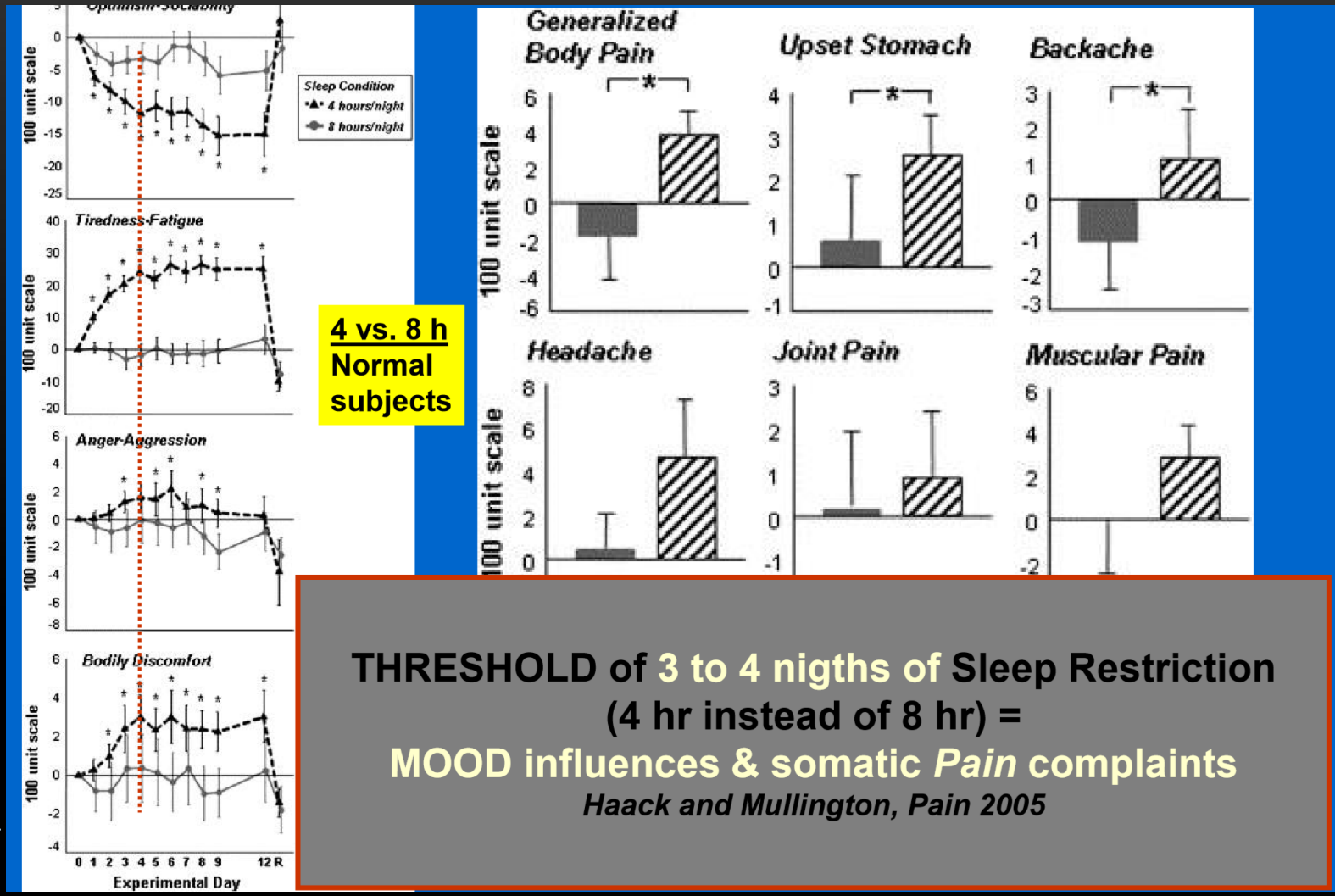
van Cauter et al
PPSM 2016,
Kryger et al eds,
Elsevier



# AROUSAL during sleep = Transient activation (3-15 sec/ 7 to 14 times per hr) of brain, muscle and heart + respiratory system




Optimism-Sociability
Sleep Condition
4 hours/night
8 hours/night
100 unit scale
Tiredness-Fatigue
Anger-Aggression
Bodily Discomfort
0 1 2 3 4 5 6 7 8 9 12 R
Experimental Day
4 vs. 8 h
Normal
subjects
Generalized
Body Pain
Upset Stomach
Backache
Headache
Joint Pain
Muscular Pain
THRESHOLD of 3 to 4 nigths of Sleep Restriction
(4 hr instead of 8 hr) =
MOOD influences & somatic Pain complaints
Haack and Mullington, Pain 2005

# INSOMNIA in PAIN & SLEEP interaction

**INSOMNIA : 20 to 30 min (if NAP) to fall asleep or cannot resume sleep if awakening**

**Prevalence: 10% general population up to 30% in chronic pain patients**

**Initial insomnia induce significant rise in pain over time (explain 16% of the variance; Temporomandibular pain, n=53; Quartana et al, PAIN 2010)**

**NB: Insomnia is present in 56% of Substance Abuser Subjects (Mafoud Y et al, 2009 /Pilot study)**

# INSOMNIA in PAIN & SLEEP interaction

Insomnia syndrome psychological vulnerability characterized by higher depressive and anxiety symptoms,
lower extraversion,
higher arousability, and poorer self-rated mental health,

PLUS a higher level of bodily pain and a poorer general health.

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Five variables associated with a new onset of insomnia syndrome:
previous episode of insomnia,
positive family history of insomnia,
higher arousability predisposition,
poorer self-rated general health,

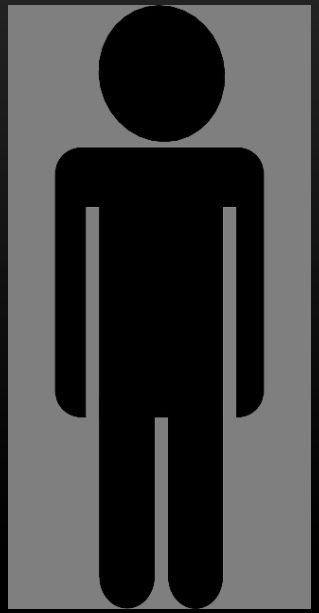
and **higher bodily pain**.

(LeBlanc, M SLEEP 2009; Jarrin DC, J Sleep Res 2014)

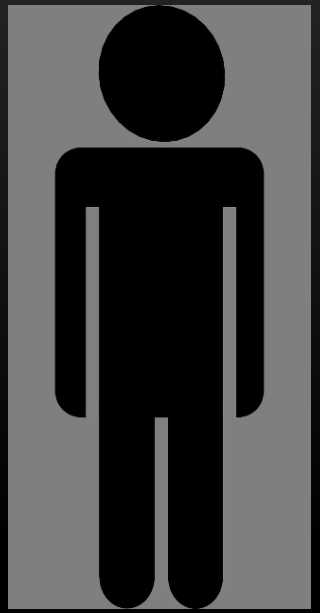
**The trajectory(ies)**
**of changes in sleep quality**
may help us to screen
(identify vunerability) for
new onset of future chronic
**TEMPOROMANDIBULAR**
**pain**

**See the OPPERA study in USA (Dr Maixner et al)**

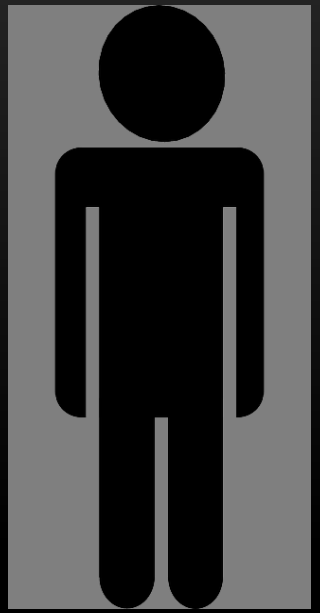
# Overview



Objectives of sleep assessment and methods



Types of sleep questionnaires

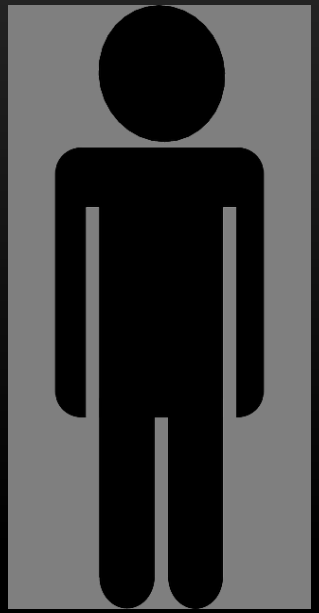


Application of sleep questionnaires to orofacial pain

# Why assess sleep?

- Sleep is fundamental to health.
- Sleep disorders can often be a symptom of a disease; or also may be an indicator of a future disease such as depression.
- For those reasons, sleep assessment is an essential component of any health check.
- As such, many health care systems stablish mechanisms to prevent sleep disorders by providing specific plans in relation to education and awareness of good sleep habits

