PHILADELPHIA
SLEEP ★ CONFERENCE

MEDICATION EFFECTS ON POLYSOMNOGRAPHY

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Conflict of Interest Disclosures Speaker:

[X] I wish to disclose the following potential conflicts of interest:

Type of Potential Conflict	Details of Potential Conflict
Grant/Research Support	
Consultant	Circadiance, LLC
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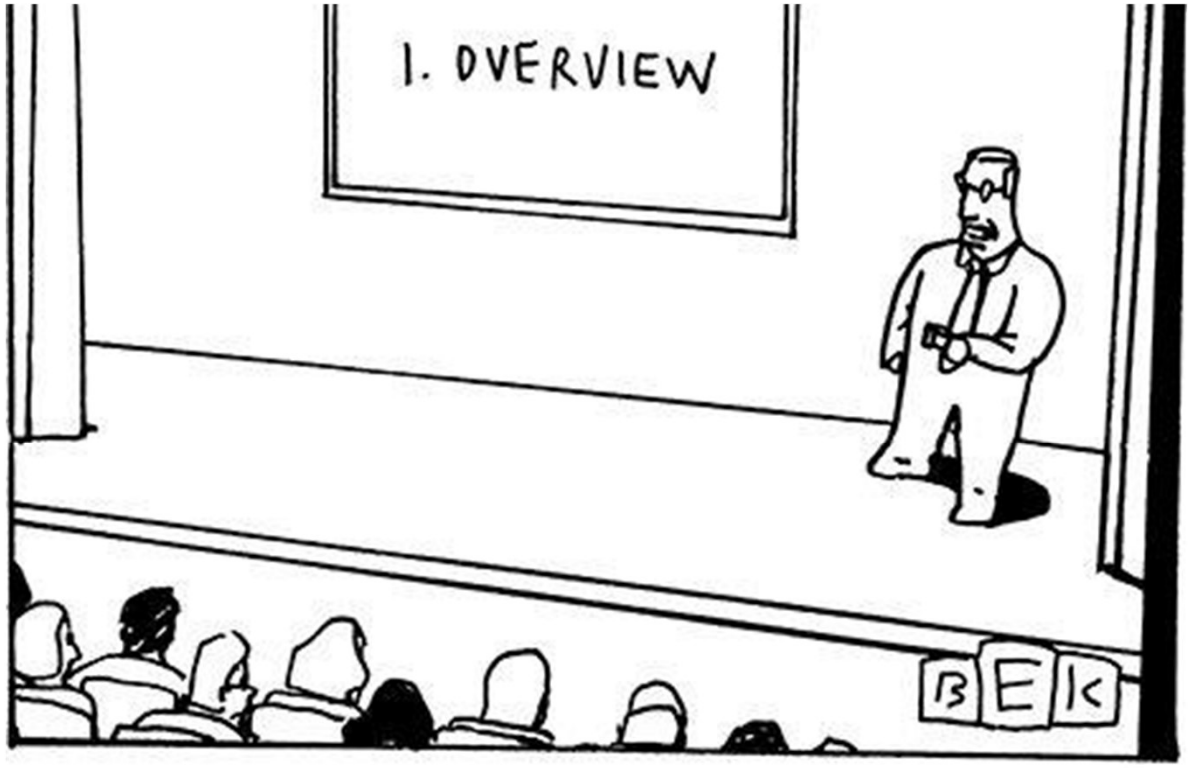
Financial support	
Other	

[X] The material presented in this lecture has no relationship with any of these potential conflicts



"First, I want to give you an overview of what I will tell you over and over again during the entire presentation."

