

Sleep Diagnostic Tools-A Review

Kentucky Sleep Society

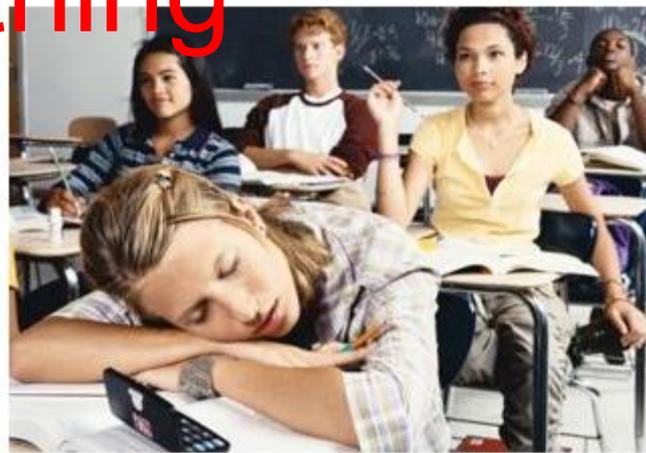
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Objectives

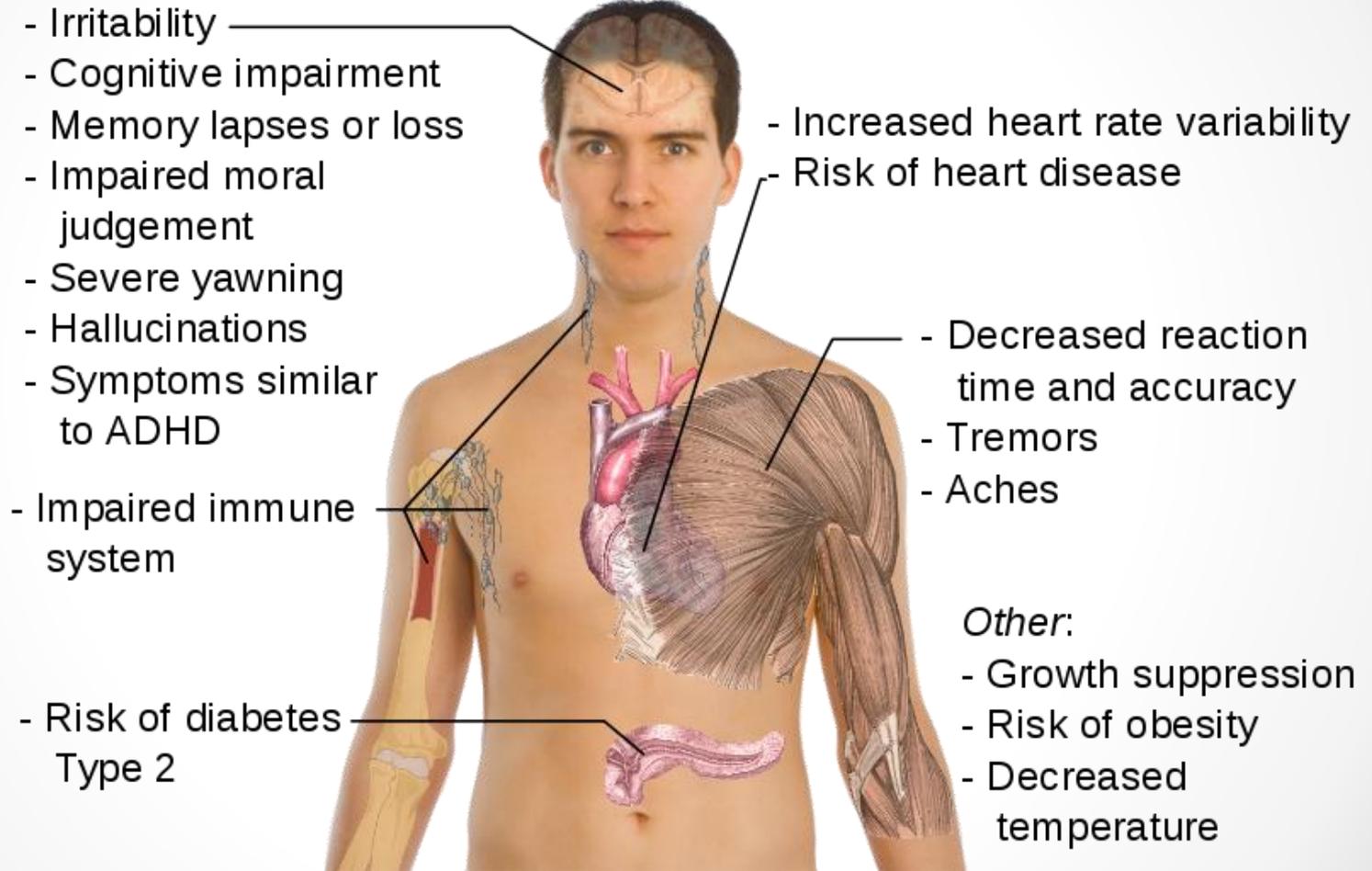
- Describe the most often used sleep questionnaires
- Discuss the limitation of the types of sleep evaluation
- Explain a polysomnogram