# Overview



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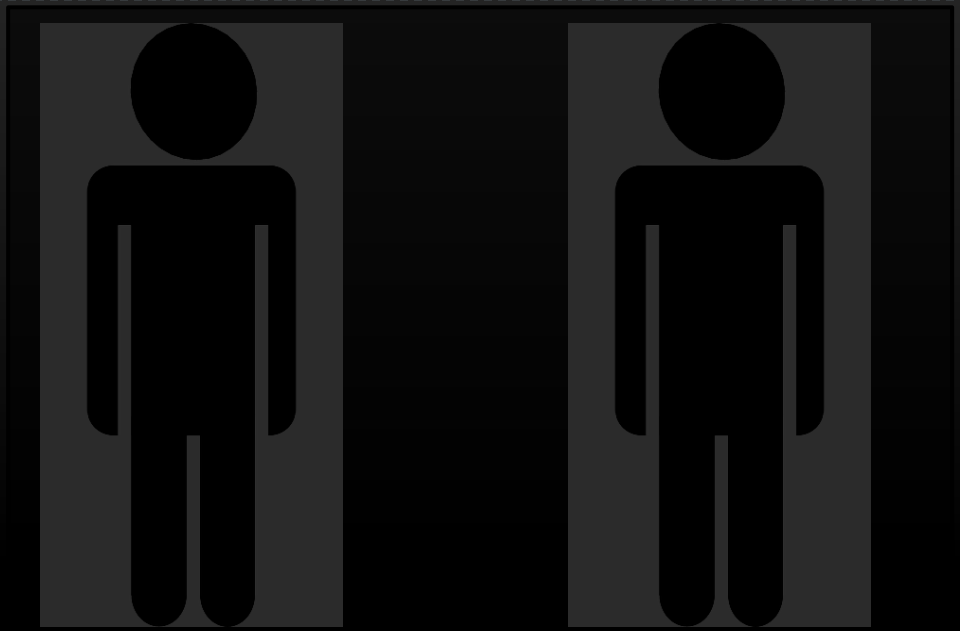

How to prevent these injuries?

How to manage these injuries?

# Systematic reviews of Qs

- There have in the past been different reviews of sleep assessment methods, but most of them are outdated

- Lomeliet al.,2008; Kelly,Strecker&Bianchi,2012;Winter,2014), or they are partial, or only focus on a specific subset of methods (e.g., sleep questionnaires: Silvaetal.,2011; Firatetal., 2012; El-Sayed,2012; Patakaetal.,2014; Singh&Mims,2015; Chai-Coetzeretal.,2015, mobile apps: Lee&Finkelstein,2015; Ong&Gillespie,2016, or contact sleep detection methods: Kolla,Mansukhani&Mansukhani,2016; Maslakovic,2017; Green,2017

PeerJ

## A survey on sleep assessment methods

Vanessa Ibáñez[1], Josep Silva[2] and Omar Cauli[3]

[1] Facultad de Enfermería, Universidad Católica de Valencia "San Vicente Mártir", Valencia, Spain
[2] Departamento de Sistemas Informáticos y Computación, Universitat Politècnica de València, Valencia, Spain
[3] Departamento de Enfermería; Universidad de Valencia, Valencia, Spain

**ABSTRACT**

**Purpose.** A literature review is presented that aims to summarize and compare current methods to evaluate sleep.
**Methods.** Current sleep assessment methods have been classified according to different criteria; e.g., objective (polysomnography, actigraphy…) vs. subjective (sleep questionnaires, diaries…), contact vs. contactless devices, and need for medical assistance vs. self-assessment. A comparison of validation studies is carried out for each method, identifying their sensitivity and specificity reported in the literature. Finally, the state of the market has also been reviewed with respect to customers' opinions about current sleep apps.
**Results.** A taxonomy that classifies the sleep detection methods. A description of each method that includes the tendencies of their underlying technologies analyzed in accordance with the literature. A comparison in terms of precision of existing validation studies and reports.
**Discussion.** In order of accuracy, sleep detection methods may be arranged as follows: *Questionnaire* < *Sleep diary* < *Contactless devices* < *Contact devices* < *Polysomnography* A literature review suggests that current subjective methods present a sensitivity between 73% and 97.7%, while their specificity ranges in the interval 50%–96%. Objective methods such as actigraphy present a sensibility higher than 90%. However, their specificity is low compared to their sensitivity, being one of the limitations of such technology. Moreover, there are other factors, such as the patient's perception of her or his sleep, that can be provided only by subjective methods. Therefore, sleep detection methods should be combined to produce a synergy between objective and subjective methods. The review of the market indicates the most valued sleep apps, but it also identifies problems and gaps, e.g., many hardware devices have not been validated and (especially software apps) should be studied before their clinical use.

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Corresponding author
Vanessa Ibáñez,
vanessa.ibanez@ucv.es

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Additional Information and Declarations can be found on page 21

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**Subjects** Global Health, Neurology
**Keywords** Sleep, Sleep assessment, Sleep disorders, Sleep assessment methods

### INTRODUCTION

Sleep is fundamental to health. Sleep disorders can often be a symptom of a disease; or also may be an indicator of a future disease such as depression. For those reasons, sleep assessment is an essential component of any health check. As such, many health care systems stablish mechanisms to prevent sleep disorders by providing specific plans in relation to education and awareness of good sleep habits.

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Josep Silva,[2] and Omar Cauli[3] A survey on sleep assessment methods. PeerJ. 2018; 6: e4849. 2018 May 25. doi: 10.7717/peerj.484

# Sleep parameters

**Table 1 Definition of basic sleep detection parameters.** This table summarizes the main parameters of a sleep study. The top of the table (light blue) lists the fundamental parameters. Those parameters that can be derived from the primitive variables are listed in the dark blue rows. Each of them includes its associated formula.

| Sleep measure | Definition | Formula |
|---|---|---|
| **Fundamental parameters** | | |
| Initial In Bed Time (IIB) | Time when patient goes to bed initially | – |
| Final Out Bed Time (FOB) | Time when patient leaves the bed definitely | – |
| Time Out of Bed (TOB) | Total time out of bed between IIB and FOB | – |
| Lights Out Time (LT) | Time of lights out | – |
| Lights On Time (LN) | Time of lights on | – |
| Sleep Onset (SO) | Time when first sleep starts | – |
| Final Sleep (FS) | Time when last sleep finishes | |
| Sleep Latency (SL) | Time taken to fall sleep (at any time) | – |
| Sleep Period (SP) | Time spent sleeping between two awakenings/SO | – |
| Awake Period (AWP) | Time spent awake between two sleep periods | (*awakening* = *wake period* >10 *s*) |
| Arouse Period (ARP) | Time spent awake between two sleep periods | (*arousal* = *wake period* <10 *s*) |
| **Derived parameters** | | |
| In Bed Time (IBT) | Total time in bed | IBT = FOB-IIB-TOB |
| Total Recording Time (TRT) | Time between lights out and lights on | TRT = LN-LT |
| Initial Sleep Latency (ISL) | Time taken to fall sleep the first time | ISL = SO-LT |
| Total Sleep Time (TST) | Amount of time the patient sleeps during TRT | $TST = \sum_{i=1}^{i=N(\#sleepperiods)} SP_i$ |
| Sleep Interval (SI) | Time between the first sleep and the last sleep | SI = FS-SO |
| Wake After Sleep Onset (WASO) | Wake time between IIB and FOB | WASO = SI-TST |
| Total Wake Time (TWT) | All wake time throughout TRT | TWT = ISL +WASO |
| Mean Sleep Latency (MSL) | Arithmetic average of sleep latencies | $MSL = \left(\sum_{i=1}^{i=N(\#sleeplatencies)} SL_i\right)/N$ |
| Sleep Efficiency (SE) | Percentage of sleep of the total time in bed | SE = (TST/TRT) ×100 |
| Mean Awakening Length (MAL) | Arithmetic average of awake periods | $MAL = \left(\sum_{i=1}^{i=N(\#awakeperiods)} AWP_i\right)/N$ |
| Awakening Index (AWI) | Number of awakenings per unit of time | AWI = #AWP/TST |
| Arousal Index (ARI) | Number of arousals per unit of time | ARI = #ARP/TST |

- •What methods for sleep assessment have been developed?
  - Sleep detection
  - Self assessment -Questionnaires
- What are the main characteristics of each sleep assessment method?

