PAIN AND INSOMNIA: WHEN SLEEP BECOMES THE VICIOUS CYCLE

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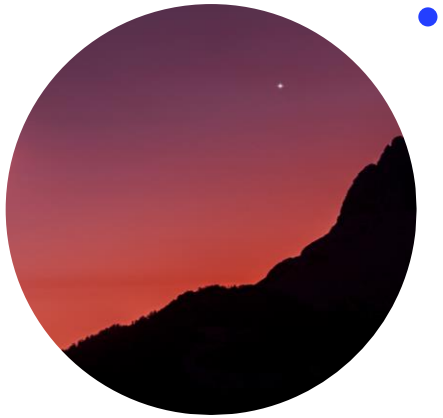
OBJECTIVES

1. Appreciate the scope of pain in the United States
2. Understand the scope of sleep disorders in the United States
3. Identify the magnitude of chronic pain and sleep disorders
4. Understand sleep architecture
5. Describe abnormal sleep and consequences
6. Cognize good sleep hygiene
7. Comprehend medicinal treatments for sleep disorders and the effect on chronic pain patients

AMERICAN ACADEMY OF PAIN MEDICINE

The Burden of Pain:

- The annual cost of chronic pain in the United States, including healthcare expenses, lost income, and lost productivity, is estimated to be $100 billion
- More than half of all hospitalized patients experienced pain in the last days of their lives.
- Research shows that 50-75% of patients with cancer die in moderate to severe pain
- An estimated 20% of American adults (42 million people) report that pain or physical discomfort disrupts their sleep a few nights a week or more



COMMON PAIN CONDITIONS (AAPM)

- A National Institute of Health Statistics survey indicated that low back pain was the most common (27%), followed by severe headache or migraine pain (15%), neck pain (15%) and facial ache or pain (4%)
- Back pain is the leading cause of disability in Americans under 45 years old
- More than 26 million Americans between the ages of 20-64 experience frequent back pain
- 28% of adults with low back pain report limited activity due to a chronic condition, as compared to 10% of adults who do not have low back pain
- Adults reporting low back pain were three times as likely to be in fair or poor health and more than four times as likely to experience serious psychological distress as people without low back pain

THE SCOPE OF SLEEP PROBLEMS IN THE UNITED STATES

- Transient insomnia: 30- 50 % of the adult population
- Chronic insomnia: 5- 10 % of the adult population
- 80% elderly
- 10-20% of patients in primary care setting
- 40-50% have comorbid psych dx
- Many sleep disorders go undiagnosed/ untreated

- Health care costs $2,000.00 more per year (2009)
- Lost productivity due to absenteeism, presenteeism, and work related accidents $75 billion

What is insomnia?

DIFFICULTY FALLING ASLEEP

DIFFICULTY STAYING ASLEEP

WAKING UP EARLIER THAN DESIRED

ASSOCIATED WITH DAYTIME CONSEQUENCES NOT ATTRIBUTABLE TO ENVIRONMENT OR LACK OF OPPORTUNITY TO SLEEP

AASM

CHRONIC PAIN & INSOMNIA

Chronic pain patients:

- Back pain is the most common
- More than half the individuals with back pain report interference with sleep
- Disrupted sleep will exacerbate chronic back pain
- Report that falling asleep is the most common problem
- Patients with low back pain experience several intense microarousals per hour of sleep
- Experience less deep sleep with more awakenings, which is NON- RESORATIVE SLEEP.

Sleep Medicine Clinics Journal (2016)

PAIN & INSOMNIA

"Sleep and pain are bidirectional; pain can interfere with sleep and sleep disturbance can exacerbate pain"

Cheatle, *Anesthesiology Clinics,* (2016)

PAIN & INSOMNIA

- Poor sleep quality and insufficient sleep duration are risk factors for chronic pain
- Strong evidence of hyperalgesia with shortened or disturbed sleep
- Can develop or exacerbate spontaneous pain symptoms

Haack, et al, *Neuropsychopharmacology* (2019)

Circadian Rhythm

is responsible for the sleep-wake cycle, hormone release, immune function which will all effect the neurobiological processes underlying the experience of pain

Circadian Misalignment

From shift work, social, jet lag, or an irregular sleep schedule can heighten pain sensitivity

Goldfarb, et al, (*Pain* 2025)