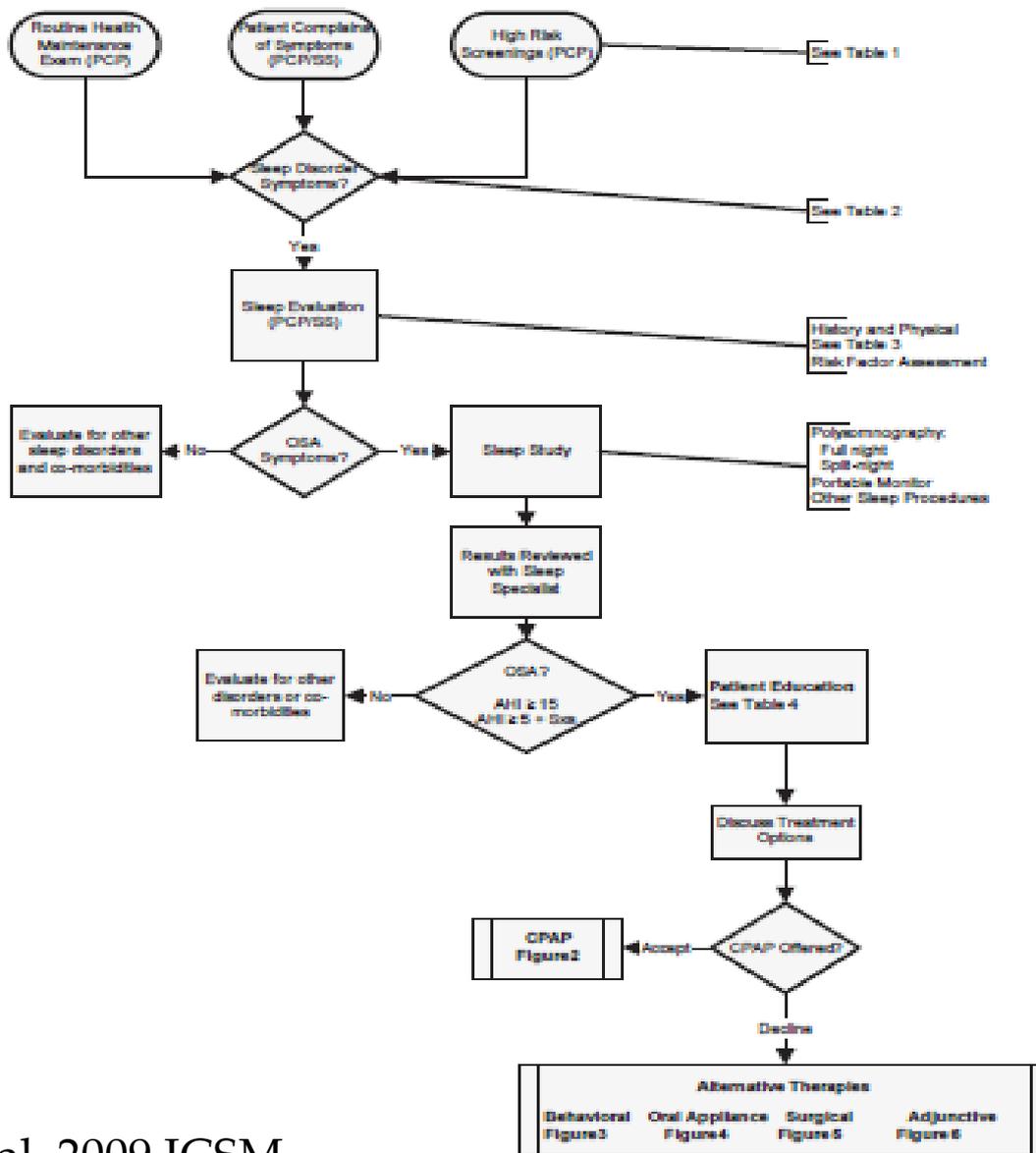


Sleepiness is not a
very good thing



Effects of Sleep deprivation





Epstein, et al. 2009 JCSM

Diagnostic Options

- Sleep Diary
- Questionnaires
 - A good “first line” option
 - Do not have adequate sensitivity and specificity
 - Many different questionnaires available
 - Epworth Sleepiness Scale
 - Berlin Sleep Questionnaire
 - Sleep Habits Questionnaire
 - Children's sleep habits Questionnaire
 - STOP/STOP BANG
 - Etc.....

Which is the right one?

Most Commonly Used for OSA

- Epworth Sleepiness Scale (not specific)
- STOP/STOP-Bang
- Berlin

ESS

EPWORTH SLEEPINESS SCALE				
DIRECTIONS: Please rate the chance that you would doze off or fall asleep during different routine situation. Answers to the questions are rated from 0 to 3, with 0 meaning you would never doze or fall asleep in a given situation, and 3 meaning that there is a very high likelihood that you would doze or fall asleep in that situation.				
Situation	Chances that you would doze off or fall asleep during			
	0	1	2	3
Sitting and reading				
Watching television				
Sitting inactive in a public place, for example, a theatre or meeting				
As a passenger in a car for an hour without a break				
Lying down to rest in the afternoon				
Sitting and talking to someone				
Sitting quietly after lunch (when you've had no alcohol)				
In a car, while stopped in traffic				
Total				
Add each value from the totals for a combined total score				

STOP/STOP-BANG

S (Snoring)

Do you snore loudly (louder than talking or loud enough to be heard through closed doors?)

YES NO

T (Tired)

Do you often feel tired, fatigued, or sleepy during the daytime?

YES NO

O (Observed)

Has anyone observed you stop breathing during your sleep?

YES NO

P (Blood Pressure)

Do you have or are you being treated for high blood pressure?