KAPLAN, BRUCE. "OVERVIEW." CARTOON. *CONDENASTSTORE.COM*

OVERVIEW

MEDICATION USE→PSG→PATIENT CARE

TOOLS FOR CONNECTING THE DOTS BETWEEN MEDICAL HISTORY, SLEEP, AND CLINICAL CARE

THIS IS NOT ABOUT…

- BIG PHARMA
- BIOCHEMISTRY
- OR CPAP

CATEGORIZE COMMON MEDICATIONS WHICH AFFECT SLEEP

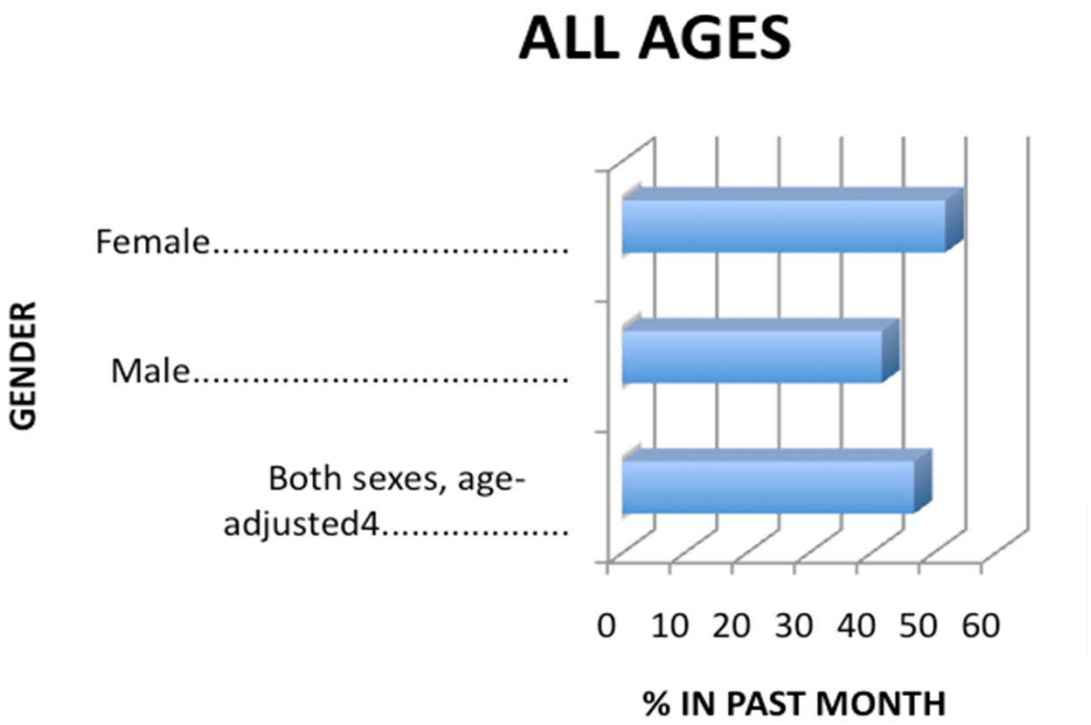
USE “NORMAL” PSG TO CONTRAST MEDICATION EFFECTS

DETAIL SPECIFIC WAYS THAT MEDICATIONS AFFECT SLEEP

WHAT DOES THIS MEAN FOR SLEEP PROFESSIONALS?

GOALS FOR TODAY

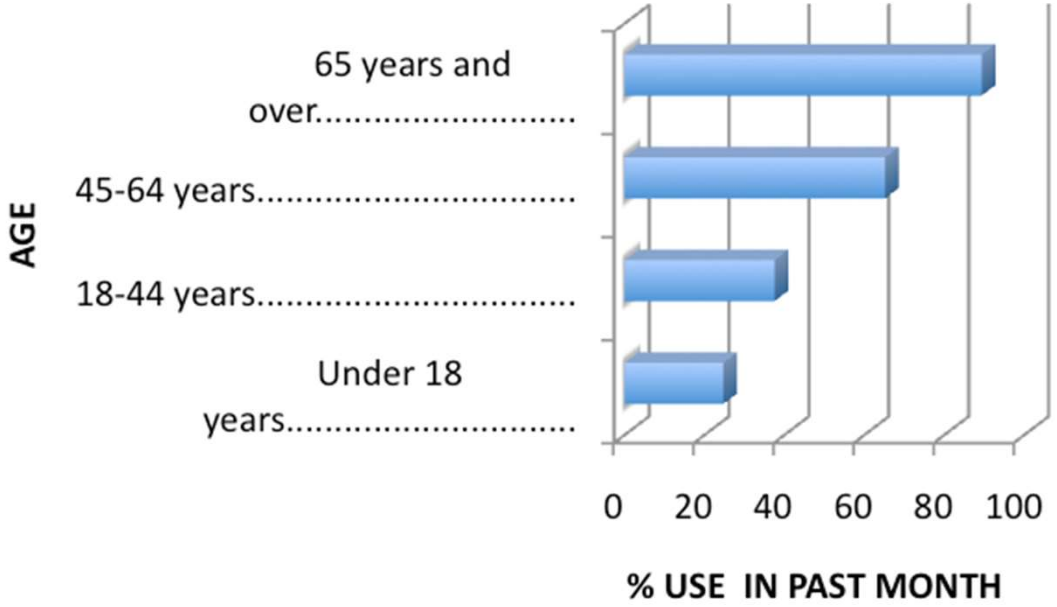
MEDICATION USE IS COMMON



CDC/NATIONAL CENTER FOR HEALTH STATISTICS/OFFICE OF ANALYSIS AND EPIDEMIOLOGY. (2009) HEALTH, UNITED STATES, 2009.