# Sleep detection methods

- A sleep detection method is a function that classifies the sleep state of a patient. Most sleep detection methods such as wrist actigraphy or mobile apps consider a binary function, where the state can be classified as Awake/Sleep.
- More sophisticated methods consider aternary function: Awake/NREM/REM.
- The most advanced methods, such as polysomnography—often used as the gold standard—consider a quinquenary function: Awake/N1/N2/N3/REM.
  - polysomnography used to diagnose sleep diseases.
  - Includes oxygen saturations, limb movements, apneas, respiratory events by body position
  - Medical sleep lab assessments are the gold standard for sleep evaluation (see, e.g., Silvaet al.,2011;Firatetal.,2012;El-Sayed,2012;Luoetal.,2014;Chai-Coetzeretal.,2015;Silvaet al.,2016)

(Robertson, Marshall & Carno(2014), Pandi-Perumal, Spence & BaHammam (2014) and Armonetal.(2016)

# Polysomnogram(PSG)

- A PSG (Robertson, Marshall&Carno,2014; Pandi-Perumal,Spence&BaHammam,2014; Armonetal.,2016) is a medical procedure composed of several concurrent but independent tests that monitor different body functions during sleep and that are recorded for their later study using different channels. An exhaustive list of tests and information gathered in a modern PSG follows:
- ◦ Electroencephalogram(EEG)—measures and records the brainwave activity to identify sleep stages and detect seizure activity.
- ◦ Electrooculogram(EOG)—records eye movements. These movements are important for identifying the different sleep stages, especially the REM stage.
- ◦ Electromyogram(EMG)—records muscle activity (e.g., teeth grinding and face twitches; but also, limb movements using surface EMG monitoring of limb muscles, periodic or other). Chin EMG is necessary to differentiate REM from wakefulness, limb EMG can identify periodic limb movements during sleep (PLMS). ◦ Electrocardiogram(EKG)—records the heart rate and rhythm.
- ◦ Pulseoximetry—monitors the oxygen saturation (SO2).
- ◦ Respiratorymonitor—measures the respiratory effort (thoracic and abdominal). It can be of several types, including impedance, inductance, strain gauges, etc.
- ◦ Capnography—measures and graphically displays the inhaled and exhaled CO2 concentrations at the airway opening.
- ◦ Transcutaneousmonitors—measure the diffusion of O2 and CO2 through the skin.

# Equipment needed

- ◦ Microphone—continuously records the snoring volume and kind. ◦ Videocamera—continuously records video. It is useful to identify the body motion and position.
- ◦ Thermometer—records the core body temperature and its changes. ◦ Light intensity tolerancetest—determines the influence of light intensity on sleep.
- ◦ Nocturnal penile tumescence test—is used to identify physiological erectile dysfunctions.
- ◦ Esophagealtests—includes pressure manometry, to measurepleural pressure; oesophageal manometry to assess peristalsis, and esophageal pH monitoring (acidity test).
- ◦ Nasal and oral airflow sensor—records the airflow and the breathing rate. ◦ Gastroesophageal monitor—is used to detect Gastroesophageal Reflux Disease (GERD).
- ◦ Blood pressure monitor—measures the blood pressure and its changes.

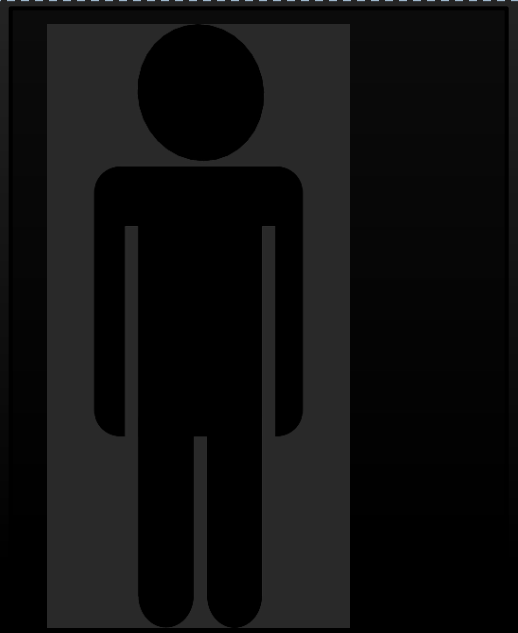
- Multiple sleep latency test(MSLT)
  - This sleep study (Carskadon,1986; Sullivan&Kushida,2008) is a test to identify excessive daytime sleepiness (i.e., feeling sleepy in a situation where one should be awake and alert, e.g., driving a truck) and determines how long it takes the patient to fall asleep.
- Maintenance of wakefulness test (MWT)
  - This test (Banksetal.,2004; Meiraetal.,2017) is performed over a whole day. Contrary to a PSG, this test is made while the patient is awake
- Home sleep test(HST)
  - The HST (Cruz,Littner&Zeidler,2014; Kapoor&Greenough,2015) is a kind of limited PSG that is made at home (i.e., portable equipment is transported to the patient's home).
- CPAP titration test(CTT)
  - A CTT (Lopez-Camposetal.,2007) is a type of sleep study that is used to calibrate continuouspositiveairwaypressure(CPAP)andbi-levelpositiveairwaypressure(BIPAP) therapies. CPAP/BIPAP are the common treatments in some sleep-related respiratory disorders

# SELF-ASSESSMENTMETHODS Sleep questionnaires

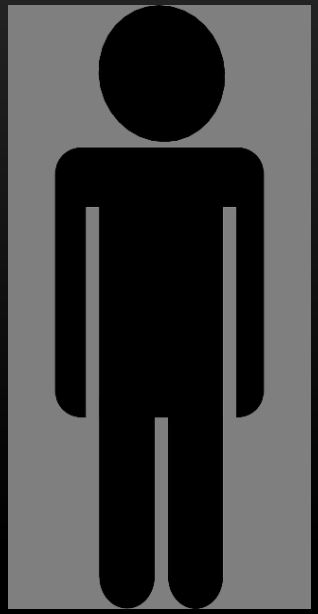
- The preliminary evaluation of sleep in primary care is often completed with a sleep questionnaire(also known as a sleep scale).
- Sleep questionnaires are a very inexpensive and rapid test, and for these reasons, they are ideal for the first diagnostic test.
- They summarize in a quantitative way the (subjective) perception of the patient about his or her own quality of sleep.
- Mostly subjective, sleep questionnaires can be influenced by the same sources of bias and inaccuracy as any other such reports.
- However, their subjectivity does not necessarily render questionnaires inaccurate, as it has been demonstrated by several validation studies

(Silvaetal.,2011;El-Sayed,2012;Firat etal.,2012; Luoetal.,2014; Patakaetal.,2014; Chai-Coetzeretal.,2015).

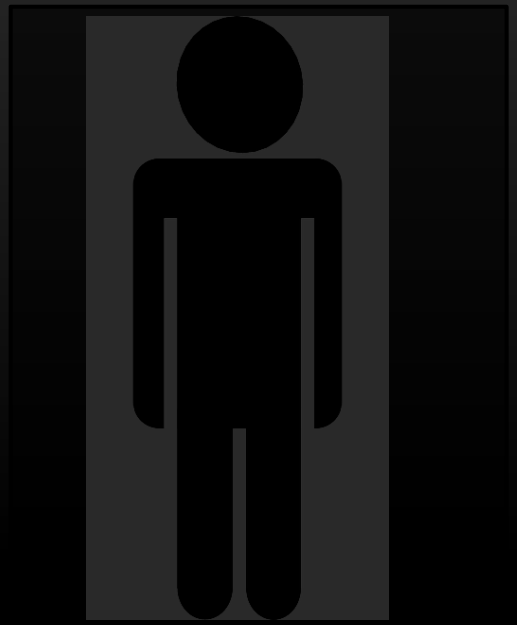
# Overview



Why prevent these injuries?



