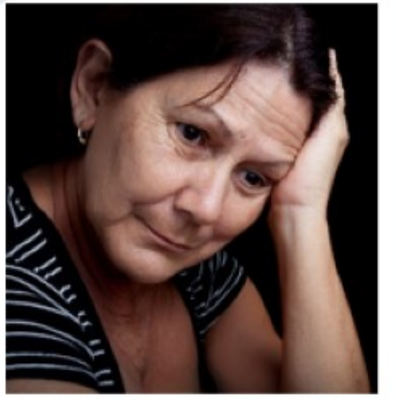
WHY THE BRAIN NEEDS SLEEP

Repair and maintain brain cells:
prune connections and remove toxins

Why we sleep.....

- Immune function
- Hormone regulation
- Clearing toxins from brain
- Mood regulation

Sleepless Patient



- 57-year-old woman with difficulty falling asleep and staying asleep for past 5 months
- Manager at a large grocery store
- Bedtime 10:30-11:00 PM; wake time 6:30 AM
- Typically takes 30 to 60 minutes to fall asleep, wakes up after 2 to 3 hours and either can't back to sleep or sleeps on and off for another 3 hours
- Sleep is light, easily disturbed
- Just can't seem to shut her mind down at bedtime
- She feels anxious, tired, irritable, and more stressed overall due to pandemic

Insomnia Disorder Diagnostic Criteria

- Insomnia disorder is characterized by difficulty falling asleep, staying asleep, or both, despite an adequate opportunity to sleep, which can lead to daytime consequences such as fatigue, difficulty concentrating, and irritability[a,b]

Diagnostic Criteria for Insomnia (DSM-5/ICSD-3)[c,d]

Symptoms + **Impairment** + **Chronicity**

Key Revisions From Earlier Criteria
• Chronicity and severity: 3-months duration criterion, with 3 times per week as the minimum frequency • Elimination of the distinction between "primary" and "secondary" insomnia diagnoses, recognizing the bi-directionality between insomnia and comorbid conditions

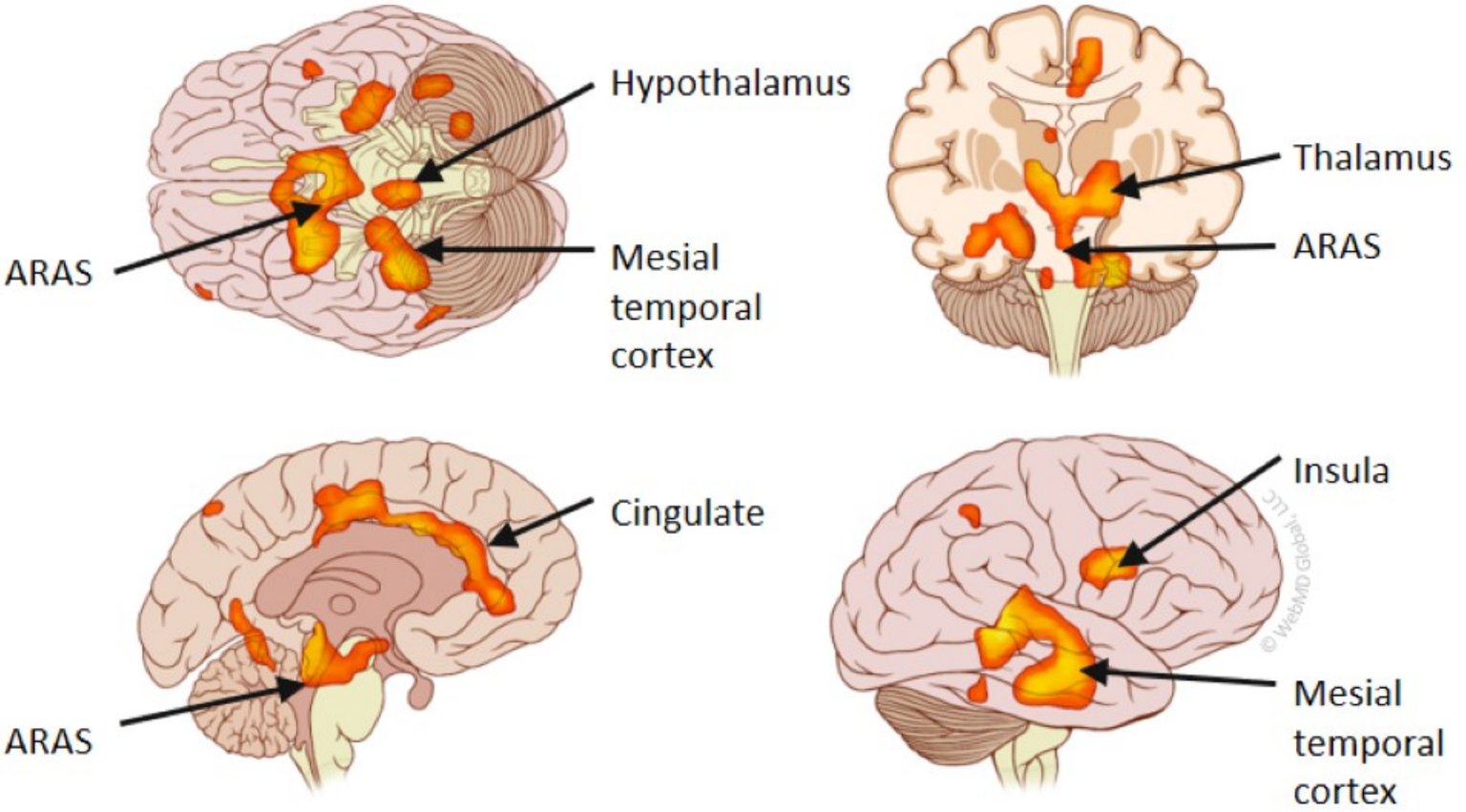
a. Institute of Medicine. Sleep Disorders. 2006; b. Ohayon MM, *Sleep Med Rev.* 2002;6:97-111; c. SAMHSA. DSM-IV to DSM-5. 2016; d. Sateia MJ. *Chest*. 2014;146:1387-1394.