OUR 24 HOUR RHYTHM

CHRONIC PAIN PATIENTS CAN EXPERIENCE DYSSOMNIAS

Intrinsic sleep disorders

- Hypersomnia
- RLS
- Sleep apnea
- Narcolepsy

Parasomnias

- Sleepwalking
- Night terrors
- Sleep paralysis

Extrinsic sleep disorders

- Alcohol dependence
- Food allergy insomnia

Circadian Rhythm disorders

- Jetlag
- Shift work sleep disorder

Symptoms of Sleep-Disordered Breathing

Nighttime	Daytime
Snoring	Excessive Sleepiness
PAUSES in breathing	Fatigue
Choking	High Blood Pressure
Recurrent Awakening	Depression, Irritability
Palpitations	Morning Headaches
Nocturia	Impaired Memory/Concentration
Restlessness	Breath Not Silent
Hours of Sleep	Auto Accidents
Sour Taste	Diabetes
Rapid Heart Rate	Family History
Poor Sleep Architecture	Scalloped Tongue
Insomnia	Worn/Eroded Teeth
GERD	Medications
Rapid Onset of Sleep	Weight Gain/Neck Size
Many Dreams	GERD
Elevated Pressure in AM	Forward Head Posture

SLEEP APNEA

20 million Americans

Obstructive- partial/ complete airway blockage

Mild 5-14 interruptions

Mod 15-30 interruptions

Severe > 30 interruptions

Central- brain fails to signal breathing

Mixed or complex- both obstructive and central

CHRONIC PAIN & SLEEP DISORDERS

Sleep disordered breathing was common when chronic pain patients took prescribed opioids. A direct dose response relationship was found between central sleep apnea, and methadone and BZD, as association that has been not previously reported

140 patients

chronic pain

ATC opioids for at least 6 months

Results: 75% obstructive and central sleep apnea

Higher than expected prevalence of sleep disordered breathing in opioid treated chronic pain patients

(Dr Lynn Webster, 2007 AAPM)

CHRONIC PAIN & SLEEP DISORDERS

Have a bidirectional relationship impacting quality of life

Sleep disturbances decrease physical and mental well being

50-88% of chronic pain patients report poor sleep making it the primary complaint

Poor sleep quality exacerbates pain and pain disrupts sleep

Seiger et al (*Cell Reports Medicine*, 2024)

Neurotransmitters regulate sleep

The dysregulation of neurotransmitters, the hypothalamus-pituitary-adrenal axis and inflammatory pathways mediate the sleep pain relationship contributing to chronicity of pain and poor sleep

HOW IS POOR SLEEP AND CHRONIC PAIN CONNECTED?

DIAGNOSIS OF INSOMNIA

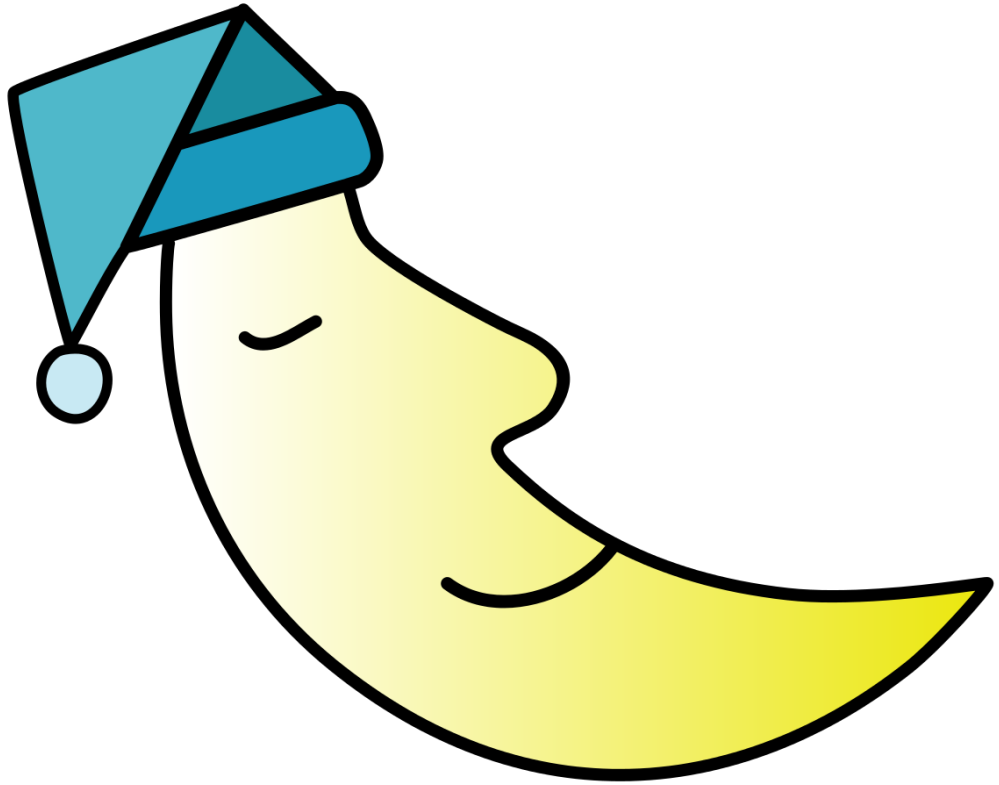
- Polysomnography (not indicated)
- Physical examination
- Mental status examination
- Two week log:
    - -Bedtime
    - -Sleep latency
    - -Number/ duration of awakenings
    - -Wake after sleep onset
    - -Time in bed
    - -Total sleep time
    - -Sleep efficiency
    - -Nap times