Total number of retail prescriptions filled annually in the U.S. 2013-2024. (n.d.). Retrieved August 21, 2019, from https://www.statista.com/statistics/261303/total-number-of-retail-prescriptions-filled-annually-in-the-us/

ESPECIALLY ACROSS THE LIFESPAN



CDC/NATIONAL CENTER FOR HEALTH STATISTICS/OFFICE OF ANALYSIS AND EPIDEMIOLOGY. (2009) HEALTH, UNITED STATES, 2009.

MOST PRESCRIBED CLASSES

- STATINS
- ANTI-DEPRESSANTS
- ANALGESIC
- BETA BLOCKERS
- ACE INHIBITORS

IMS HEALTH (DEC. 2010). IMS NATIONAL PRESCRIPTION AUDIT.

MOST PRESCRIBED: CARDIOVASCULAR

- STATINS
- ANTI-DEPRESSANTS
- ANALGESIC
- BETA BLOCKERS
- ACE INHIBITORS

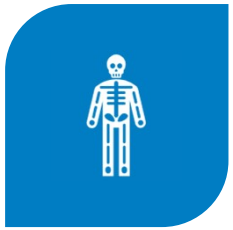
IMS HEALTH (DEC. 2010). IMS NATIONAL PRESCRIPTION AUDIT.

A SAMPLE OF OUR PATIENTS

N=70

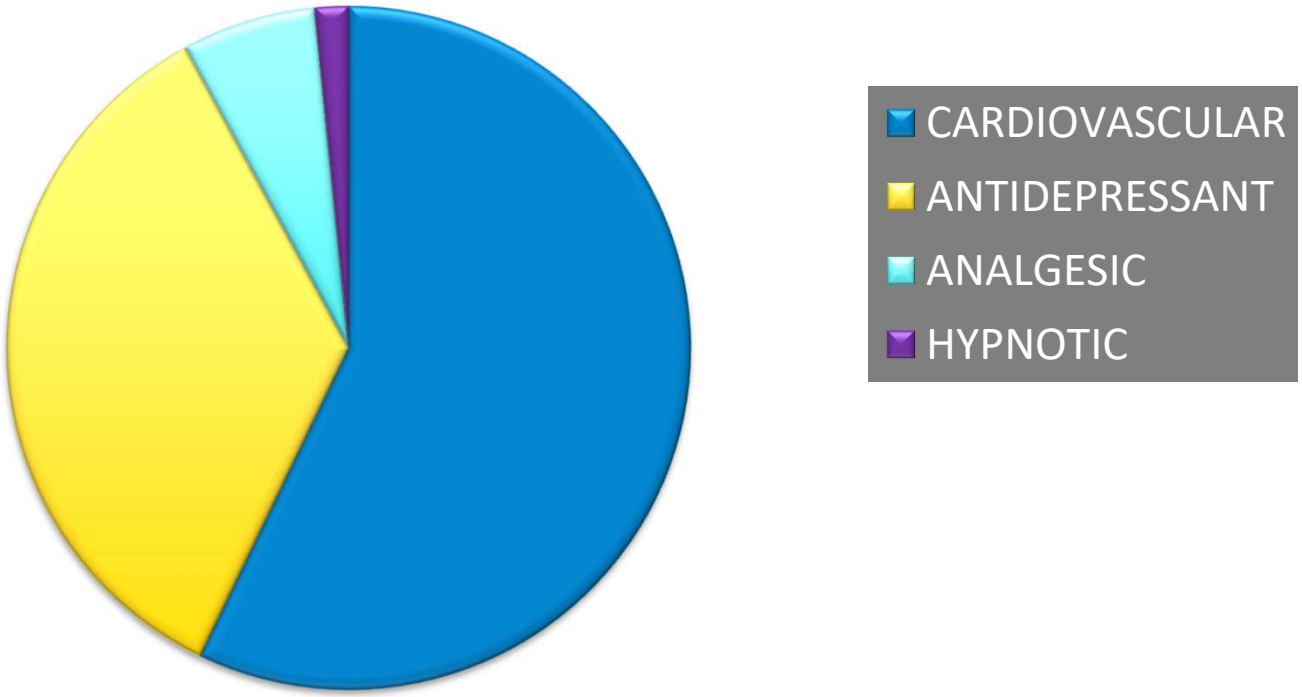
AGE: 52

MEDICATION USE: 84%



AVG. # PRESCRIBED MEDS: 3.3

SAMPLE POPULATION MEDICATION USE BY TYPE



RELEVANCE

WHAT DOES THIS MEAN

FOR ME AND MY PATIENT?