Numerous Consequences of Insomnia

INSOMNIA[a]	• Major depression	• Interpersonal, social, occupational problems
	• Hypertension	• Reduced productivity
	• Myocardial infarction	• Reduced QoL
	• Cognitive impairment	• Increased economic burden
	• Substance use	• Absenteeism
OLDER ADULTS[b-e]	• Difficulty sustaining attention	**Predicts dementia**
	• Slowed response time	**Cardiometabolic disease**
	• Difficulty with memory	

a. Phyllis C. Zee, MD, PhD. Personal communication; b. Stone KL, et al. *J Am Geriatr Soc*. 2006;54:1177-1183; c. Stone KL, et al. *Arch Intern Med*. 2008;168:1768-1775; d. Robinson L, et al. *BMJ*. 2015;350:h3029; e. Shi L, et al. *Sleep Med Rev*. 2018;40:4-16.

Brain Activity Alteration in Patients With Insomnia

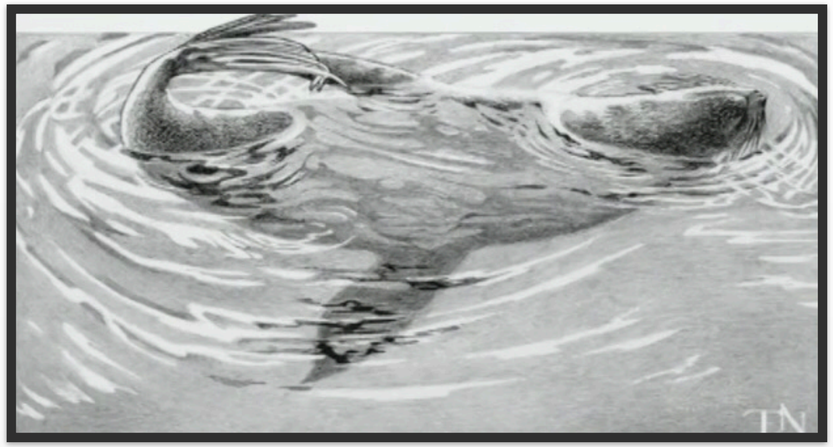


Neuroimaging (multimodal MRI) evaluated in an activation likelihood estimation meta-analysis found structural and functional deficits that could contribute to cognitive dysfunction[b]

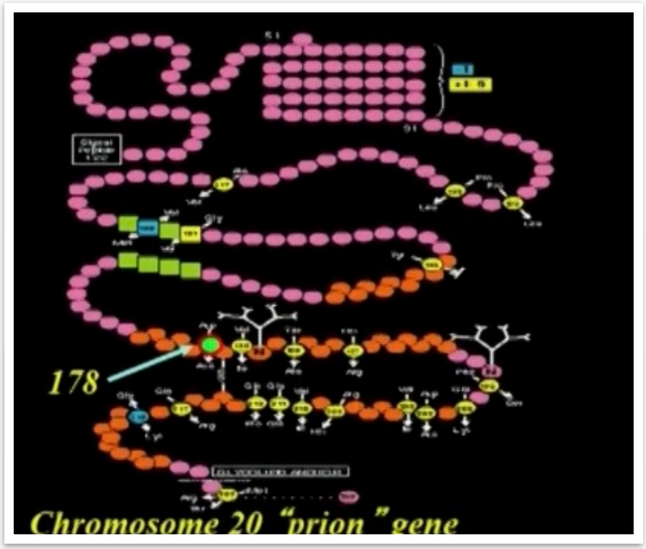
Insomnia is associated with increased risk of dementia and reduced white matter integrity[c]

a. Nofzinger EA, et al. *Am J Psychiatry*. 2004;161:2126-2129; b. Wu Y, et al. *Medicine* (Baltimore). 2020;99:e19151; c. Sexton CE, et al. *Neurosci Bull*. 2020;36:77-84.

Do we have to sleep?