AASM, 2008

TOOLS

- Epworth Sleepiness Scale: 8-item self report questionnaire used to assess subjective sleepiness
- Insomnia Severity Index: 7-item questionnaire measuring severity of sleep disturbance
- Fatigue Severity Scale: 9-item patient rating of daytime fatigue.
- Mini Sleep Questionnaire: 10-item self report tool for sleep quality
- Pittsburg Sleep Quality Index: 19-item questionnaire to assess sleep quality over the past month
- Short Form Health Survey: 36-item self report inventory that generically measures quality of life for any disorder
- Dysfunctional Beliefs and Attitudes self-rating of 28 statements that is used to assess negative cognitions about sleep

SLEEP ARCHITECTURE



WHAT HAPPENS WHEN WE SLEEP?

Sleep architecture is an alternating pattern of REM and NREM sleep that repeats every 90 - 120 minutes

Typically 4-6 sleep cycles per night

1. N1
2. N2
3. N3
4. REM

ZZZZZZZ

The human body needs time to complete all phases of sleep for:

- Muscle repair
- Memory consolidation
- Release of hormones

Basically 1/3 of our lives are spent sleeping. Plays a direct role in how successful our other 2/3 of life will be!

NREM (75% OF NIGHT'S SLEEP)
N1

AKA Stage 1 (changed 2008)

- Between fully awake and falling asleep
- Light sleep
- "Drifting"
- Easily awaken
- Muscle activity slows
- Sensation of falling occurs here
- The "switch" (VLPO) activates **GABA** and galanin to inhibit wake promoting regions of the brain while **orexin** neurons stabilize the switch
- **Alpha waves**

LIGHT SLEEP
N2

AKA Stage 2 (changed 2008)

- Onset of sleep
- Become disengaged from surroundings
- Breathing and heart rate regulate
- Body temperature drops
- Eye movement stops
- Brain waves slow
- **Theta waves**

DEEP SLEEP
N3

AKA Stages 3 & 4 (changed 2008)

- RESTORATIVE SLEEP
- Blood pressure drops
- Respiratory rate slows
- Muscles relax
- Blood supply to muscles increases
- Tissue growth/ repair
- Energy restored
- Hormones released (HGH, testosterone)
- Glucose levels stabilize
- **Parasomnias** occur here
- Extremely slow brain waves
- **Delta waves**

REM (25% OF NIGHT'S SLEEP)

- Occurs 90 minutes after falling asleep, repeats every 90 minutes, 3-5 per night

- Energy to brain/ body
- Brain waves mimic wakeful state
- Cellular regeneration
- Cognitive restoration
- Memory allocation and retention
- Supports daytime performance
- Brain is active/ vivid dreaming!
- Eyes dart back and forth
- Body is immobile/ muscles turned off
- Male erections

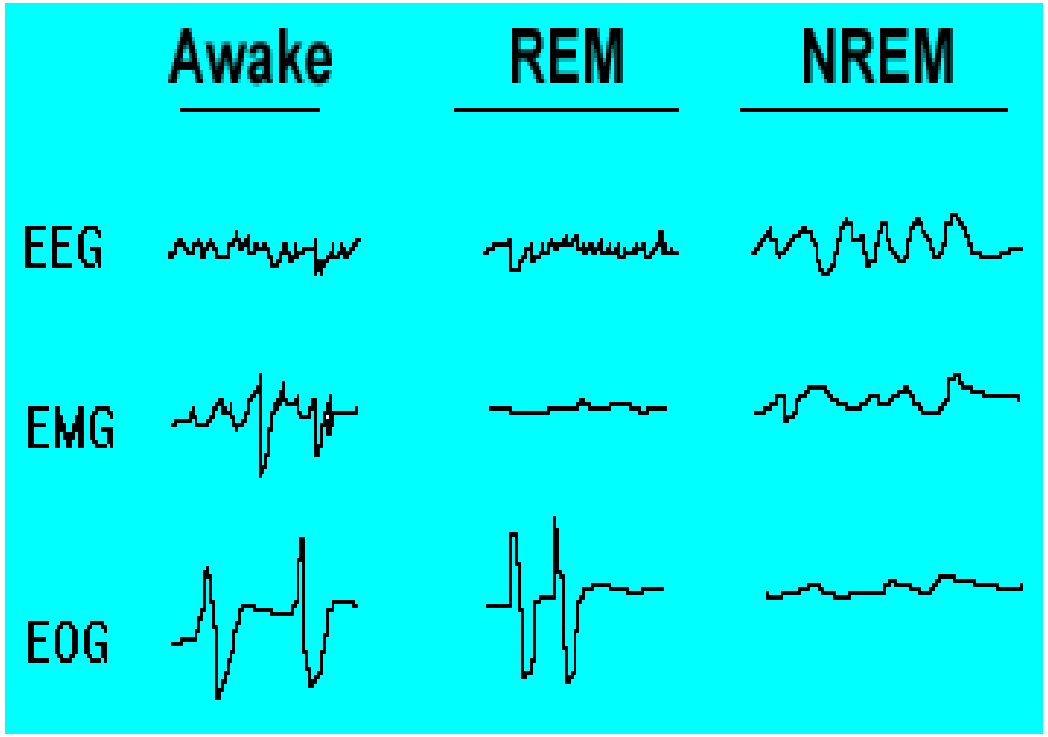
REM was discovered by French scientists in 1953. Previous theory was the deprivation of REM sleep could lead to insanity. Now known the lack of REM can alleviate clinical depression.