MEDICATIONS: BY SOLVING ONE PROBLEM, WE CREATE OTHERS…

BALDWIN, MIKE. "SIDE-EFFECT CARTOON." CARTOON. *CARTOONSTOCK.COM*


0:00 / 0:34

CATEGORIZE COMMON MEDICATIONS WHICH AFFECT SLEEP

USE "NORMAL" PSG TO CONTRAST MEDICATION EFFECTS

DETAIL SPECIFIC WAYS THAT MEDICATIONS AFFECT SLEEP

WHAT DOES THIS MEAN FOR SLEEP PROFESSIONALS?

GOALS FOR TODAY

ABNORMAL? YOU KNOW IT WHEN YOU SEE IT

ERIN. “LADY-GAGA-HAIR-PHONE.” PHOTO. *MYHAIRSTYLINGTOOLS.COM* 22 FEB. 2010.
MTV. PHOTO. HANDOUT/GETTY IMAGES NORTH AMERICA. 21 JAN. 2010.

“NORMAL” SLEEP

- **SLEEP CONTINUITY:**
  SL, TST, WASO, NWAK & SE%

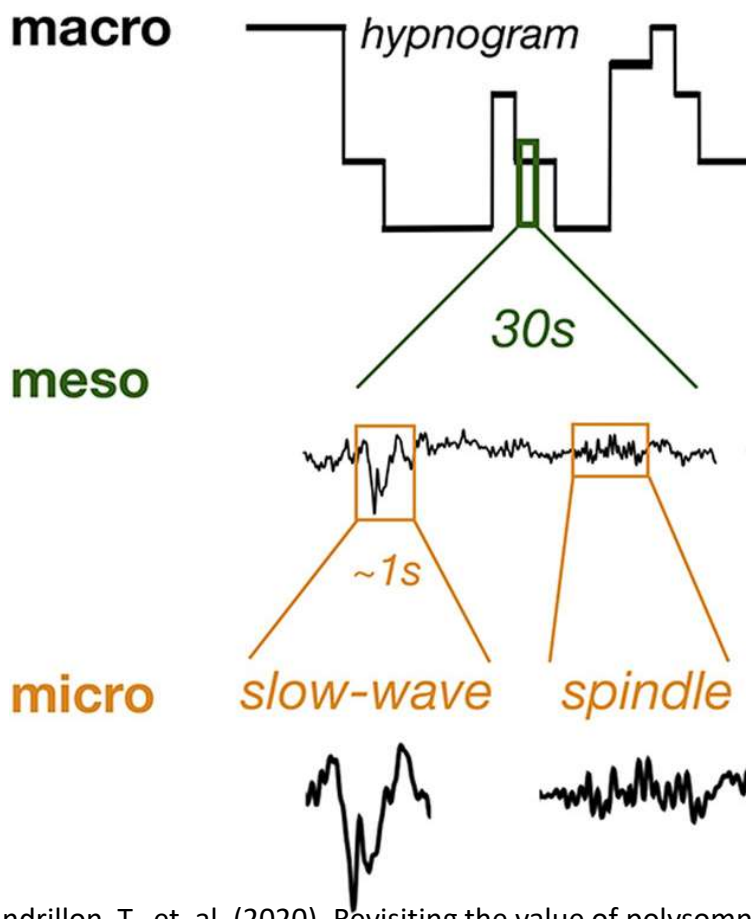
- **SLEEP ARCHITECTURE:**
  N1, N2, SWS & REM

- **SLEEP MICRO-ARCHITECTURE:**
  EEG, EOG, EMG & EKG

OHAYON, MM, ET AL. (2004). META-ANALYSIS OF QUANTITATIVE SLEEP PARAMETERS FROM CHILDHOOD TO OLD AGE IN HEALTHY INDIVIDUALS: DEVELOPING NORMATIVE SLEEP VALUES ACROSS THE HUMAN LIFESPAN. SLEEP, 27(7), 1255-1273.