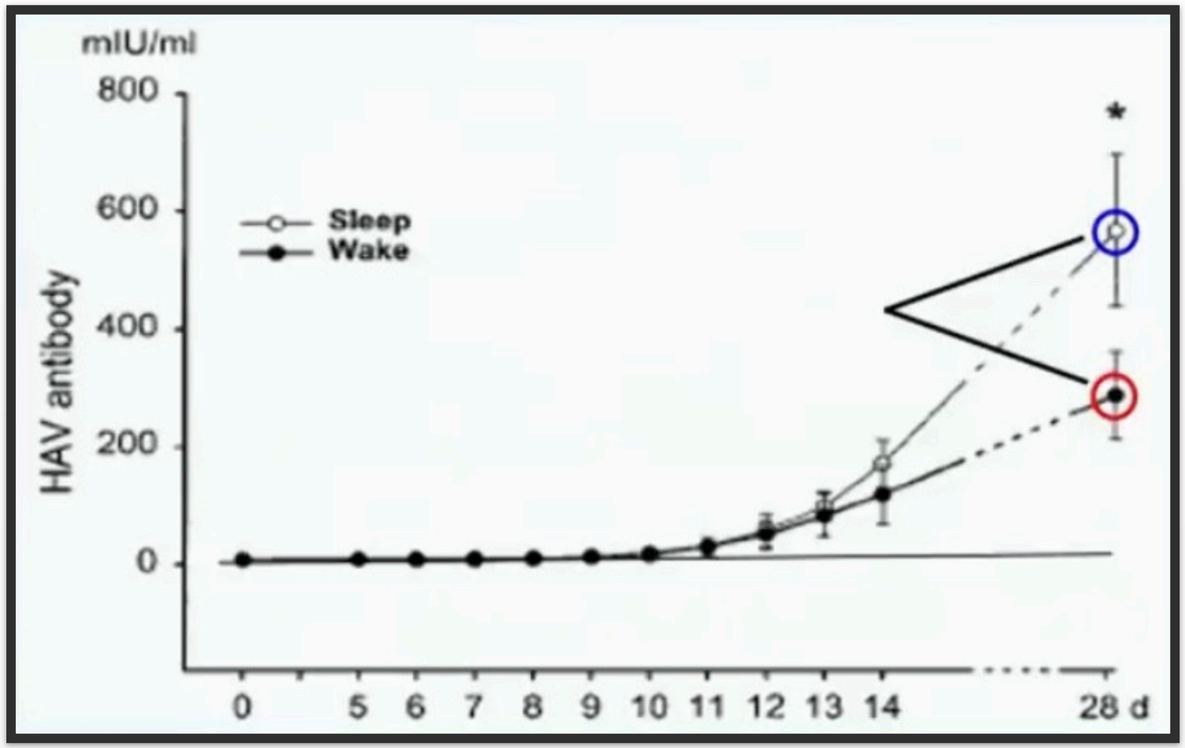


- Rats die without sleep
- Humans die without sleep (FFI)
- And some sleep by halves



Hepatitis vaccination

- One night of sleep deprivation after immunization



- After 4 weeks, antibodies in the blood are reduced 49%

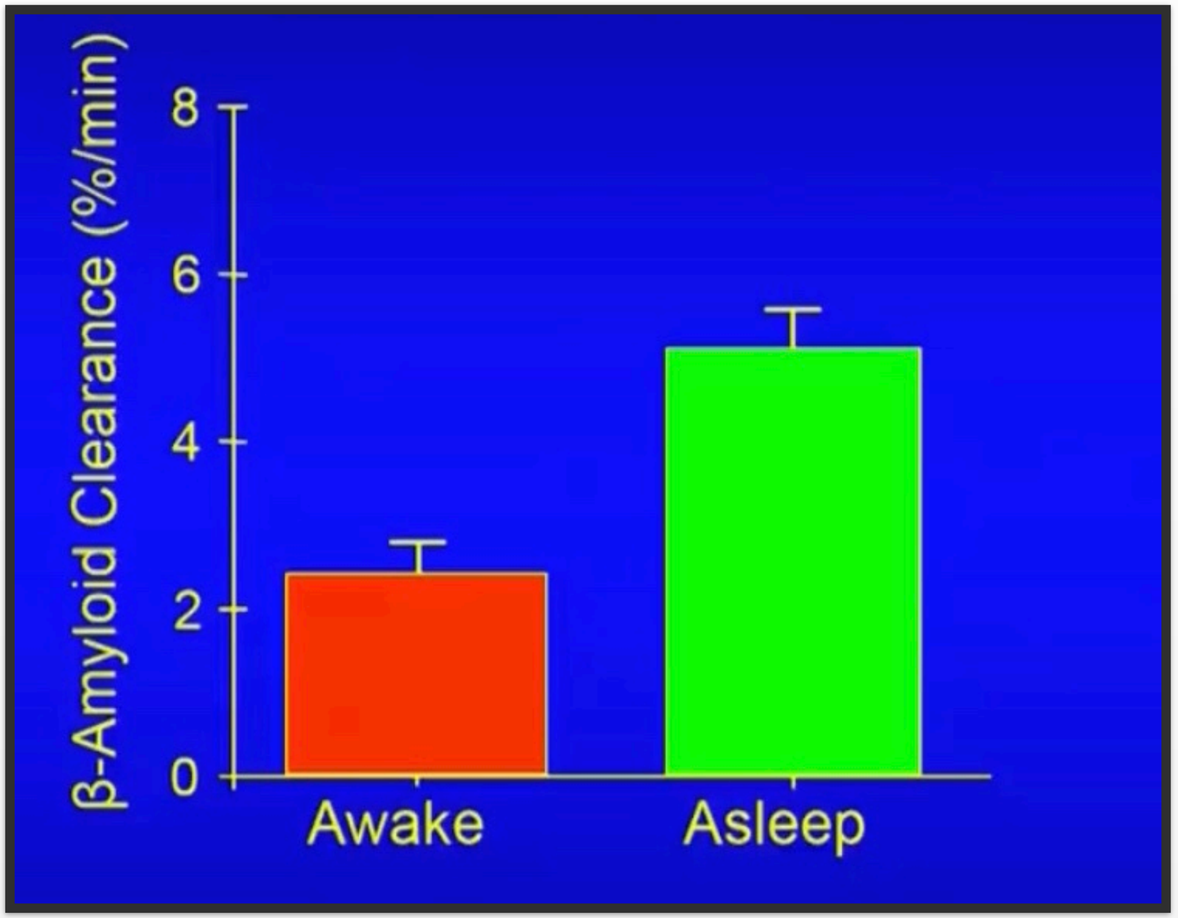
Lange et al. (2003) Psychosomatic Med 65:821;835