YES NO

B (BMI)

BMI more than 35 kg/m²?

YES NO

A (Age)

Age over 50 year old?

YES NO

N (Neck Circumference)

Neck circumference greater than 40 cm (16 in)?

YES NO

G (Gender)

Gender male?

YES NO

BERLIN

Berlin Questionnaire - Sleep Evaluation

Complete the following:

Height: _____ Weight: _____

Age: _____ Gender: ____M ____F

1. Do you snore?

- Yes
 No
 Don't know

If you snore:

2. Your snoring is...

- Slightly louder than breathing
 As loud as talking
 Louder than talking
 Very loud

3. How often do you snore?

- Almost every day**
 3-4 times a week
 1-2 times a week
 never or almost never

4. Has your snoring ever bothered other people?

- Yes
 No

5. Has anyone noticed that you quit breathing during your sleep?

- Almost every day.**
 3-4 times a week
 1-2 times a week
 never or almost never

6. Are you tired after sleeping?

- Almost every day**
 3-4 times a week
 1-2 times a week
 never or almost never

7. Are you tired during waketime?

- Almost every day**
 3-4 times a week
 1-2 times a week
 never or almost never

8. Have you ever nodded off or fallen asleep while driving a vehicle?

- Yes
 No
 If yes, how often does it occur?
 Almost every day.
 3-4 times a week
 1-2 times a week
 1-2 times a month
 never or almost never

9. Do you have high blood pressure?

- Yes
 No
 Don't know

10. BMI (Body mass index) = _____

$$\text{BMI} = \frac{\text{Weight in Pounds} \times 703}{\text{Height in inches}^2}$$

Comparison of Questionnaires to PSG

- Compared Berlin, Sleep Apnea Clinical Score to in lab and level 3 portable testing
- N=128
- PSG threshold of AHI 10

Questionnaire	Sensitivity	Specificity
Berlin	88	25
SACS	33	75
Stop Bang	90	25

- Conclusions: Questionnaires alone (reliance on sleepiness alone) cannot reliably rule out the presence of OSA; objective measurement is critical