Types of sleep questionnaires



How to manage these injuries?

# Types of sleep questionnaires

**Table 2 Questionnaires for the detection of sleep disorders.** Each row represents a sleep questionnaire, and includes its acronym, its structure (number of items and scale used), and a reference to the article where it was proposed.

| Sleep questionnaire | | Structure | Period | Objectivity |
|---|---|---|---|---|
| MSQ | Mini Sleep Questionnaire (*Zoomer et al., 1985*) | 10 items (7 point scale) | Recently | 0 |
| PSQI | Pittsburgh Sleep Quality Index (*Buysse et al., 1989*) | 9 items (4 point scale) | 1 month | 0 |
| ESS | Epworth Sleepiness Scale (*Johns, 1991*) | 8 items (4 point scale) | Recently | 0 |
| ISI | Insomnia Severity Index (*Morin, 1993*) | 7 items (5 point scale) | Recently | 0 |
| SDQ | Sleep Disorders Questionnaire (*Douglass et al., 1994*) | 175 items (5 point scale) | Recently | 1 |
| SACS | Sleep apnea clinical score (*Flemons et al., 1994*) | 4 items (100 point scale) | Recently | 4 |
| FOSQ | Functional Outcomes of Sleep Questionnaire (*Weaver et al., 1997*) | 30 items (4–5 point scale) | Recently | 0 |
| SAQLI | Calgary Sleep Apnea Quality of Life Index (*Flemons & Reimer, 1998*) | 35 items (7 point scale) | 1 month | 0 |
| OSQ | Oviedo Sleep Questionnaire (*Bobes et al., 1998*) | 15 items (4–7 point scale) | 1 month | 0 |
| BQ | Berlin Questionnaire (*Netzer et al., 1999*) | 10 items (2–5 point scale) | Recently | 2 |
| ASQ | Athens Sleep Questionnaire (*Soldatos, Dikeos & Paparrigopoulos, 2000*) | 8 items (4 point scale) | 1 month | 0 |
| SEMSA | Self-efficacy in Sleep Apnea (*Weaver et al., 2003*) | 26 items (4 point scale) | Recently/Future | 0 |
| SQ | STOP Questionnaire (*Chung et al., 2008*) | 4 items (2 point scale) | Recently | 2 |
| SBQ | STOP-BANG Questionnaire (*Pallesen et al., 2008*) | 8 items (2 point scale) | Recently | 3 |
| BIS | Bergen Insomnia Scale (*Chasens, Ratcliffe & Weaver, 2009*) | 6 items (8 point scale) | 1 month | 0 |
| FOSQ-10 | Functional Outcomes of Sleep Questionnaire—10 (*Takegami et al., 2009*) | 10 items (4 point scale) | Recently | 0 |
| SFV | Simple Four Variables (*Chai-Coetzer et al., 2011*) | 4 items (2–6 point scale) | Recently | 3 |
| OSA50 | Obesity, Snoring, Apneas, aged over 50 (*Chai-Coetzer et al., 2011*) | 4 items (3–4 point scale) | Recently | 4 |

Devine EB, Hakim Z, Green J A systematic review of patient-reported outcome instruments measuring sleep dysfunction in adults *PharmacoEconomics* volume 23, pages889–912(2005)

# But……..

- We use the Chronic pain sleep inventory CPSI not on this list! never always
  - CPSI 1 Trouble falling asleep because of pain
  - CPSI 2 Needed sleep medication to help you fall asleep
  - CPSI3 Awakened by pain during the night
  - CPSI4 Awakened by pain in the morning
  - CPSI5 Rate overall quality of your sleep

# Insomnia Severity Index (ISI)

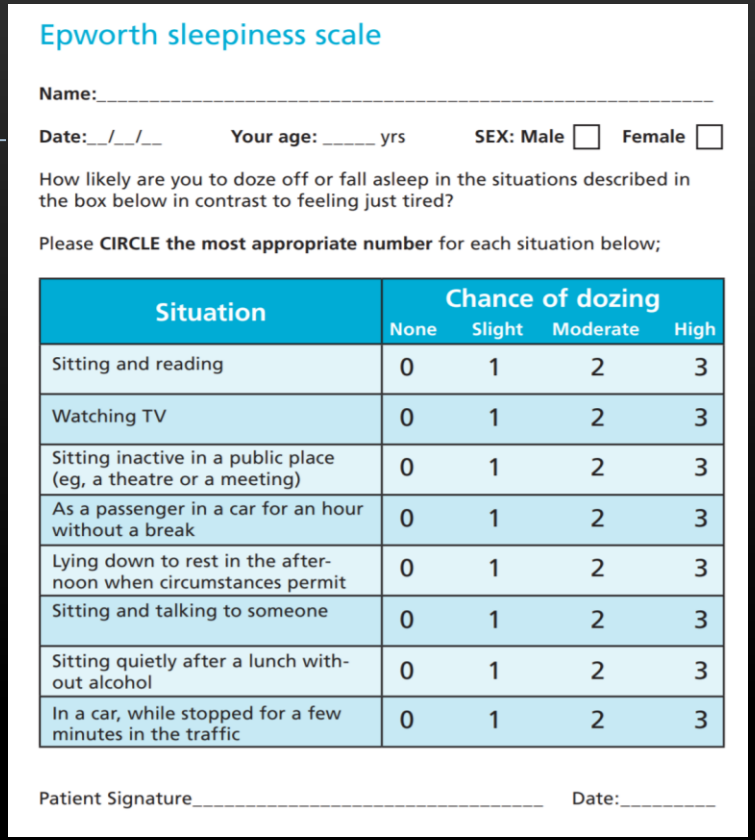
- (Morin CM; Belleville G; Bélanger L; Ivers H. The insomnia severity index: psychometric indicators to detect insomnia cases and evaluate treatment response. SLEEP 2011;34(5):601-608.)
- The ISI is a 7-item self-report questionnaire assessing the nature, severity, and impact of insomnia.11,24 The usual recall period is the "last month" and the dimensions evaluated are: severity of sleep onset, sleep maintenance, and early morning awakening problems, sleep dissatisfaction, interference of sleep difficulties with daytime functioning, noticeability of sleep problems by others, and distress caused by the sleep difficulties.
- A 5-point Likert scale is used to rate each item
- (e.g., 0 = no problem; 4 = very severe problem), yielding a total score ranging from 0 to 28. The total score is interpreted as follows: absence of insomnia (0-7); sub-threshold insomnia (8- 14); moderate insomnia (15-21); and severe insomnia (22-28). Three versions are available—patient, clinician, and significant others—but the present paper focuses on the patient version only.

**Table 1**—Percentage of clinical sample who endorsed each item response

| | Item response choice* | | | | |
|---|---|---|---|---|---|
| **Item ISI** | **0** | **1** | **2** | **3** | **4** |
| 1. falling asleep | 19.6 | 25.3 | 22.8 | 21.5 | 10.8 |
| 2. staying asleep | 0.0 | 4.4 | 17.7 | 53.8 | 24.1 |
| 3. early awakening | 9.5 | 8.2 | 27.9 | 39.9 | 14.6 |
| 4. satisfaction | 0.6 | 1.9 | 6.3 | 43.7 | 47.5 |
| 5. interference | 1.3 | 7.6 | 43.0 | 36.1 | 12.0 |
| 6. noticeable | 6.3 | 29.1 | 45.6 | 17.1 | 1.9 |
| 7. worry | 0.0 | 4.4 | 38.6 | 41.1 | 15.8 |

*Items 1-3 0, no problem; 1, mild; 2, moderate; 3, severe; 4, very severe
*Item 4 0, very satisfied; 1, satisfied; 2, neutral; 3, dissatisfied; 4, very dissatisfied
*Items 5-7 0, not at all; 1, a little; 2, somewhat; 3, much; 4, very much

# Epworth sleep questionnaire



## Epworth sleepiness scale

**Name:**_____

**Date:**__/__/__ **Your age:** _____ yrs **SEX: Male** ☐ **Female** ☐

How likely are you to doze off or fall asleep in the situations described in the box below in contrast to feeling just tired?