Insulin Regulation

- Sleep restricted to 4 hr (1-5AM) for 4 nights
- Glucose clearance rate down 40%
- Acute insulin response down 30%
- Subjects look like they have type 2 diabetes

Speigel et al. (1999) Lancet 354:1435-1439
Knutson et al. (2006) Arch Intern Med 166:1768-1774

Clearance of β-amyloid

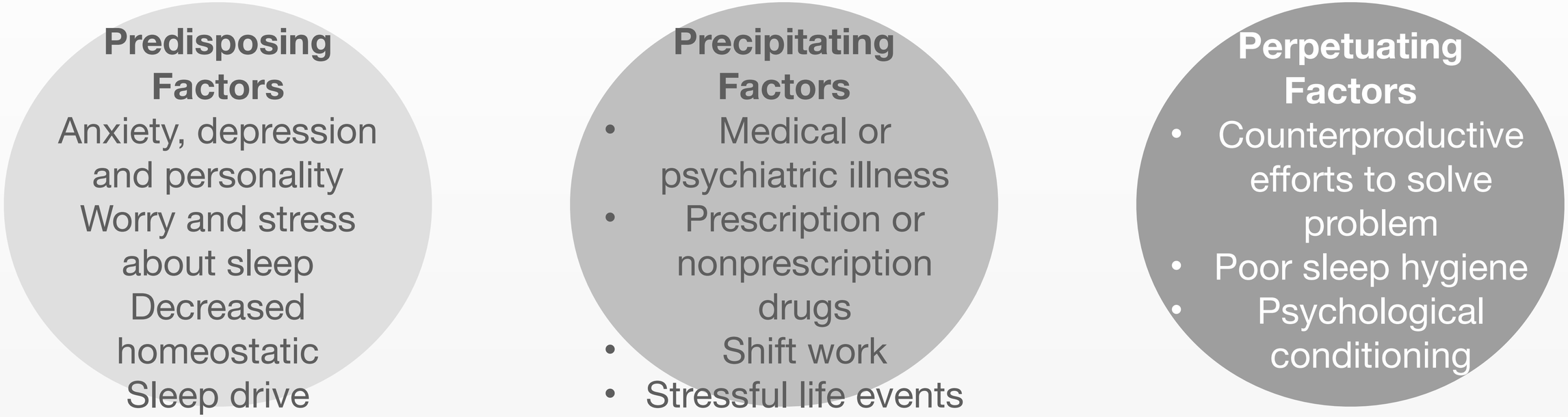


Xie et al. (2014) Science 342: 373-377

So you need sleep

- To maintain alertness and optimal cognitive functioning
- To optimize immune defenses
- To maintain hormonal regulation
- To prevent β-amyloid buildup
- To permit sleep-dependent learning and memory consolidation, and…

Spielman's Model of Insomnia: The Three P's



Spielman, A & Glovinsky, P (1991) The varied nature of insomnia in P J Hauri (Ed.), Case studies in insomnia (pp 1-15) New York Plenum Press

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CBT-I components

- Sleep Education (2-process model of sleep regulation; 3-p's model of insomnia)
- Sleep restriction (reduce time spent awake in bed and regularize sleep schedule)
- Stimulus control (eliminate association between bedroom and arousal)
- Sleep hygiene (correct behavioral/lifestyle factors impacting sleep quality)
- Cognitive therapy (correct inaccurate or maladaptive beliefs about sleep)
- Relaxation therapy (optional)

Chesson Jr., Anderson WM, Littner M, et al ASSM standards of practice committee. Sleep 1999,22 1-6

Patients who should get CBT-I

- Patients with insomnia problems
- For more than 3 months
- That impacts functioning or causes worry/distress

- Patients who are interested in an approach other than medications
- Patients may be using sleeping pills and still get CBT-I

- Patients with comorbid conditions that may be exacerbated by poor sleep

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Clinical guidelines for treatment of Chronic Insomnia

- Psychological and behavioral interventions are effective and recommended in the treatment of chronic insomnia
- These treatments are effective for adults of all ages
- These treatments should be utilized as an initial intervention when appropriate and conditions permit.