POLYSOMNOGRAPHY

- SLEEP CONTINUITY
  - SL, TST, WASO, NWAK & SE
- SLEEP ARCHITECTURE (MACRO)
  - N1, N2, SWS & REM
- SLEEP MICRO-ARCHITECTURE (MESO / MICRO)
  - EEG, EOG, EMG & EKG



Andrillon, T., et. al. (2020). Revisiting the value of polysomnographic data in insomnia: more than meets the eye. *Sleep Medicine (66),* 184-200. ISSN 1389-9457, https://doi.org/10.1016/j.sleep.2019.12.002

“NORMAL” SLEEP CONTINUITY

SLEEP LATENCY (SL) > 5 MIN; < 30 MIN

TOTAL SLEEP TIME (TST) > 6 HRS; < 9 HRS*

WAKE AFTER SLEEP ONSET (WASO)
> 10 MIN; < 100 MIN*

AWAKENINGS (NWAK) > 5 TIMES; < 50 TIMES

SLEEP EFFICIENCY (SE %) > 80 %; < 100 %

OHAYON, MM, ET AL. (2004). META-ANALYSIS OF QUANTITATIVE SLEEP PARAMETERS FROM CHILDHOOD TO OLD AGE IN HEALTHY INDIVIDUALS: DEVELOPING NORMATIVE SLEEP VALUES ACROSS THE HUMAN LIFESPAN. SLEEP, 27(7), 1255-1273.

“NORMAL” SLEEP ARCHITECTURE

N1	> 5%; < 8%
N2	**> 45%; <65%**
N3 (SWS)	**> 5%; < 25%***
REM	> 15%; < 25%

OHAYON, MM, ET AL. (2004). META-ANALYSIS OF QUANTITATIVE SLEEP PARAMETERS FROM CHILDHOOD TO OLD AGE IN HEALTHY INDIVIDUALS: DEVELOPING NORMATIVE SLEEP VALUES ACROSS THE HUMAN LIFESPAN. SLEEP, 27(7), 1255-1273.

"NORMAL" SLEEP MICRO-ARCHITECTURE

EEG

- BETA 12-20 Hz
- ALPHA 8-12 Hz
- THETA 3-7 Hz
- DELTA .5-2 Hz
- **SLEEP SPINDLES / K-COMPLEXES IN N2**

EOG, EMG & EKG

- **ROLLING, RAPID OR ABSENT EYE MOVEMENTS**
- CHIN AND LEG EMG WHICH REFLECTS THE STAGE
- HEART RATE 60-100 BPM WITHOUT DYSRHYTHMIA

CATEGORIZE COMMON MEDICATIONS WHICH AFFECT SLEEP

USE “NORMAL” PSG TO CONTRAST MEDICATION EFFECTS

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WHAT DOES THIS MEAN FOR SLEEP PROFESSIONALS?

GOALS FOR TODAY

PSG WHICH DEVIATES FROM "NORMAL" IS ABNORMAL:

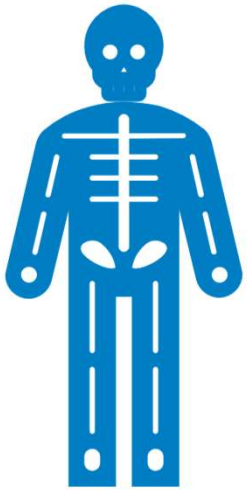
IS THE FINDING "REAL"?

REVIEW MEDICAL HISTORY

…OR ARTIFACT?

CORRECT ARTIFACT

GOT ARTIFACT?
WE HAVE CORRECTIVE TECHNIQUES



- SWEAT ARTIFACT (SLOW UNDULATING BASELINE)
  - LOWER TEMPERATURE / ADD FAN / ↑ HP FILTER FROM .1 HZ TO .75 HZ
- ELECTRODE "POPPING"
  - TURN SUBJECT SUPINE OR TO OTHER SIDE
- **EKG ARTIFACT**
  - **REFERENCE A1 AND A2 TO EACH OTHER**
- **MUSCLE ARTIFACT**
  - **HIGH FREQUENCY FILTER**
  - **LIVE WITH IT***

ILENE ROSEN, M.D., UNIVERSITY OF PENNSYLVANIA, DIVISION OF SLEEP MEDICINE.

PSG WHICH DEVIATES FROM "NORMAL" IS ABNORMAL:

IS THE FINDING "REAL"?

REVIEW MEDICAL HISTORY

…OR ARTIFACT?