Please **CIRCLE the most appropriate number** for each situation below;

| Situation | Chance of dozing | | | |
|---|---|---|---|---|
| | None | Slight | Moderate | High |
| Sitting and reading | 0 | 1 | 2 | 3 |
| Watching TV | 0 | 1 | 2 | 3 |
| Sitting inactive in a public place (eg, a theatre or a meeting) | 0 | 1 | 2 | 3 |
| As a passenger in a car for an hour without a break | 0 | 1 | 2 | 3 |
| Lying down to rest in the afternoon when circumstances permit | 0 | 1 | 2 | 3 |
| Sitting and talking to someone | 0 | 1 | 2 | 3 |
| Sitting quietly after a lunch without alcohol | 0 | 1 | 2 | 3 |
| In a car, while stopped for a few minutes in the traffic | 0 | 1 | 2 | 3 |

Patient Signature_____ Date:_____

Kosinski M[1], Janagap CC, Gajria K, Schein J. Psychometric testing and validation of the Chronic Pain Sleep Inventory (CPSI) Clin Ther. 2007;29 Suppl:2562-77.

## THE EPWORTH SLEEPINESS SCALE

***(if more than 10-12/24 refer to MD)***

**How likely are you to doze off or fall asleep in the following situations, in contrast to feeling just tired?**

**This refers to your usual way of life in recent times. Even if you have not done some of these things recently try to work out how they would have affected you.**

**Use the following scale to choose the most appropriate number for each situation:**

**Available on Google**

| |
|---|
| 0 = no chance of dozing |
| 1 = slight chance of dozing |
| 2 = moderate chance of dozing |
| 3 = high chance of dozing |

| SITUATION | CHANCE OF DOZING |
|---|---|
| Sitting and reading | _____ |
| Watching TV | _____ |
| Sitting inactive in a public place (e.g a theater or a meeting) | _____ |
| As a passenger in a car for an hour without a break | _____ |
| Lying down to rest in the afternoon when circumstances permit | _____ |
| Sitting and talking to someone | _____ |
| Sitting quietly after a lunch without alcohol | _____ |
| In a car, while stopped for a few minutes in traffic | _____ |

# Mini sleep questionnaire

**Table 1.** Pattern matrix of the Mini Sleep Questionnaire with varimax rotation in the whole sample

| | Wake dimension | Sleep dimension |
|---|---|---|
| Item 1 – Difficulty falling asleep | 0.30 | 0.64 |
| Item 2 – Waking up too early | 0.11 | 0.75 |
| Item 3 – Hypnotic medication use | 0.01 | 0.51 |
| Item 4 – Falling asleep during the day | 0.79 | 0.05 |
| Item 5 – Feeling tired upon waking up in the morning | 0.83 | 0.10 |
| Item 6 – Snoring | –0.17 | 0.39 |
| Item 7 – Mid-sleep awakenings | 0.13 | 0.74 |
| Item 8 – Headaches on awakening | 0.52 | 0.23 |
| Item 9 – Excessive daytime sleepiness | 0.77 | 0.23 |
| Item 10 – Excessive movement during sleep | 0.49 | 0.60 |

Vincenzo Natale[1], Marco Fabbri, Lorenzo Tonetti, Monica Martoni **Psychometric Goodness of the Mini Sleep Questionnaire.** Psychiatry Clin Neurosci 2014 Jul;68(7):568-73. doi: 10.1111/pcn.12161. Epub 2014 Mar 10.

# Pittsburgh sleep questionnaire

| | No bed partner or room mate | Partner/room mate in other room | Partner in same room but not same bed | Partner in same bed |
|---|---|---|---|---|
| 10. Do you have a bed partner or room mate? | | | | |
| | Not during the past month | Less than once a week | Once or twice a week | Three or more times a week |
| If you have a room mate or bed partner, ask him/her how often in the past month you have had: | | | | |
| a. Loud snoring | | | | |
| b. Long pauses between breaths while asleep | | | | |
| c. Legs twitching or jerking while you sleep | | | | |
| d. Episodes of disorientation or confusion during sleep | | | | |
| e. Other restlessness while you sleep, please describe: | | | | |

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.**

1. During the past month, what time have you usually gone to bed at night? _____
2. During the past month, how long (in minutes) has it usually taken you to fall asleep each night? _____
3. During the past month, what time have you usually gotten up in the morning? _____
4. During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spent in bed.) _____

| 5. During the past month, how often have you had trouble sleeping because you… | Not during the past month | Less than once a week | Once or twice a week | Three or more times a week |
|---|---|---|---|---|
| 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: | | | | |
| 6. During the past month, how often have you taken medicine to help you sleep (prescribed or "over the counter")? | | | | |
| 7. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity? | | | | |
| | No problem at all | Only a very slight problem | Somewhat of a problem | A very big problem |
| 8. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done? | | | | |
| | Very good | Fairly good | Fairly bad | Very bad |
| 9. During the past month, how would you rate your sleep quality overall? | | | | |

Devine, E.B., Hakim, Z. & Green, J. A systematic review of patient-re
adults. *Pharmacoeconomics* **23,** 889–912 (2005). https://doi.org/10.

# Other questionnaires that include sleep

- World Health Quality of Life (WHOQOL-bref).

The Pain and Sleep Questionnaire three-item index (PSQ-3 or PSQI):

- A reliable and valid measure of the impact of pain on sleep in chronic non malignant pain of various etiologies
  - PSQ is an eight-item questionnaire developed to assess the impact of pain on quality of sleep. Seven of the eight items are scored using 100 mm VAS, while the remaining item asks individuals to indicate the average number of hours of sleep they get each night.
  - Typically, the first five items on the scale are summed and used as an overall measure of the impact of pain on quality of sleep

ORIGINAL ARTICLE

**The Pain and Sleep Questionnaire three-item index (PSQ-3): A reliable and valid measure of the impact of pain on sleep in chronic nonmalignant pain of various etiologies**

Lindsay E Ayearst PhD[1], Zoltan Harsanyi MBA PStat[2], Kenneth J Michalko PharmD MBA[2]

**LE Ayearst, Z Harsanyi, KJ Michalko. The Pain and Sleep Questionnaire three-item index (PSQ-3): A reliable and valid measure of the impact of pain on sleep in chronic nonmalignant pain of various etiologies. Pain Res Manage 2012;17(4):281-290.**

**BACKGROUND:** Sleep disturbance is among the more common complaints reported by chronic pain patients. Because pain-related sleep disturbance may serve as a marker for the assessment of responses to treatment for chronic pain, inclusion of a measure designed to assess the impact of pain on sleep in clinical trial protocols is important, if not necessary. Measures typically used for this purpose lack scales specifically designed for the assessment of the impact of pain on sleep or are based on a single item. Single-item scales lack reliability and, therefore, validity.

**OBJECTIVES:** To investigate the psychometric properties of the five-item Pain and Sleep Questionnaire (PSQ) Index, which is embedded in the eight-item inventory, by applying an accepted methodology using retrospective analyses in controlled clinical trials in which the measure had been administered among patients with chronic nonmalignant pain.

**METHODS:** Data were pooled from nine independent, single-site, double-blind, randomized placebo-controlled clinical trials conducted over a period of approximately 10 years, the majority of which were cross-over designs. A cross-validation approach was adopted with exploratory and confirmatory factor analyses conducted to evaluate the underlying structure and dimensionality of the measure. Internal consistency reliability was evaluated using Cronbach's alpha coefficient. Mean score differences were used to assess the ability of the index to detect important treatment changes. Correlation coefficients were calculated between index scores and scores from other health-related outcome measures to evaluate the criterion validity of the index. Finally, predictive validity was assessed using multiple regression analyses.

**RESULTS:** Pooling the data resulted in a sample of 605 patients (65.5% female; mean age 55.7 years). Findings suggested a revised three-item PSQ Index (PSQ-3). The PSQ-3 demonstrated high internal consistency across samples (ranging from 0.82 to 0.93) and was sensitive to detecting meaningful treatment effects within different chronic pain categories. Moderate to strong correlations (r>0.40) between the PSQ-3 and other health-related outcome measures provided preliminary evidence for criterion-related validity. Results of multiple regression analyses demonstrated that the PSQ-3 accounted for between 29% and 40% of the variance in scores from other health-related outcome measures.