Schutte-Rodin, et al. Clinical guideline for the evaluation and management of chronic insomnia in the adult. JCSD 2008, 4(5): 487-504

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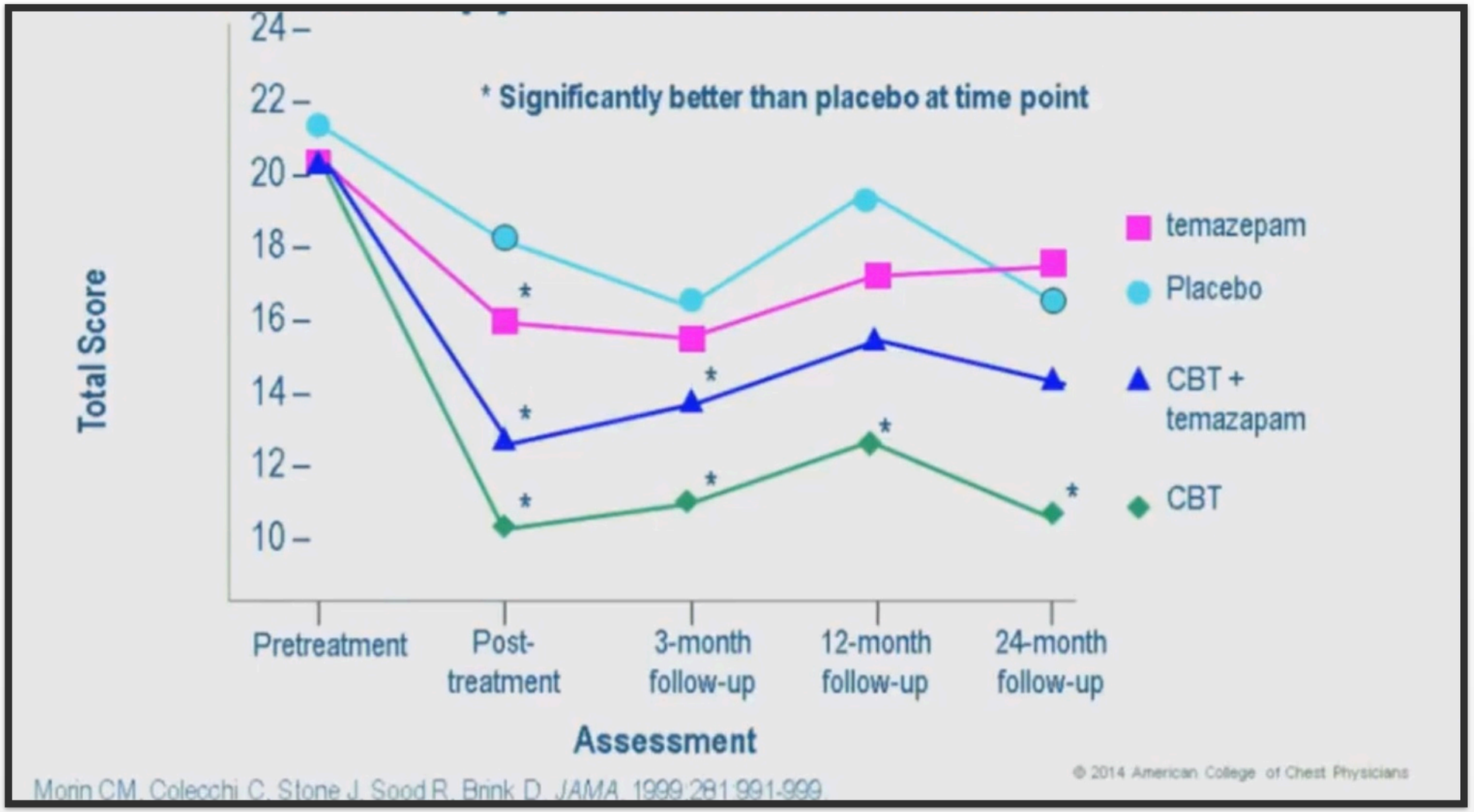
Cognitive Behavioral Therapy vs. Pharmacotherapy for insomnia in older adults



Sleep Restriction

- Particularly effective for patients spending too much time in bed
- Improves sleep continuity by limiting time spent in bed to match reported time asleep
- Increases sleep drive (homeostat) via sleep deprivation
- Total sleep time determined from sleep diaries
- Useful for both sleep onset and sleep maintenance problems

Spielman AJ, Saskin P. Thorpy MJ Sleep 1987, 10 45-46, Morin CM. J Clin Psychiatry 2004, 65(suppl 16) 33-40

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Time in Bed (Sleep Restriction)

- *IT'S ALL ABOUT SLEEP EFFICIENCY*
- Normal sleep efficiency is 90-95% in adult populations
- Average sleep efficiency seen in sleep clinics: 70%
- No one ever sleeps 100% of the time
- Goal is 85%+
- Calculate sleep efficiency (from sleep diary):
- Time asleep/Time in bed
- Time asleep = time in bed – (time to fall asleep + time awake at night)

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Sleep Restriction: Procedures