Comparison of 4 sleep questionnaires

- Cross sectional study
- n=234
- Berlin, ESS, Stop and Stop Bang compared to PSG
- OSA was found in 87%

• Ev

Questionnaire	Sensitivity	Specificity
ESS	75	48
Berlin	95	7
Stop	94	25
Stop Bang	97	3

re)

Comparison of 4 sleep questionnaires

- Cross sectional study
- n=234
- Berlin, ESS, Stop and Stop Bang compared to PSG
- OSA found in 87%
- Evaluated various cut offs (severe)

Questionnaire	Sensitivity	Specificity
ESS	79	46
Berlin	97	10
Stop	95	19
Stop Bang	98	5

Conclusions

Questionnaires were able to identify high risk patients for OSA, but did not accurately exclude those at low risk

Most Commonly Used for Insomnia

- Pittsburgh Sleep Quality Index
- Insomnia Severity Index
- Sleep Wake Inventory

Assess Outcomes

- Functional Outcomes of Sleep Questionnaire
- MOS Sleep Questionnaire
- General
 - SF 36/SF-12

Most Commonly Used for Restless Legs/WED

Restless legs syndrome rating scale



Diagnostic Options

- Full in lab polysomnogram aka “gold standard”
 - Requires attendance by a technologist, consists of
 - EEG, EOG, EMG, Resp (flow/effort), SpO2 ++
 - More comprehensive data
 - Expensive
 - May not be available
 - Some patients do not like to sleep in the sleep lab

What is a sleep study?



WatchPAT
Home Sleep Testing



Polysomnography

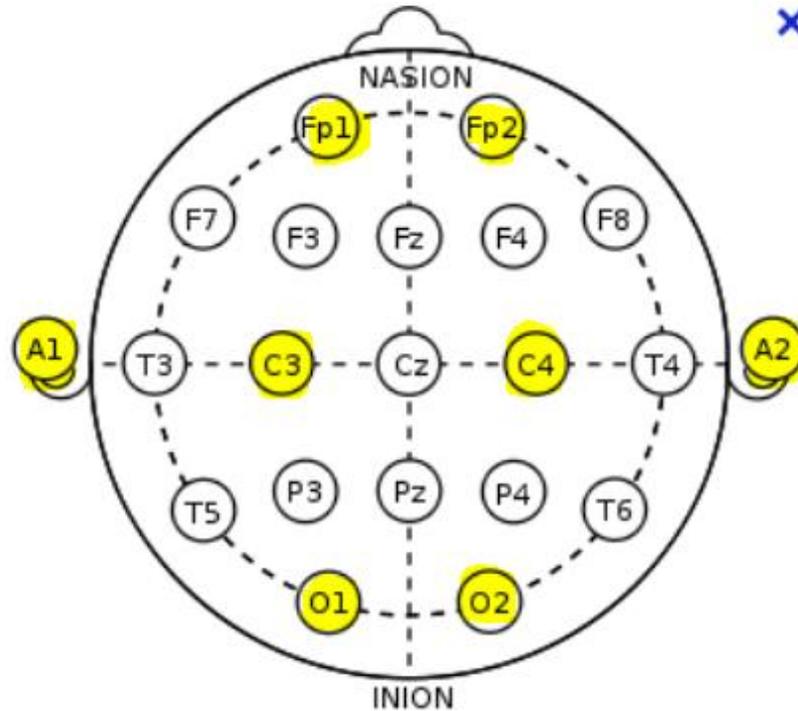
- Gold Standard for assessment of sleep related breathing disorders
- Typically not recommended for insomnia, RLS
- May be used for parasomnias
- Used in conjunction with MSQ for Narcolepsy
- PAP titration
- Evaluation of treatment
- Weight gain