**CONCLUSIONS:** Results support the scoring of a revised three-item index for the assessment of the impact of pain on sleep. The revised index demonstrated acceptable levels of internal consistency and preliminary support for the structural, criterion-related and predictive validity of the index was achieved.

**Key Words:** *Measurement; Pain and sleep; Psychometric testing; Reliability; Validity*

**L'indice en trois points du questionnaire sur la douleur et le sommeil (PSQ-3) : une mesure fiable et valide des répercussions de la douleur sur le sommeil en cas de douleurs chroniques d'origine non cancéreuse de diverses étiologies**

**HISTORIQUE :** Les troubles du sommeil font partie des principales doléances des patients atteints d'une maladie chronique. Puisque les perturbations du sommeil liées à la douleur peuvent servir de marqueur pour évaluer les réponses au traitement des douleurs chroniques, il est important, sinon nécessaire, d'intégrer aux protocoles d'essais cliniques une mesure conçue pour évaluer les répercussions de la douleur sur le sommeil. Les mesures généralement utilisées à cette fin ne sont pas fondées sur des échelles conçues expressément pour évaluer les répercussions de la douleur sur le sommeil ou sur un seul point. Les échelles à un seul point ne sont pas fiables et donc pas valides.

**OBJECTIFS :** Examiner les propriétés psychométriques de l'indice du questionnaire en cinq points sur la douleur et le sommeil (PSQ), qui est inclus dans l'inventaire en huit points, en mettant en application une méthodologie acceptée faisant appel à des analyses rétrospectives dans des essais cliniques contrôlés où la mesure était administrée chez des patients souffrant d'une douleur chronique d'origine non cancéreuse.

**MÉTHODOLOGIE :** Les chercheurs ont regroupé les données à partir de neuf essais monocentriques cliniques indépendants à double insu, aléatoires et contrôlés contre placebo, menés sur une période d'environ dix ans, dont la majorité était de conception croisée. Ils ont adopté une démarche transversale et procédé à des analyses factorielles exploratoires et confirmatoires pour évaluer la structure et la dimensionnalité sous-jacentes de la mesure. Ils ont évalué la cohérence interne au moyen du coefficient alpha de Cronbach. Ils ont utilisé les différences de score moyennes pour évaluer si l'indice pouvait déceler d'importants changements thérapeutiques. Ils ont calculé les coefficients de corrélation entre les scores des indices et les scores d'autres mesures d'issues liées à la santé, afin d'évaluer la validité des critères de l'indice. Enfin, ils ont évalué la validité prédictive au moyen d'analyses de régression multiples.

**RÉSULTATS :** Le regroupement des données a permis de colliger un échantillon de 605 patients (65,5 % de femmes, âge moyen de 55,7 ans). Les résultats laissent croire à l'intérêt d'un indice révisé en trois points du PSQ (PSQ-3). Le PSQ-3 a démontré une cohérence interne élevée entre les échantillons (plage de 0,82 à 0,93) et permettait de constater des effets thérapeutiques significatifs dans les diverses catégories de douleur chronique. Des corrélations modérées à fortes (r>0,40) entre le PSQ-3 et d'autres mesures d'issues liées à la santé ont fourni des données probantes préliminaires sur la validité des critères. Les résultats des analyses de régression multiple ont démontré que le PSQ-3 représentait de 29 % à 40 % de la variance des scores provenant d'autres mesures d'issue liées à la santé.

**CONCLUSIONS :** Les résultats appuient le score d'un indice révisé en trois points pour évaluer les répercussions de la douleur sur le sommeil. L'indice révisé a démontré une cohérence interne acceptable et a permis de vérifier de manière préliminaire la validité prédictive des critères de l'indice.

Sleep disturbance is characterized by difficulties with sleep onset, sleep maintenance and poor sleep quality, and is among the more common complaints reported by chronic pain patients. Chronic pain patients experience more cyclic fluctuations in sleep due to frequent arousals, as well as longer awakenings, shifts between sleep stages and periodic body (ie, limb) movements (1). As a result, understanding the relationship between chronic pain and sleep has been the topic of numerous theoretical and empirical investigations. There is now substantial evidence that a mutually reinforcing relationship exists, whereby pain contributes to sleep disturbance, and sleep disturbance,

[1]*University of Toronto Scarborough, Scarborough;* [2]*Purdue Pharma, Pickering, Ontario*

*Correspondence: Dr Lindsay E Ayearst, Department of Psychology, SY-123, University of Toronto Scarborough, 1265 Military Trail, Scarborough, Ontario M1C 1A4. Telephone 416-208-2888, fax 416-208-2675, e-mail leyearst@utsc.utoronto.ca*

Ayearst L, Harsanyi Z, Michalko KJ. The Pain and Sleep Questionnaire three-item index (PSQ-3): a reliable and valid measure of the impact of pain on sleep in chronic nonmalignant pain of various etiologies. *Pain Res Manag*. 2012;17(4):281-290. doi:10.1155/2012/635967

# http://www.stopbang.ca/osa/screening.

## Screening

### STOP-Bang Questionnaire


Is it possible that you have ...
Obstructive Sleep Apnea (OSA)?

Please answer the following questions below to determine if you might be at risk.

Yes ○ No ○ **S**noring ?

Do you **Snore Loudly** (loud enough to be heard through closed doors or your bed-partner elbows you for snoring at night)?

Yes ○ No ○ **T**ired ?

**FATIQUE IS A STRONG PREDICTOR**

Do you often feel **Tired, Fatigued, or Sleepy** during the daytime (such as falling asleep during driving or talking to someone)?

Yes ○ No ○ **O**bserved ?

Has anyone **Observed** you **Stop Breathing** or **Choking/Gasping** during your sleep ?

Yes ○ No ○ **P**ressure ?

Do you have or are being treated for **High Blood Pressure** ?

Yes ○ No ○ **B**ody Mass Index more than 35 kg/m$^2$?

# Frequency of use in pain studies

- The Pittsburgh Sleep Quality Index (PSQI) and Medical Outcomes Study (MOS) Sleep Scale were found to be the most frequently used.
- The PSQI consists of 19 items and measures seven different domains of sleep problems including sleep latency, sleep duration, sleep efficiency, sleep quality, sleep disturbances, medication use and daytime dysfunction (12). The sum of scores for these seven components yields one global score.
- The MOS Sleep Scale, on the other hand, is a 12-item measure developed using patients with chronic illness and designed to assess a total of five domains of sleep problems: initiation, maintenance, respiratory problems, quantity, perceived adequacy and somnolence (13). A sleep problems index can also be scored based on summarizing information across nine items on the MOS Sleep Scale (14)

Cole JC, Dubois D, Kosinski M. Use of patient-reported sleep measures in clinical trials of pain treatment: A literature review and synthesis of current sleep measures and a conceptual model of sleep disturbance in pain. Clin Therapeutics 2007;29:2580-8.