Infants 50%

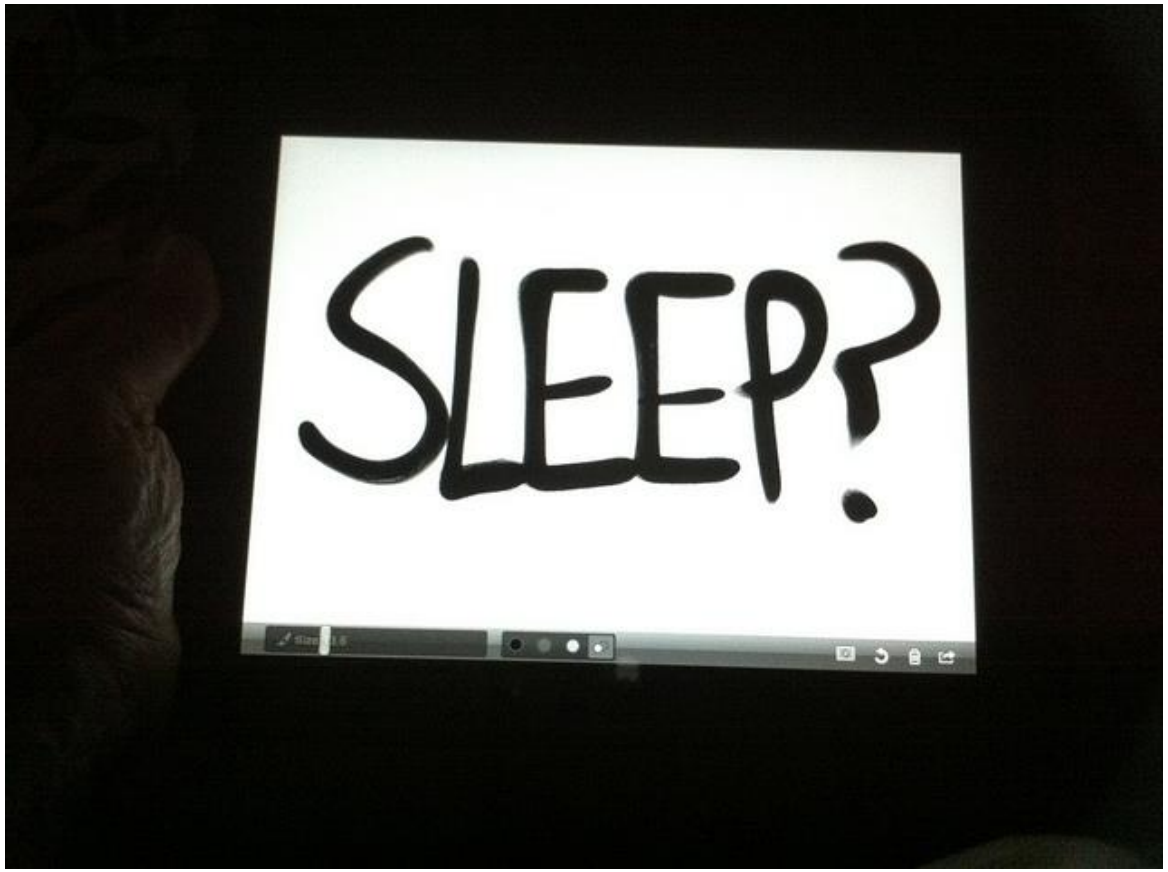
Adults 20%

⬇Elderly

REM



ABNORMAL SLEEP & CONSEQUENCES



RISK FACTORS FOR POOR SLEEP

- Gender
- Age
- Stress
- Environment
- Poor sleep hygiene
- Psychiatric disorders
- Medical disorders
- Medications
- Physical inactivity

EPIDEMIOLOGICAL STUDIES

- Marked functional impairment
- Increased rates of absenteeism
- Increased occupational accidents
- Increased MVA
- Significant risk factor in developing psych disorders
- Increased risk of relapse of depression
- Increased risk of alcoholism
- **Increase in adverse effects in the chronic pain population**

UNADDRESSED INSOMNIA

- Decreased cognitive function
- Metabolic syndrome
- Decreased immune function
- Poor judgement
- Decreased core body temperature
- Obesity
- Migraines
- Depression
- Muscle pain
- Fatigue
- Irritability

Medscape 2015

INSOMNIA TREATMENT:

The AASM suggests that treating comorbid conditions is priority.