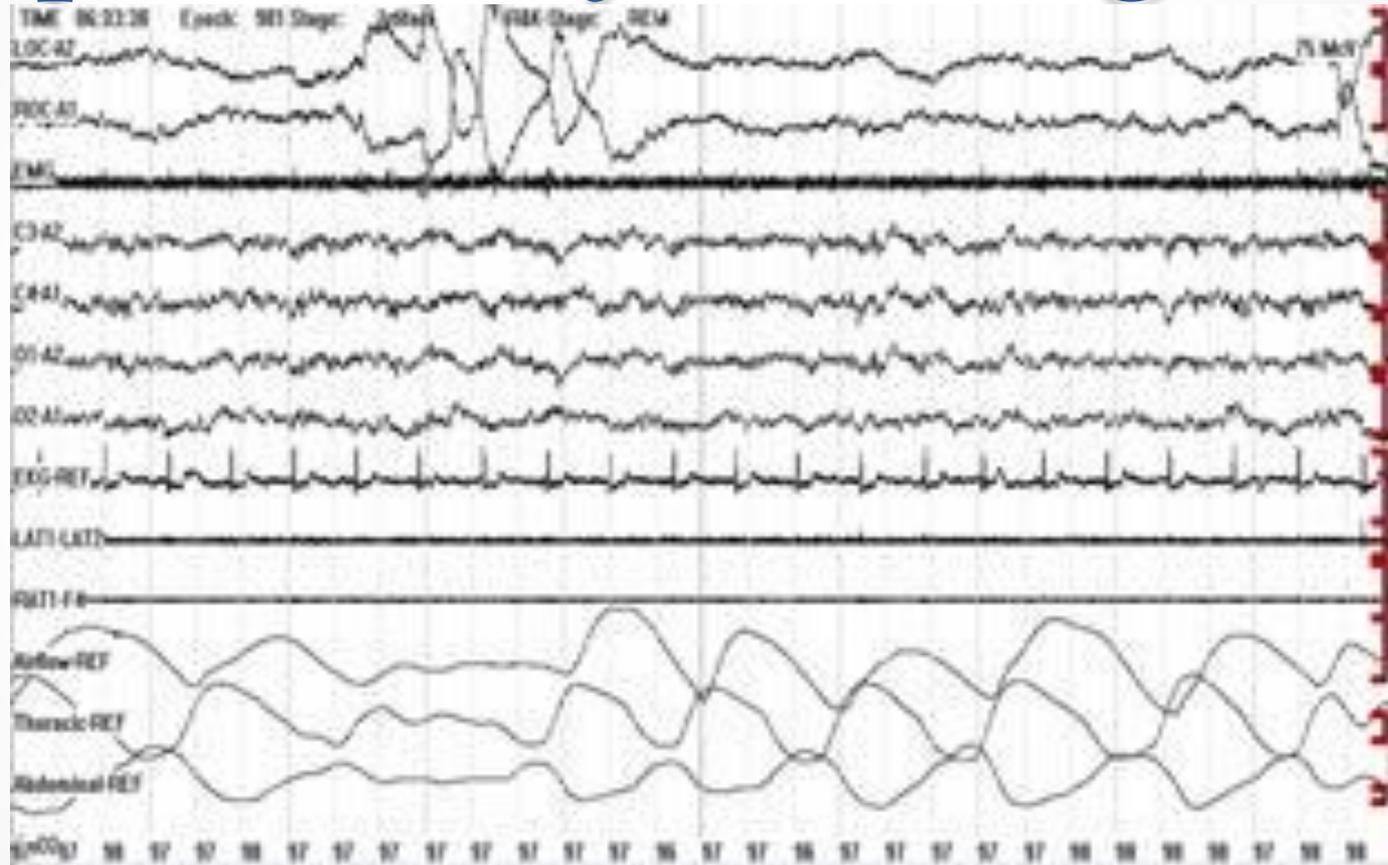
Polysomnogram

- Multi channel monitoring of various physiologic parameters
 - EEG
 - Standard for assessment of sleep (frontal, central and occipital leads)
 - Extend leads to assess for seizure activity
 - EOG
 - EMG
 - Respiratory
 - Oxygenation status via pulse oximetry
 - Capnography
 - Respiratory Effort
 - Airflow via pressure transducers and nasal thermistor
 - Limb EMG
 - Flexible Tool

International 10/20 System



Typical Polysomnogram



Home Sleep APNEA Testing

- Widely available
- Many different types
 - Single channel (Oxi
 - 2-3 channels
 - >3 channels



- Insurers/Sleep Benefits Management companies may leave the clinician with no option