- Determine patient's current, subjective total sleep time using sleep diaries and history
- Establish a fixed wake up time
- Can be negotiated with the patient
- Working backwards from the desired wake time, determine patient's bedtime
- No sleep is permitted outside of this "window"
- Sleep efficiency is monitored, and bedtime is adjusted accordingly

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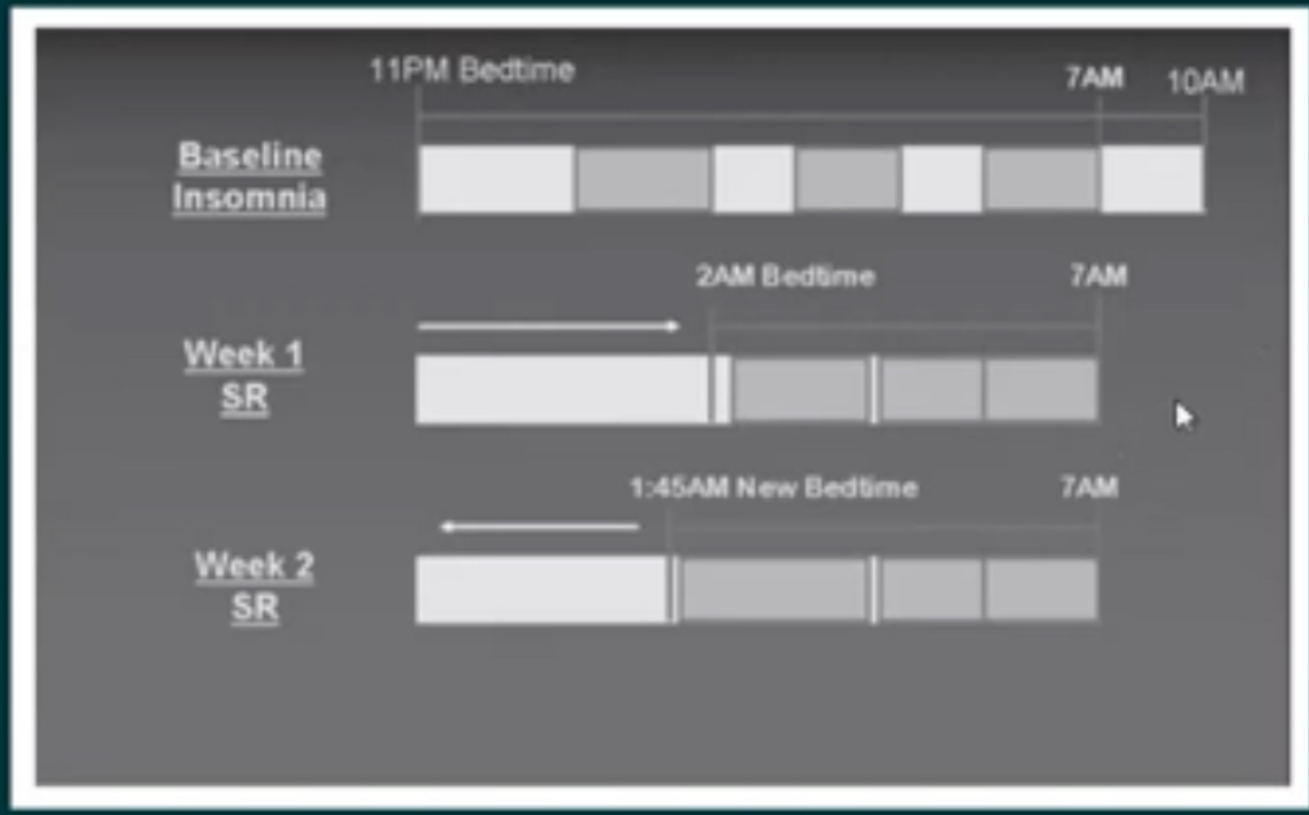
Sleep Restriction



White boxes: wake

Dark boxes: sleep

Figure from Perlis et al. Cognitive Behavioral Treatment of Insomnia: A Session-by-Session Guide. 2005

	Time in Bed	Fall asleep	Wake	Time Out of Bed
Mon	10 pm	11:30	3:30	7:00
Tues				
Wed				
Thurs				
Fri:				

TIB	TST
9	4
10	6
8	7
14	12
6	2
47	31
/5	/5
9.4	6.2

$6.2/9.4 = 66\%$

$+ 80\%$

Bed - 1 am!

Wake 7 am

Titrate Time in Bed (Sleep Restriction)

- Sleep efficiency <85% ↓ TIB by 15 minutes
- Sleep efficiency >90% ↑ TIB by 15 minutes
- Otherwise, keep TIB the same for another week

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Stimulus Control

- Considered one of the most effective behavioral treatments
- Useful for both sleep onset and sleep maintenance problems
- Based on the behavioral principle of classical conditioning
- Insomnia leads to stress, anxiety, wakefulness
- This takes place in bed
- The bed comes associated with stress, anxiety, wakefulness

Chesson AL, Anderson WM, Littner M, et al ASSM standards of practice committee. Sleep 1999, 22:1-6

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Stimulus Control

Stimulus control attempts to:

↓ Conditioned arousal:
Break the pairing of bed with being awake

↑ Conditioned sleepiness:
Strengthen the pairing of bed with sleep and falling asleep quickly
… and this may take time

Stimulus Control: Typical instructions

- Fixed morning rise time, 7 days a week, regardless of how much sleep during the night
- The bed is only for sleep (and sex)
- Sleep only in bed (no couch napping)
- Go to bed only when sleepy
- Leave the bedroom if awake for > about 20 minutes

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Stimulus Control: Typical instructions

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What this really means is leave the bed when you start getting tense and anxious about not sleeping.