The two common approaches to treatment are:

- Cognitive behavioral therapies
- Pharmacotherapy

Goals:

- Improve sleep quality/ quantity
- Improve daytime functioning

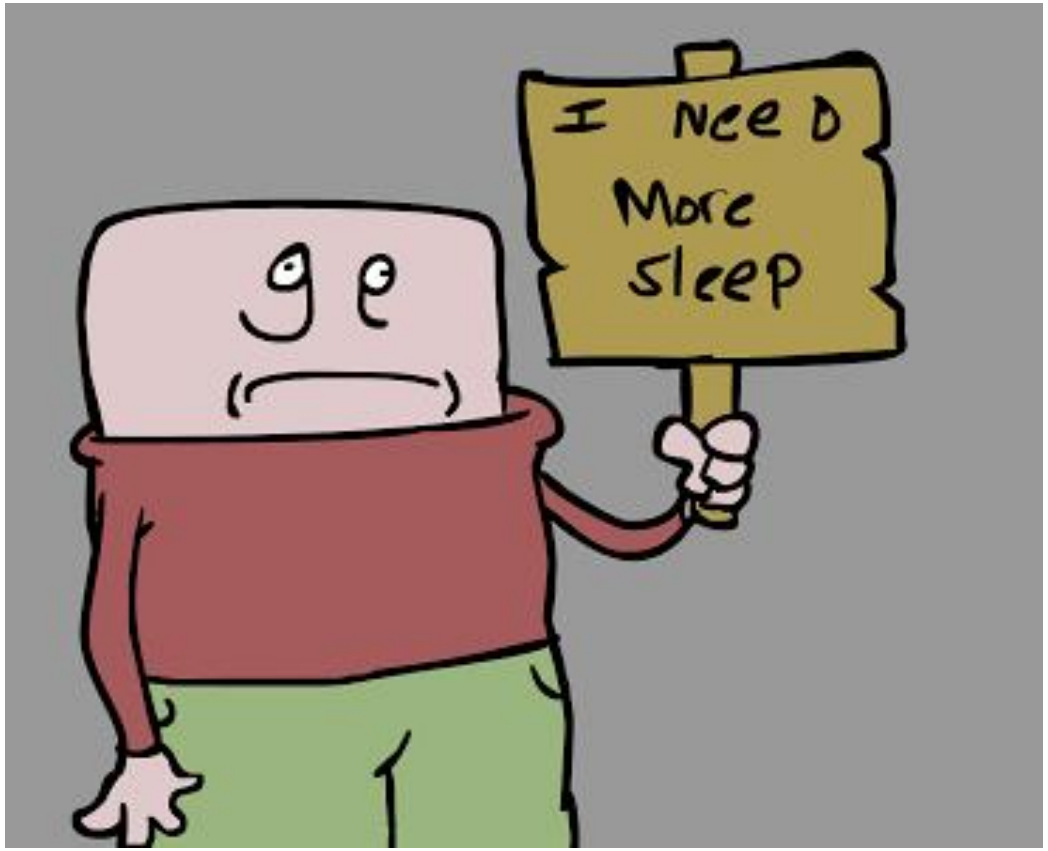
GOOD SLEEP HYGIENE

Appropriate sleep is important for physical and mental health and overall quality of life

Sleep hygiene is a variety of habits that are necessary to have nighttime sleep quality and daytime productivity

Goal is to get RESTORATIVE SLEEP

Deep sleep (N3) and REM are when we undergo most renewal- this is **restorative sleep**



Major restoration: tissue repair, muscle growth, protein synthesis, hormones that control metabolism, appetite regulation and stress response.

RESTORATIVE SLEEP

INSOMNIA TREATMENTS

COGNITIVE BEHAVIORAL THERAPIES (CBT)

Is a structured program that helps identify and replace thoughts and behaviors that cause or worsen sleep problems with habits that promote sound sleep

These changes can help overcome the underlying causes of your sleep problems

Regular exercise is helpful

Requires steady practice

Can also help CHRONIC PAIN and psychiatric disorders

CBT

Stimulus control therapy

This method helps remove factors that condition your mind to resist sleep

Sleep hygiene

This method of therapy involves changing basic lifestyle habits that influence sleep