CORRECT ARTIFACT

TAKE HOME CHART OF MEDICATION EFFECTS ON PSG

MEDICATION EFFECTS ON POLYSOMNOGRAPHY

CLASS	BRAND (GENERIC)	SLEEP CONTINUITY	SLEEP ARCHITECTURE / MICRO-ARCH	SUBJECTIVE
CARDIOVASCULAR				
ALPHA-AGONIST	Aldomet (methyldopa)	↑ TST	↑ REM; ↓ SWS	Sedating/Insomnia
ALPHA-AGONIST	Catapres (clonidine)	↓ TST in hypertensive patients	↓ REM	Sedating/Insomnia
STATIN	Lipitor (atorvastatin)	No Studies	No Studies	Insomnia
BETA-BLOCKER	Lopressor (metoprolol)	↑ SOL, WASO & NWAK; ↓ TST & SE	↑ N1; ↓ SWS & REM	Insomnia/Nightmares
ANALGESIC				
NARCOTIC	Vicodin (hydrocodone)	↑ SOL, WASO & NWAK; ↓ TST & SE	↓ SWS, REM & MYOCLONUS	
NARCOTIC	Avinza (morphine)	↑ SOL, WASO & NWAK; ↓ TST & SE	↓ SWS, REM & MYOCLONUS	
NARCOTIC	OxyContin (oxycodone)	↑ SOL, WASO & NWAK; ↓ TST & SE	↓ SWS, REM & MYOCLONUS	
NON-NARCOTIC	Tylenol (acetaminophen)	↑ SOL, WASO & NWAK; ↓ TST & SE	↓ SWS & REM	
ANTI-DEPRESSANT				
SSRI	Prozac (fluoxetine)	↑ SOL, WASO & NWAK; ↓ TST & SE	↑ N1; ↓ SWS; ↓↓ REM	Insomnia
SSRI	Zoloft (sertraline)	↑ SOL, WASO & NWAK; ↓ TST & SE	↑ N1; ↓ SWS; ↓↓ REM	Insomnia
MAOI	Nardil (phenelzine)	↑ SOL, WASO & NWAK; ↓ TST & SE	↑ N1; ↓ SWS; ↓↓ REM	Insomnia
TCA	Anafranil (clomipramine)	↓ SOL, WASO & NWAK; ↑ TST & SE	↓ ↓ REM; ↑ PLMs & EYE MOVEMENTS IN REM	Sedating
STIMULANT				
	Caffeine & Nicotine	↑ SOL, WASO & NWAK; ↓ TST & SE	↓ SWS & REM	Chronic use effects
	Cocaine	↑ SOL; ↓ TST	↓ REM	Chronic use effects
DEPRESSANT				
	Alcohol	↑ SOL, WASO & NWAK; ↓ TST & SE	↑ SWS; ↓ REM	Chronic use effects
	Cannabis	No Studies	↓ SWS	Chronic use effects
ANTIPSYCHOTICS				
	Zyprexa (olanzapine)	↓ SOL & WASO; ↑ TST	↑ SWS; ↓ REM	Sedating
ANTIEPILEPTICS				
	Neurontin (gabapentin)	↓ SOL & WASO; ↑ TST	↑↑ SWS; ↑ REM	
HYPNOTIC				
BENZODIAZEPINE	Halcion (triazolam)	↓ SOL & WASO; ↑ TST	↓ N1, REM & MYOCLONUS; ↓↓ SWS; ↑ DELTA, THETA & BZA	Sedating
BENZODIAZEPINE	Valium (diazepam)	↓ SOL & WASO; ↑ TST	↓ N1, REM & MYOCLONUS; ↓↓ SWS; ↑ DELTA, THETA & BZA	Sedating
NON-BENZO	Ambien (zolpidem)	↓ SOL & WASO; ↑ TST	↓ N1 & MYOCLONUS; ↑ DELTA & THETA	Sedating
NON-BENZO	Lunesta (eszopiclone)	↓ SOL & WASO; ↑ TST	↓ N1 & MYOCLONUS; ↑ DELTA & THETA	Sedating
OTC				
	Benadryl (diphenhydramine)	↓ SOL, WASO & NWAK; ↑ TST & SE	↑ MYOCLONUS	
	Melatonin	↓ SOL, WASO & NWAK; ↑ TST & SE	↓ SWS; ↓ REM	Sedating
	Valerian	↓ SOL, WASO & NWAK; ↑ TST & SE	No Studies	