JCSM Guidelines

Technology Used in Portable Monitoring

1. Oximetry
2. Respiratory monitoring, including but not limited to:
 - a. Effort
 - b. Airflow
 - c. Snoring
 - d. End-tidal CO₂
 - e. Esophageal pressure
3. Cardiac monitoring, including but not limited to:
 - a. Heart rate or heart rate variability
 - b. Arterial tonometry
4. Measures of sleep wake activity, including but not limited to:
 - a. Electroencephalography
 - b. Actigraphy
5. Body position
6. Other

Suitability

- High pre-test probability of obstructive sleep apnea
- Unable to have access to a sleep

1. Indications for Portable Monitoring

1.1. PM FOR THE DIAGNOSIS OF OSA SHOULD BE PERFORMED ONLY IN CONJUNCTION WITH A COMPREHENSIVE SLEEP EVALUATION. CLINICAL SLEEP EVALUATIONS USING PM MUST BE SUPERVISED BY A PRACTITIONER WITH BOARD CERTIFICATION IN SLEEP MEDICINE OR AN INDIVIDUAL WHO FULFILLS THE ELIGIBILITY CRITERIA FOR THE SLEEP MEDICINE CERTIFICATION EXAMINATION. IN THE ABSENCE OF A COMPREHENSIVE SLEEP EVALUATION, THERE IS NO INDICATION FOR THE USE OF PM.



Not Indicated JCSM 2007

1.2.1. PM is not appropriate for the diagnosis of OSA in patients with significant comorbid medical conditions that may degrade the accuracy of PM, including, but not limited to, moderate to severe pulmonary disease, neuromuscular disease, or congestive heart failure.

1.2.2. PM is not appropriate for the diagnostic evaluation of OSA in patients suspected of having other sleep disorders, including central sleep apnea, periodic limb movement disorder (PLMD), insomnia, parasomnias, circadian rhythm disorders, or narcolepsy.

1.2.3. PM is not appropriate for general screening of asymptomatic populations:

Limitations

- Lack of objective sleep
- Fewer respiratory parameters/little to no flexibility
- Leads may fall off, data loss
- Patient may not understand how to apply or what to do
- Potential loss of equipment
- Negative test may not be negative, need to potentially repeat study in lab
- Personal Experience: Autoscoring may not be accurate

Other

- Actigraphy
 - Useful in insomnia
 - Hypersomnia
 - Used in conjunction with Diary's

Subjective Estimates

COMPLETE IMMEDIATELY **PRIOR TO BED** REGARDING HOW YOU FELT TODAY:

	Sample	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7		Avg
Day of the Week	Mon									
Date	5/6									
Naps Today (when, how long?)	2p, 30 min									
Time Spent Exercising (Min.)	15									
Time Spent Outside (Min.)	30									
# Alcoholic Beverages	1									
Caffeine Consumed after 3 PM (what, how much)	1 coffee									
Pain Today (None 0—1—2—3—4—5 A Lot)	1									
Fatigue? (None 0—1—2—3—4—5 A Lot)	2									
Overall health Today? (Felt Fine 0—1—2—3—4—5 Bad)	2									
Sleeping Pills Today? Pill Name/Dose:	1 @ 10P									
How sleepy were you at bedtime? (Very Alert 0—1—2—3—4—5 Very Sleepy)	1									

COMPLETE IMMEDIATELY **UPON AWAKENING** EACH DAY:

	Sample	Night 1	Night 2	Night 3	Night 4	Night 5	Night 6	Night 7		Avg
What time did you get into bed?	10 P									
What time did you try to fall asleep?	10:30 P									
How many minutes did it take to fall asleep the first time?	45									
How many times did you wake up during the night (not counting your final awakening)?	3									
About how many minutes were you awake during the night? (from the # times awoken from above)?	30									
What time was your final awakening?	5:30A									
Was this earlier than desired? If yes, by how many minutes?	Yes, 30									
What time did you get out of bed for the day?	6:15A									
How would you rate the quality of your sleep? 1= Very poor, 2= Poor, 3= Fair, 4= Good, 5= Excellent	3									

- Sleep Diary
 - Subjective perception of sleep characteristics over a period of time
 - May include assessment of daytime characteristics