CBT

Sleep restriction

Reduces the time you spend in bed

Sleep environment improvement

This offers ways that you can create a comfortable sleep environment

CBT

Relaxation training

This method helps you calm your mind and body

Biofeedback

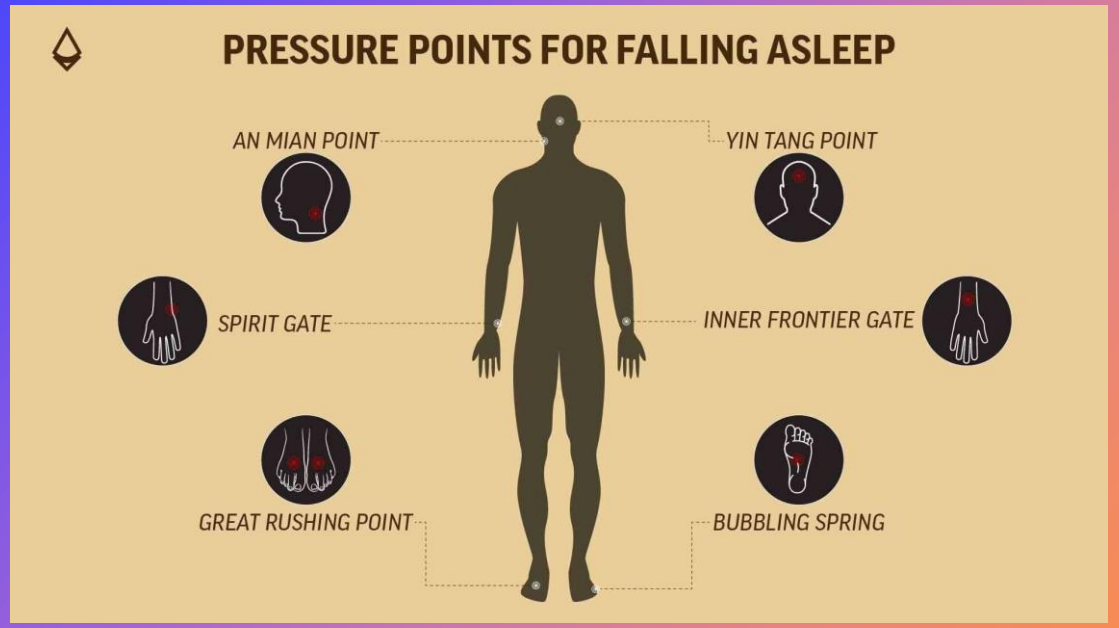
This method allows you to observe biological signs such as heart rate and muscle tension.

Remaining passively awake

“paradoxical intention” this involves avoiding any effort to fall asleep

ACUPRESSURE

- The body contains an interconnected network of vessels called meridians
- Meridians carry energy- qi
- Problems occur when there is too much, or little, qi flowing through a meridian
- Acupressure helps regulate the flow of qi
- Acupressure can slow heart rate and relieve muscle tension to promote sleep



ACUPRESSURE

Shenmen (HT7) “spirit gate”

inner wrist on 5th digit side

press thumb in circular motions 1-2 minutes each wrist

Anmian “peaceful sleep”

behind ear above base of skull

gentle circular pressure with index finger 2-3 minutes each side

Yin Tang “third eye”

between eyebrows above bridge of nose

gentle circular pressure with index finger 1-2 minutes (deep breathing)

Neiguan “inner gate”

inner wrist 3 finger widths below crease, between tendons

press thumb with firm pressure 1-2 minutes each side

ADULTS:

- Fix a bedtime and an awakening time
- Do not exceed 45 minutes of daytime sleep
- Avoid excessive alcohol ingestion 4 hours before bedtime. Do not smoke 4 hours before bedtime
- Avoid caffeine 6 hours before bedtime
- Avoid heavy, spicy, or sugary foods 4 hours before bedtime
- Exercise regularly, but not right before bed
- Use comfortable bedding
- Find a comfortable temperature setting
- Keep the room well ventilated
- Block out all distracting noise and eliminate as much light as possible
- Reserve the bed for sleep and sex
- Don’t use the bed as an office, workroom or recreation room

Harvard University

CHILDREN:
(BIRTH TO 12 YEARS)

- Go to bed at the same time every night, preferably before 9:00
- Have an age-appropriate nap schedule
- Establish a consistent bedtime routine
- Make your child's bedroom sleep conducive – cool, dark, and quiet
- Encourage your child to fall asleep independently
- Avoid bright light at bedtime and during the night, and increase light exposure in the morning
- Avoid heavy meals and vigorous exercise close to bedtime
- Keep all electronics, including televisions, computers, and cell phones, out of the bedroom and limit the use of electronics before bedtime
- Avoid caffeine, including many sodas, coffee, and teas
- Keep a regular daily schedule, including consistent mealtimes

Harvard University

PHARMACOTHERAPY

- Alcohol
- OTC remedies
- Benzodiazepine receptor agonists
- Orexin receptor antagonist
- Melatonin receptor agonist
- Anticonvulsants
- Antidepressants
- Muscle relaxers

Prior to the 20th century, this was the sleep aid!