## Sleep distrubances and disorders in chronic pain patients

Meta-analysis (n= 37) and effect size

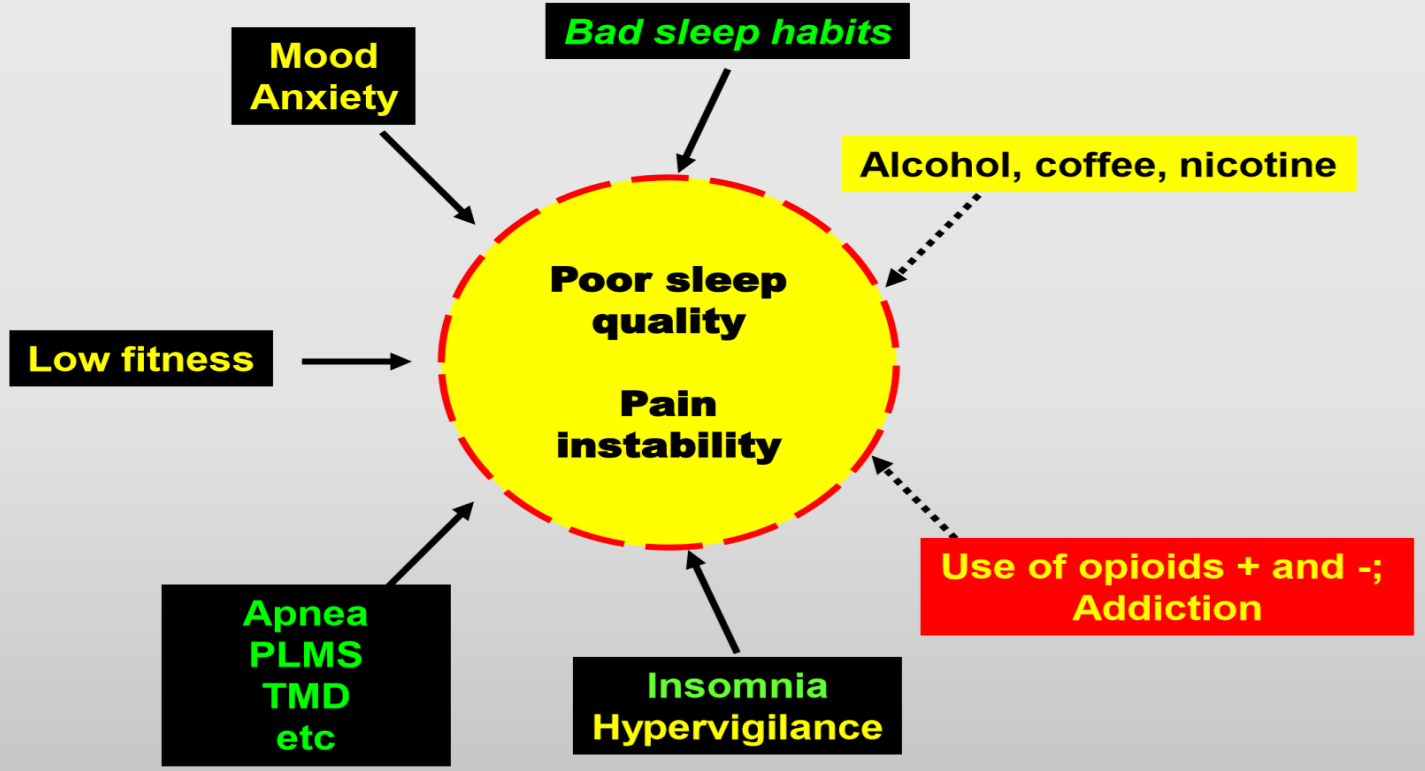
Mathias JL et al, Sleep Medicine 2018

## PSG data

- LARGE EFFECT on sleep onset latency & efficacy, time awake after onset, awakenings
- SMALL-MODEST EFFECT on total sleep time, NREM 1, # sleep stage shifts, respiratory related event & periodic limb movement
- 42%= Sleep disorders in chronic pain patients
- 14-36 % use opioids (2 studies… Caution!)

**13 times (X) more likely diagnose with INSOMNIA, 6 X for RLS and 16 X OSA**

# Exacerbation of pain and sleep comorbidities




Modified from Marshansky et al, 2018 / my lab

# Effect of sleep deprivation on chronic pain

According to the majority of the studies, sleep deprivation produces hyperalgesic changes.
Furthermore, sleep deprivation can counteract analgesic effects of pharmacological treatments involving opioidergic and serotoninergic mechanisms of action.
The heterogeneity of the human data and the exclusive interest in rapid eye movement sleep deprivation in animals so far do not allow us to draw firm conclusions as to whether the hyperalgesic effects are due to the deprivation of specific sleep stages or whether they result from a generalized disruption of sleep continuity.
The significance of opioidergic and serotoninergic processes as mediating mechanisms of the hyperalgesic changes produced by sleep deprivation are discussed.

- The effects of total and REM sleep deprivation on laser-evoked potential threshold and pain perception. Pain. 2011 Sep;152(9):2052-8. doi: 10.1016/j.pain.2011.04.032. Epub 2011 May 31.PMID: 21624774 Clinical Trial.
- Sleep deprivation and pain perception. Lautenbacher S, Kundermann B, Krieg JC. Sleep Med Rev. 2006 Oct;10(5):357-69. doi: 10.1016/j.smrv.2005.08.001. Epub 2006 Jan 4.PMID: 16386930 Review.
- Effects of total sleep deprivation in major depression: overnight improvement of mood is accompanied by increased pain sensitivity and augmented pain complaints. Kundermann B, Hemmeter-Spernal J, Huber MT, Krieg JC, Lautenbacher S. Psychosom Med. 2008 Jan;70(1):92-101. doi: 10.1097/PSY.0b013e31815c1b5d. Epub 2007 Dec 24.PMID: 18158380 Clinical Trial.
- The effect of sleep deprivation on pain. Kundermann B, Krieg JC, Schreiber W, Lautenbacher S. Pain Res Manag. 2004 Spring;9(1):25-32. doi: 10.1155/2004/949187.PMID: 15007400 Review.
- The effects of total sleep deprivation, selective sleep interruption and sleep recovery on pain tolerance thresholds in healthy subjects. Onen SH, Alloui A, Gross A, Eschallier A, Dubray C. J Sleep Res. 2001 Mar;10(1):35-42. doi: 10.1046/j.1365-2869.2001.00240.x.PMID: 11285053 Clinical Trial.

- Stroemel-Scheder C, Kundermann B, Lautenbacher S. The effects of recovery sleep on pain perception: A systematic review. *Neurosci Biobehav Rev*. 2020;113:408-425. doi:10.1016/j.neubiorev.2020.03.028

# Sleep disturbances and sequelae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# Poor sleep predictor for higher acute post surgical pain

sleep difficulty one of 9 predictors

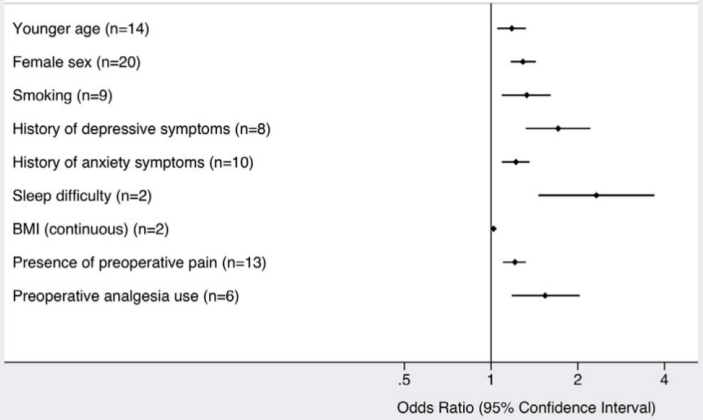


**Figure 3** Summary forest plot for significant preoperative predictors of poor postoperative pain control. ORs are shown with 95% CIs. The number of studies included in the meta-analysis for each predictor is indicated. BMI, body mass index.

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## Preoperative predictors of poor acute postoperative pain control: a systematic review and meta-analysis

Michael M H Yang,[1,2] Rebecca L Hartley,[2,3] Alexander A Leung,[4] Paul E Ronksley,[2] Nathalie Jetté,[5] Steven Casha,[1] Jay Riva-Cambrin[1,2]

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[1]Department of Clinical Neurosciences, Section of Neurosurgery, University of Calgary, Calgary, Alberta, Canada
[2]Department of Community Health Sciences, University of Calgary, Calgary, Alberta, Canada
[3]Section of Plastic Surgery, Department of Surgery, University of Calgary, Calgary, Alberta, Canada
[4]Division of Endocrinology and Metabolism, Department of Medicine, University of Calgary, Calgary, Alberta, Canada
[5]Department of Neurology, Icahn School of Medicine at Mount Sinai, New York, NY, USA

**ABSTRACT**

**Objectives** Inadequate postoperative pain control is common and is associated with poor clinical outcomes. This study aimed to identify preoperative predictors of poor postoperative pain control in adults undergoing inpatient surgery.

**Design** Systematic review and meta-analysis

**Data sources** MEDLINE, Embase, CINAHL and PsycINFO were searched through October 2017.

**Eligibility criteria** Studies in any language were included if they evaluated postoperative pain using a validated instrument in adults (≥18 years) and reported a measure of association between poor postoperative pain control (defined by study authors) and at least one preoperative predictor during the hospital stay.

**Data extraction and synthesis** Two reviewers screened articles, extracted data and assessed study quality. Measures of association for each preoperative predictor were pooled using random effects models.