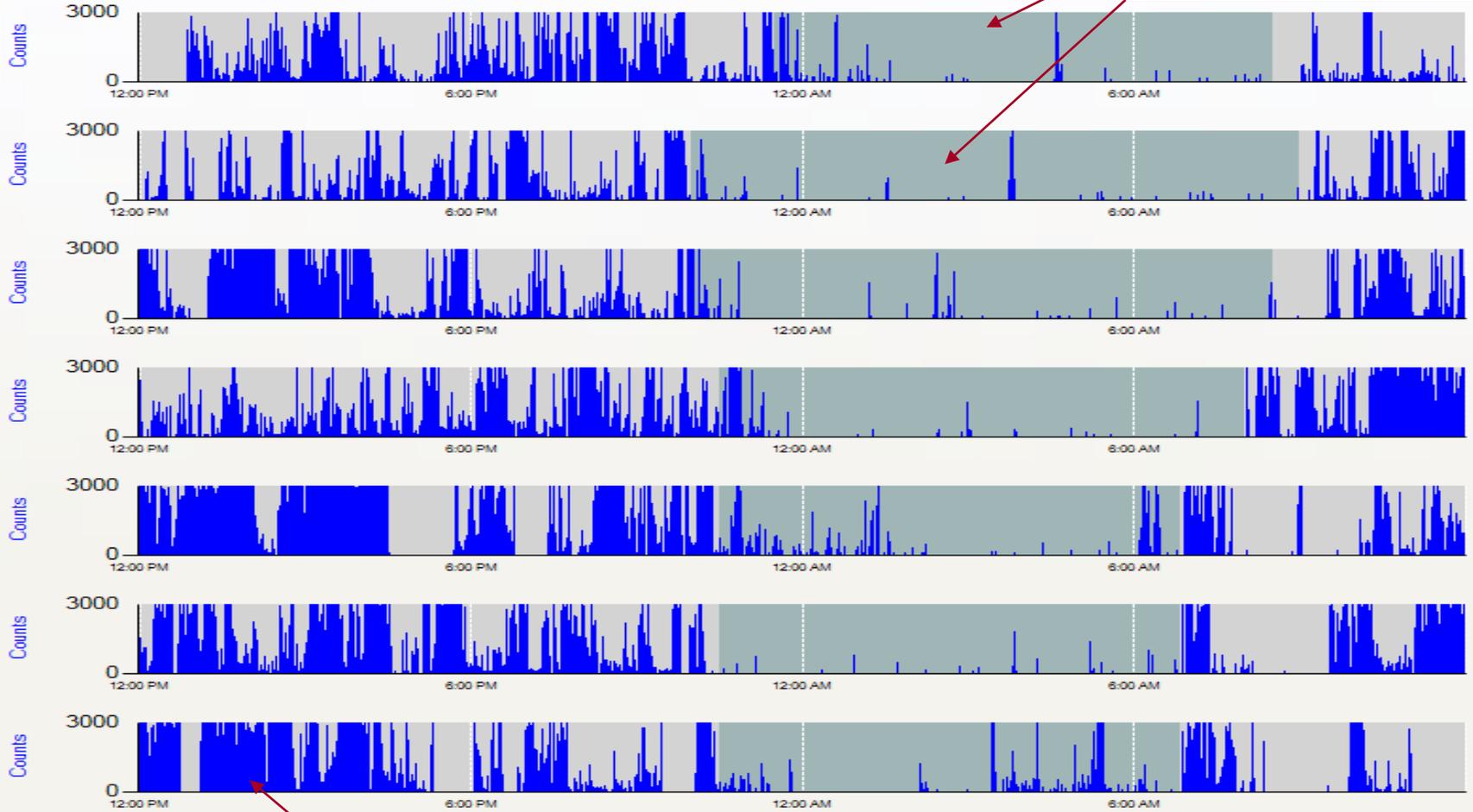
Actigraphy

- Non-invasive monitor of rest/activity cycles
- Typically wrist worn
- Accelerometer
 - Sensitive motion monitor
- Worn over successive days to identify sleep/wake patterns



Actigraphy

SLEEP PERIOD



EACH ROW = 24 HOURS

TALLER/THICKER LINES = MORE ACTIVITY



SHARE

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🐦 TWEET

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12

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17

✉️ EMAIL

JC HERZ GEAR 02.08.15 9:00 PM

NEW SLEEP-TRACKING WEARABLES HELP SOLVE REAL MEDICAL PROBLEMS



Summary

- A variety of questionnaires are readily available
- Selection of questionnaires
 - need to understand limitations; however, easy to administer
- Patient population for PSG must be considered
- Appropriate population for home testing
- Choose the best tool to answer the question you need answered!