20% of Americans use alcohol to sleep!

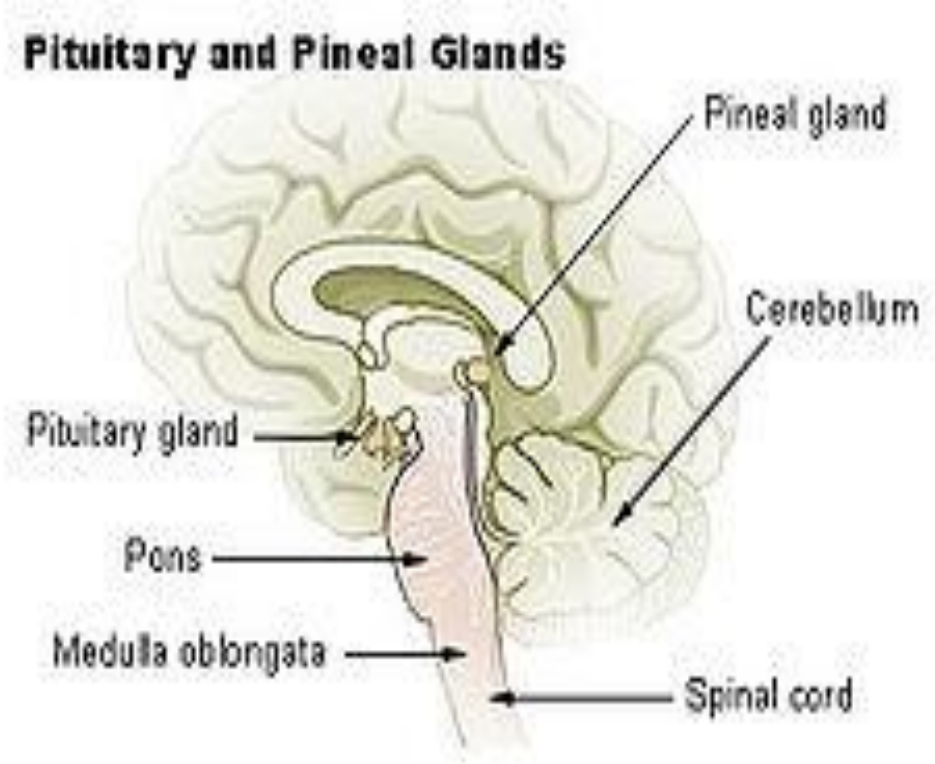
- Interrupts circadian rhythm
- Blocks REM sleep
- Aggravates breathing problems
- Frequent trips to the bathroom
- Can interact with medications

National Sleep Foundation

ALCOHOL

OTC REMEDIES

- Melatonin
- Valerian
- Antihistamines
- Chamomile
- Magnesium Glycinate



MELATONIN

- Hormone made by the pineal gland in the brain
- Controls your daily sleep-wake cycles
- Melatonin levels start to rise in the mid-to-late evening (sun set)
- Stays elevated for most of the night while it is dark
- Drops in the early morning as the sun rises, causing you to awaken

MELATONIN SUPPLEMENTS

- Many OTC brands
- Pill, liquid, chewable, or lozenge
- Doses ranging from1 to 10 mg
- Take a melatonin supplement 30 to 60 minutes before bedtime
- Good choice for the elderly

VALERIAN ROOT

- GABA receptor agonist
- 300- 600 mg 30 minutes to two hours before bedtime. Tea, soak 2- 3 grams of dried herbal valerian root in 1 cup of hot water for 10- 15 min
- Valerian root seems to work best after taking it regularly for two or more weeks
- Contains isovaltrate, which has been shown to be an adenosine agonist
- Should not be used with other depressants, such as ethanol, benzodiazepines, barbiturates, opiates, or antihistamine drugs
- Adult human hepatotoxicity has been associated with short-term use (i.e., a few days to several months) of herbal preparations containing valerian
- Withdrawal after long-term use has also been associated with benzodiazepine use

ANTIHISTAMINES

- Diphenhydramine HCL
- Tylenol PM, Advil PM, Benadryl, Sominex
- 25- 50 mg
- Side effects: (anticholinergic)
- dry mouth and throat, increased heart rate, pupil dilation, urinary retention, constipation, and, at high doses, hallucinations or delirium
- Contraindicated: narrow angle glaucoma, acute asthma

ANTIHISTAMINES

- Doxylamine Succinate
- Unisom, Select
- 25 mg
- Side effects: (anticholinergic)
- dry mouth, ataxia, urinary retention, drowsiness, memory problems, inability to concentrate, hallucinations, psychosis
- Contraindicated: narrow angle glaucoma, acute asthma