KEY: SOL (SLEEP ONSET LATENCY); TST (TOTAL SLEEP TIME); WASO (WAKE AFTER SLEEP ONSET); NWAK (# AWAKENINGS AFTER SLEEP ONSET); SE (SLEEP EFFICIENCY %)

Adapted from: Kryger, M. H., Roth, T., & Dement, W. C. (2011). Principles and practice of sleep medicine. Philadelphia, PA: Saunders/Elsevier.;
MacFarlane, J. (2019, September 18). The Effects of Psychotropic and Neurotropic Medications on Sleep. Sleep Review Magazine.;
Garcia, A. N., & Salloum, I. M. (2015, Oct). Polysomnographic sleep disturbances in nicotine, caffeine, alcohol, cocaine, opioid, and cannabis use: A focused review. Am J Addict, 24(7):590-8.

CLASS	BRAND (GENERIC)	SLEEP CONTINUITY	SLEEP ARCHITECTURE / MICRO-ARCH
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ANTI-DEPRESSANT			
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SSRI	Zoloft (sertraline)	↑ SOL, WASO & NWAK; ↓ TST & SE	↑ N1; ↓ SWS; ↓↓ REM; ↑ EYE MOVEMENTS IN N2 & SWS
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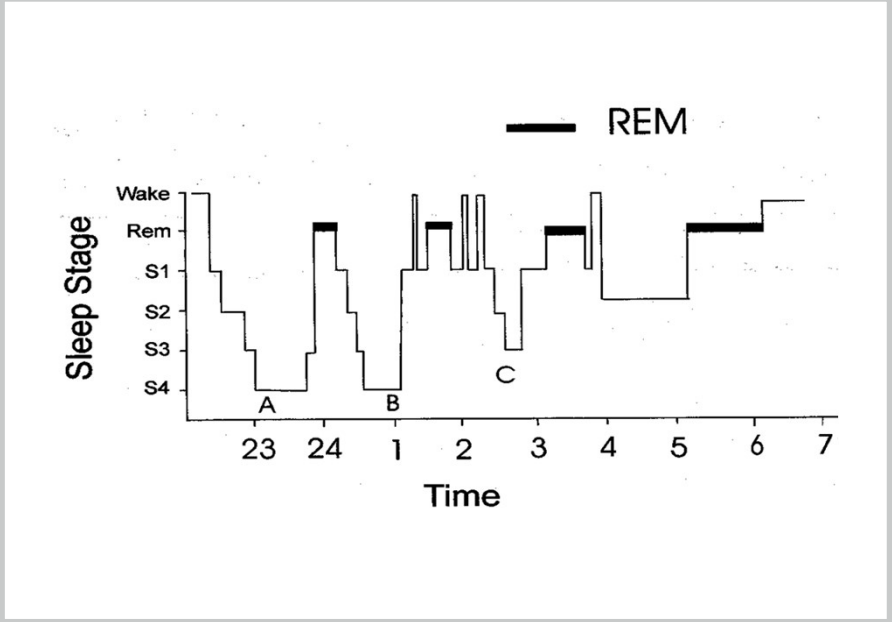
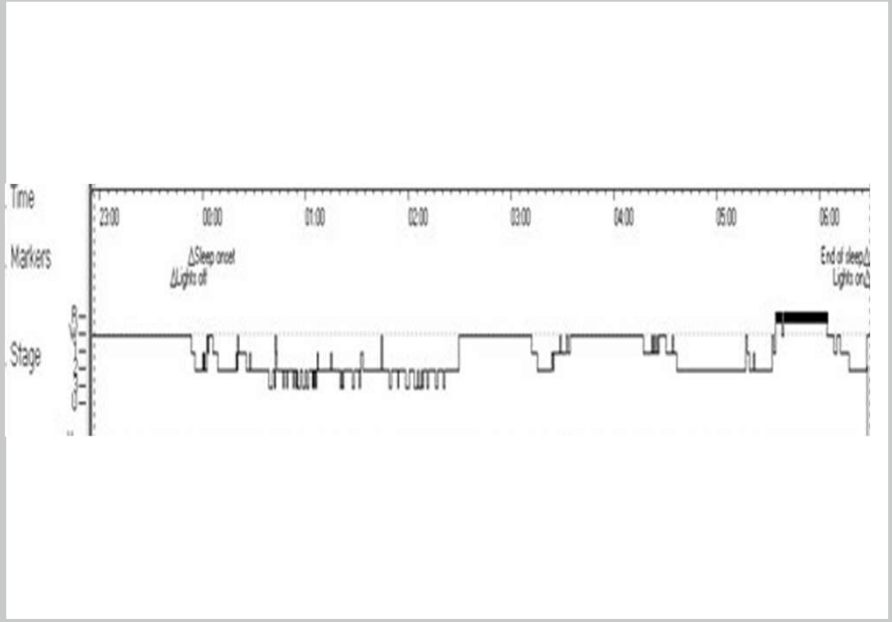
CLASS	BRAND (GENERIC)	SLEEP CONTINUITY	SLEEP ARC
STIMULANT			
	Caffeine & Nicotine	↑ SOL, WASO & NWAK; ↓ TST & SE	↓ SWS & REM
	Cocaine	↑ SOL; ↓ TST	↓ REM
DEPRESSANT			
	Alcohol	↑ SOL, WASO & NWAK; ↓ TST & SE	↑ SWS; ↓ REM
	Cannabis	No Studies	↓ SWS