- No clock watching
- Return to bed only when sleepy
- Do not nap during that day

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Stimulus Control

GOOD STIMULUS CONTROL

ODDS 1 IN 2

BEDROOM
BEDTIME

SEX

SLEEP

STIMULUS DYSCONTROL

ODDS 1 IN 8

EAT IN BED

READ IN BED

WATCH TV IN BED

BEDROOM
BEDTIME

SEX

SLEEP

WORK IN BED

WORRY IN BED

CLEAN BEDROOM

Courtesy of Sean Drummond, PhD

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Stimulus Control: What to do when you get up?

- Assume you will be up all night...this helps reduce anxiety about not sleeping
- Partake in quiet and sedentary activities
- Do not cook a full meal for the next day!
- Do not do something where you lose track of time
- Don’t get too comfortable
- Do not give yourself too much light
- Go back to bed when you cannot stay up any longer
- You only want to sleep in bed

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Sleep hygiene is…

- Education about behaviors, environmental conditions,

And other factors that may interfere with sleep

- Important to query as part of a sleep history
- Rule out specific behavioral or environmental causes of poor sleep
- Identify issues to target during comprehensive treatment

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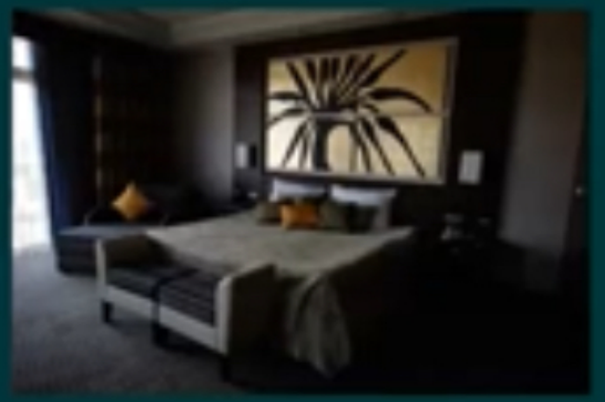
Sleep hygiene

- Cut down on caffeine
- Don’t go to bed hungry
- Avoid moderate to heavy alcohol use in the late evening
- Avoid excessive liquids in the evening
- Avoid smoking before bed or during the night
- Exercise regularly
- Make sure bedroom is quiet (except perhaps for some white noise), very dark, and comfortable in terms of mattress, pillows and temperature
- Electronic devices? Blue light?

Sleep Hygiene



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- Electronic devices? Blue light?

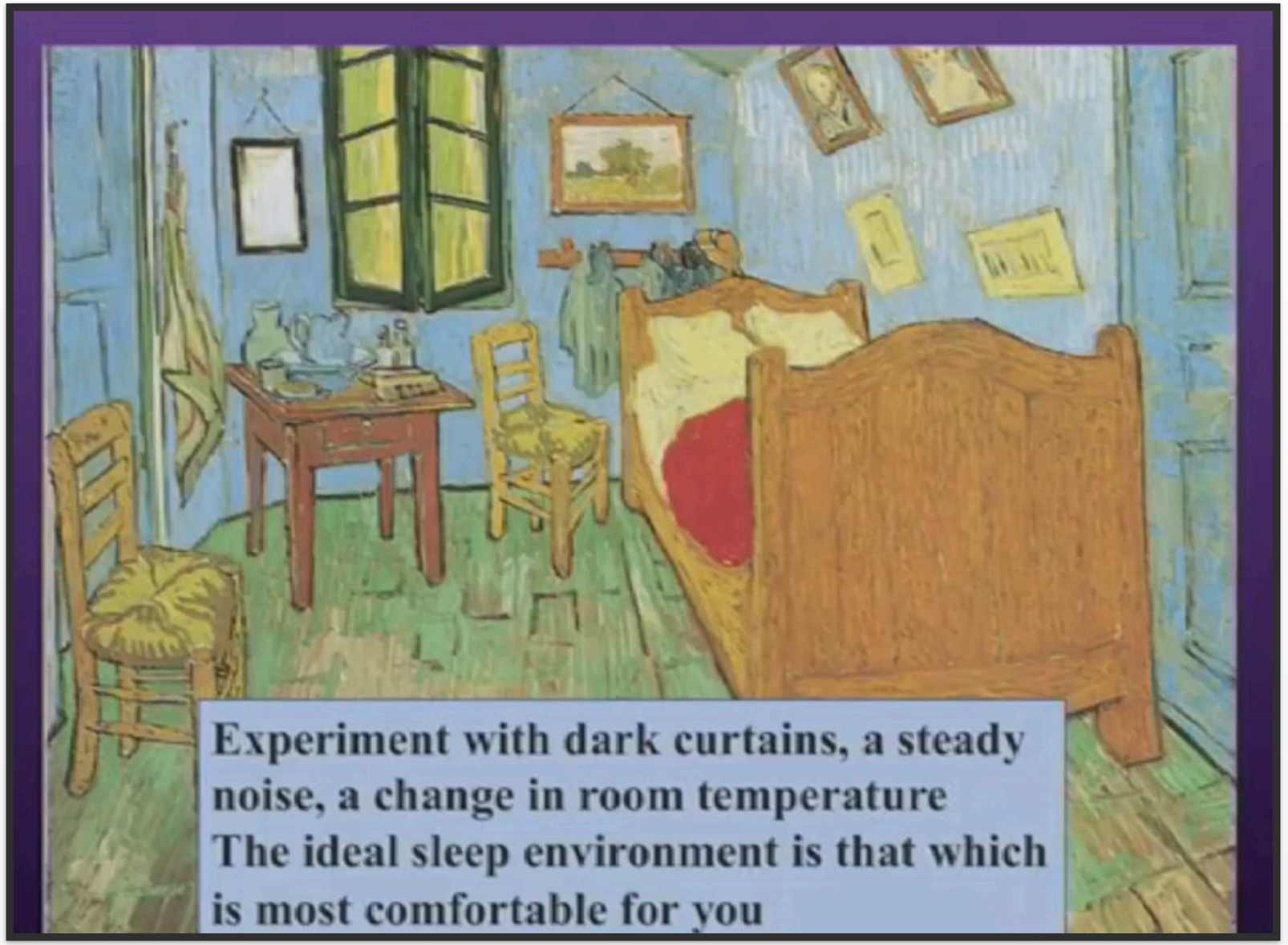
Posner & Gehrman. Sleep Hygiene in Perlis et al. Behavioral Treatments for Sleep Disorders. 2011, 31-43.