ANTIHISTAMINES

- Hydroxyzine (Vistaril, Atarax) 25-50 mg
- PRESCRIPTION
- Not for the elderly
- Side Effects:
- deep sleep, incoordination, sedation, calmness, dizziness hypotension, tinnitus, and headaches, dry mouth and constipation
- Contraindicated: narrow angle glaucoma, acute asthma

CHAMOMILE

- 400- 1600 mg
- 1-4 cups tea/ day
- In large doses can cause N/V
- Chamomile contains a small amount of coumarin, which may have mild blood thinning effects
- Stop using chamomile two weeks before surgery due to possible interactions with anesthesia

MAGNESIUM GLYCINATE

- Can promote sleep and reduce anxiety
- Stimulates the production and activity of the GABA neurotransmitter
- 100- 350 mg
- Can lead to diarrhea

BENZODIAZEPINES (BZD)

Bind to GABA

↓ sleep latency

↑ N2 sleep

↓ N3 & REM

- Used for DFA/ maintenance
- 1963: Chlordiazepoxide (Librium)
  Diazepam (Valium)

Triazolam (Halcion) 0.25-0.5 mg

Temazepam (Restoril) 15-30 mg

Estazolam (Prosom) 1-2 mg

(½ dose for elderly)

Flurazepam (Dalmane) 15-30 mg

Quazepam (Doral) 7.5-15 mg

(Not indicated for elderly)

Side Effects:

Drowsiness

Dizziness

Headache

Cognitive impairment

Amnesia

Psychosis

Nightmares

BZD

BZD

Patient Education

- No alcohol
- No opiates
- Can exacerbate depression/ SI
- Caution with heavy machinery
- Short term use only (7-14 days)
- Withdrawal sx when D/C'd abruptly

SEDATIVE HYPNOTICS
AKA NON- BENZODIAZEPINE RECEPTOR AGONISTS (NBRAS)

- Also binds to GABA
- Used for DFA/ maintenance
- Side effect profile similar to BZD
- Less tolerance and withdrawal sx
- 1992: zolpidem (87.5% of scripts!)

High incidence of **parasomnias**

NBRAS

Zolpidem (Ambien)

- 5-10 mg (elderly 5 mg)
- CR 6.25-12.5 mg
- SL 3.5 mg males, 1.75 mg females

Eszopiclone (Lunesta)

- 1-3 mg (elderly 1 mg)
- Zaleplon (Sonata)
- 5-10 mg (elderly 5 mg)

MELATONIN RECEPTOR AGONIST

Ramelteon (Rozerem) 8 mg

- Used for DFA
- Onset 30 minutes
- 3 weeks until full effect
- Efficacy up to 6 months
- High fat meal may reduce efficacy
- No dependence/ withdrawal

OREXIN RECEPTOR ANTAGONIST

Suvorexant (Belsomra) 10-20 mg

- Lemborexant (Dayvigo) 5 mg
- Daridorexant (Quviviq) 25-50 mg
- Used for DFA/ maintenance
- Take 30 minutes before bed for at least 7 hours sleep
- Efficacy to one year

<u>Side effects:</u>

- Daytime sedation
- Sleep paralysis
- Hypnagogic hallucinations
- Cataplexy
- Increased risk depression/ suicidal ideation

ANTIDEPRESSANTS

TCAs (tricyclic antidepressants)

- Amitriptyline (Elavil) 75- 150 mg
- Nortriptyline (Pamelor) 10- 100 mg
- Doxepin (Sinequan) 75- 150 mg
- “hangover” effects
- Linked to increased MVAs

SARI (serotonin antagonist reuptake inhibitor)

- Trazodone (Desyrel) 25- 300 mg
- May not be effective in those without depression
- Limited data on benefit > 1 week

ANTICONVULSANTS

Gabapentin (Neurontin, Gralisse)

- 1800 mg/day

Pregabalin (Lyrica)

- 150 mg/day

- Titrate up and down slow
- Side effects: drowsy, dizzy, nausea, peripheral edema, blurred vision, headache, dry mouth, weight gain, loss of balance

MUSCLE RELAXERS

Cyclobenzaprine (Flexeril, Amrix)

- Max 30 mg/ day

Tizanidine (Zanaflex)

- Max 36 mg/ day

Methocarbamol (Robaxin)

- Max 4500 mg/ day

Lioresal (Baclofen)*

- Max 80 mg/ day

Side effects:

- Dry mouth, blurred vision, sleepiness, loss of appetite, nausea, diarrhea, muscle weakness

TREATING A PAIN PATIENT WITH INSOMNIA

- Treat the pain!
- CBT first
- Opioids can exacerbate insomnia- AM dosing
- Avoid BZD due to OD risk
- Psychotherapy

BEWARE!

Analysis on data regarding cognition and sleep hours of 1800 people aged 27-85 (from Framingham Study)

People who slept > 9 hours a night had worse cognitive performance, especially with comorbid depression

Alzheimer's & Dementia, 2025

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THANK YOU!

Questions?