**Results** Thirty-three studies representing 53 362 patients were included in this review. Significant preoperative predictors of poor postoperative pain control included younger age (OR 1.18 [95% CI 1.05 to 1.32], number of studies, n=14), female sex (OR 1.29 [95% CI 1.17 to 1.43], n=20), smoking (OR 1.33 [95% CI 1.09 to 1.61], n=9), history of depressive symptoms (OR 1.71 [95% CI 1.32 to 2.22], n=8), history of anxiety symptoms (OR 1.22 [95% CI 1.09 to 1.36], n=10), sleep difficulties (OR 2.32 [95% CI 1.46 to 3.69], n=2), higher body mass index (OR 1.02 [95% CI 1.01 to 1.03], n=2), presence of preoperative pain (OR 1.21 [95% CI 1.10 to 1.32], n=13) and use of preoperative analgesia (OR 1.54 [95% CI 1.18 to 2.03], n=6). Pain catastrophising, American Society of Anesthesiologists status, chronic pain, marital status, socioeconomic status, education, surgical history, preoperative pressure pain tolerance and orthopaedic surgery (vs abdominal surgery) were not associated with increased odds of poor pain control. Study quality was generally high, although appropriate blinding of predictor during outcome ascertainment was often limited.

**Conclusions** Nine predictors of poor postoperative pain control were identified. These should be recognised as potentially important factors when developing discipline-specific clinical care pathways to improve pain outcomes and to guide future surgical pain research.

**PROSPERO registration number** CRD42017080682.

**Strengths and limitations of this study**

- This systematic review provides a comprehensive meta-analysis on a large number of preoperative patient prognostic factors for poor acute postoperative pain control.
- The inclusion of multiple surgical specialties and articles representing diverse geographical locations increases the generalisability of the findings.
- There were a variety of definitions for poor postoperative pain control, timing of pain assessment and thresholds used to categorise continuous preoperative variables making the clinical and statistical interpretation of the meta-analysis more challenging.
- For certain preoperative variables, the number of studies included were few and may be underpowered to detect significant differences.

set the standard for the appropriate assessment and management of pain, pain has been recognised as the fifth vital sign.[1] With the ageing and growing population, the number of surgeries has increased to an excess of 280 million procedures performed globally every year.[2–8] Numerous studies suggest poor acute postoperative pain control is common and often inadequately treated.[9–12] Importantly, ineffective postoperative pain control is associated with poor outcomes including increased length-of-stay, sleep disturbance, prolonged time to first mobilisation and increased opioid use.[11 13 14] Further, poor postoperative pain control is associated with delirium in the elderly, development of chronic pain syndromes, cardiopulmonary and thromboembolic complications.[10 11 15–17] Postoperative pain may be improved by understanding the preoperative predictors of poor pain control by allowing the use of anticipatory and individualised treatments.[18 19]

A previous systematic review reported

# Use of pain assessment in orofacial pain

- Pain intensity and interference
- Brief Pain Inventory (BPI) was used to evaluate the sensory and reactive dimensions of pain in this study. BPI is an increasingly widely used instrument, originally developed to assess cancer pain [23] and has also been validated for assessing non-cancer pain in both pain research and pain clinics. It uses numerical rating scales from 0 to 10 to measure the pain intensity and the level of interference of pain in various aspects of life: mood, walking, general activity, work, relations with others, sleep, and enjoyment of life. Pain intensity is the mean of the four BPI pain ratings, including worst, least, average, and current pain
- Sleep apnoea assessment as dentists may be involved in assisting in prevention apnoea and sleep bruxism

# Key messages…

- Sleep assessment is complex
- Many types of sleep disorders
- Medical sleep surveys are the most robust methods
- Questionnaires despite being subjective provide high sensitivity and specificity in pain disorders
- Lack of consensus on use of sleep Q assessment in OFP
- Key sleep and mood disorders are identified as risk factors for chronic pain

# Recommended book reading/watching

The New Science of Sleep and Dreams | Professor Matthew Walker
https://www.youtube.com/watch?v=5j9xCC_VtQA

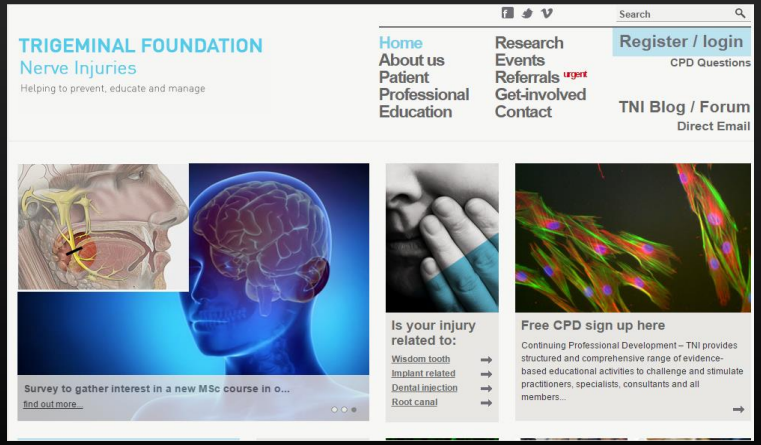
How To Improve Your Sleep | Matthew Walker
https://www.youtube.com/watch?v=lRp5AC9W_F8

The Importance of Sleep to Patients in Chronic Pain
https://www.youtube.com/watch?v=56ock_-BTSM

Sleep Dysfunction and Myofascial Pain
https://www.youtube.com/watch?v=RxnEuOp8oPk

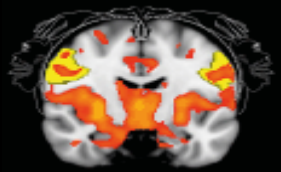
The Body Keeps the Score: Brain, Mind, and Body in the Healing of Trauma
https://www.youtube.com/watch?v=53RX2ESIqsM

# Thank you




Websites

**Trigeminalnerve.org.uk**
**Orofacialpain.org.uk**



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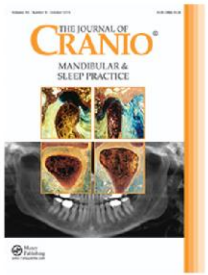


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# Relevance of sleep, pain cognition, and psychological distress with regard to pain in patients with burning mouth syndrome

Geun-Shin Lee, Hye-Kyoung Kim & Mee-Eun Kim

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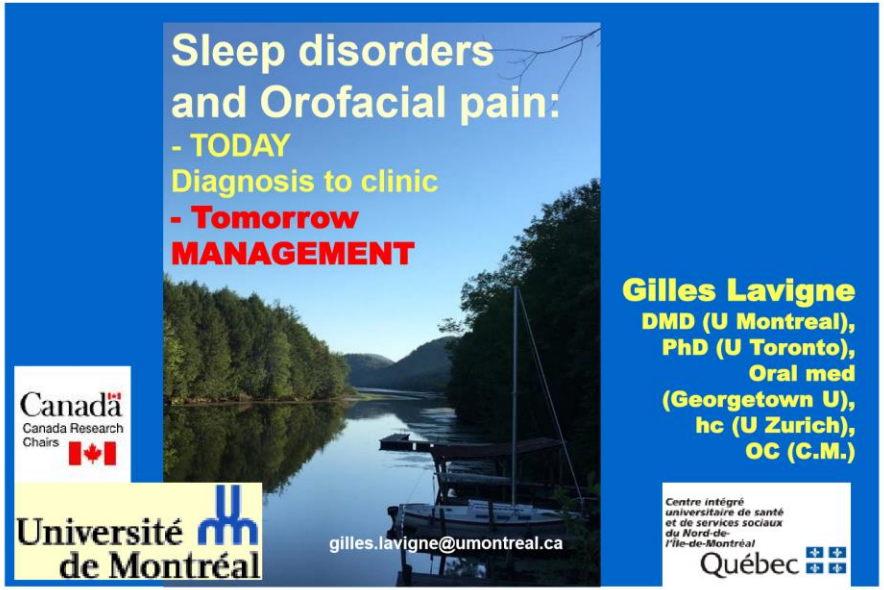

## Chronic pain = Non Restorative Sleep or sleep restriction (shorter duration)?

- About **2/3 of patients with chronic pain** also complain of **poor sleep quality and/or un-refreshing sleep sensation**
- This is reported by about 50% of orofacial patients and up to 70% OA & 60-90% of *fibromyalgia (FM)*- **chronic widespread pain (CWP)** patients