Sleep hygiene rules

Rule	Rationale
Reduce time in bed	Excessive time in bed can lead to fragmentation of sleep
Keep a regular sleep schedule (especially wake up time)	Stabilization of circadian rhythms; limits time in bed (rule 1)
Eliminate the bedroom clock	Watching the clock can lead to rumination and worry
Exercise in the afternoon/early evening	May deepen sleep and if timed correctly, may shorten sleep onset
Avoid caffeine, nicotine and alcohol	All can negatively impact sleep. Caffeine and nicotine are stimulants. Metabolism of alcohol disrupts sleep

Sleep hygiene rules

Rule	Rationale
Eat a light bedtime snack	Avoids awakenings from drop in blood sugar at night
Sleep in a quiet, dark bedroom	Noise and light cause awakenings. Light impacts circadian rhythms
Enhance sleep environment	Comfortable temperature, good mattress
Avoid trying to sleep	Reduces development of anxiety/ worry about sleeplessness
Limit/avoid napping	Napping reduces nighttime sleepiness


Experiment with dark curtains, a steady noise, a change in room temperature
The ideal sleep environment is that which is most comfortable for you

Worry time

During the day

- Schedule a worry time
- Find specific place to worry
- Set an appointment
- DO something about the worry
- Move on when the issue doesn’t bother you anymore

At night

- Remind yourself you will have no “time to worry about these things tomorrow” (during worry time)
- Once solutions have been generated, the worry will come up less often when you are in bed at night

Teaching sleep hygiene

- In a rare cases, a clear sleep hygiene issue arises ....I'll die before I give up my coffee. It's all I drink"
- Patients with chronic insomnia often have a poor sleep hygiene
- Correcting these problems is typically insufficient
- Effective sleep hygiene intervention:
- Identify 1-2 issues that are particularly slient
- Ask patient to maintain change for >2 weeks
- Keep a diary to track progress
- Follow up to assess effectiveness

Brief behavioral treatment of insomnia (BBTI): How to do it? Four steps

1. Reduce your time in bed
2. Don’t go to bed unless you are sleepy
3. Don’t stay in bed unless you are asleep
4. Get up at the same time every day of the week, no matter how much you slept the night before

Cognitive Therapy

- Challenge dysfunctional beliefs about sleep
- **“I must sleep 8 hours**

- Correct unrealistic expectations
- **“I should never wake up at night**

- Reconsider insomnia consequences
- **“ I can’t function without 8 hours of sleep”**

Sleep related anxiety

- I can't function on less than 8 hours of sleep.
- I shouldn't wake up in the middle of the night.
- If I'm tired, I should go to bed earlier/spend more time in bed.
- Chronic insomnia is going to harm me.
- I'll have to cancel my plans.
- If I can't sleep, it will ruin my day.

Relapse Prevention

- Relapse is NOT one bad night
- A return of insomnia may be a sign of another psychological distress
- Insomnia may be prodromal symptom
- **Ex.: depression, alcohol abuse relapse**
- If insomnia returns, “restrict and control”
- Aim for 5/7 good nights

A night of insomnia isn’t the end of the world…

Summary of key points – The bottom line

1. Sleep is controlled by both the sleep drive (Homeostat) and by circadian rhythms.
2. The 3-P model suggests that predisposing, precipitating and perpetuating factors determine insomnia; CBT-I targets the perpetuating factors
3. CBT-I should be the first line of treatment of chronic insomnia
4. Stimulus control and sleep restrictive therapy are effective without any cognitive component
5. Sleep hygiene is not an effective stand-alone treatment