Play (k)
0:00 / 0:14

CLASSIC EXAMPLES OF “REAL” MEDICATION EFFECTS ON A PSG

- ANTIDEPRESSANT REM-SUPPRESSION
- “PROZAC-EYES”
- BENZODIAZEPINE ARTIFACT

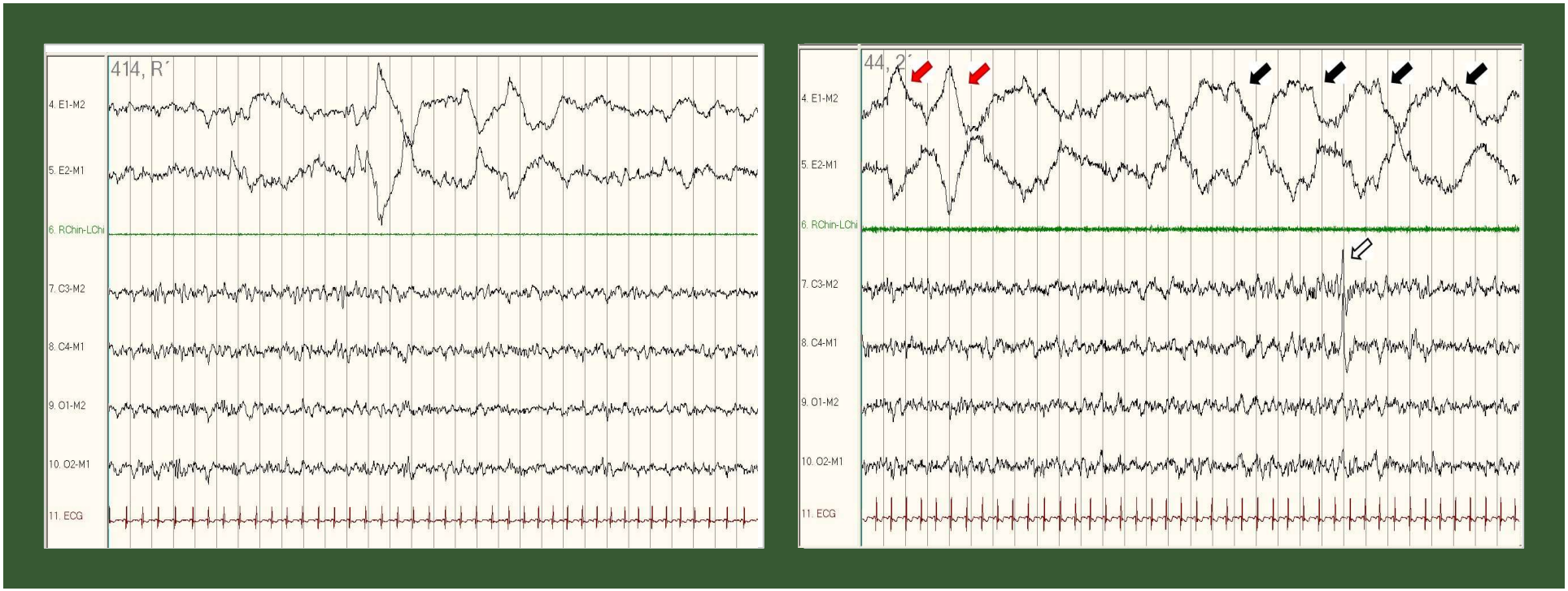




ARCHITECTURE: “NORMAL” VS “ABNORMAL”

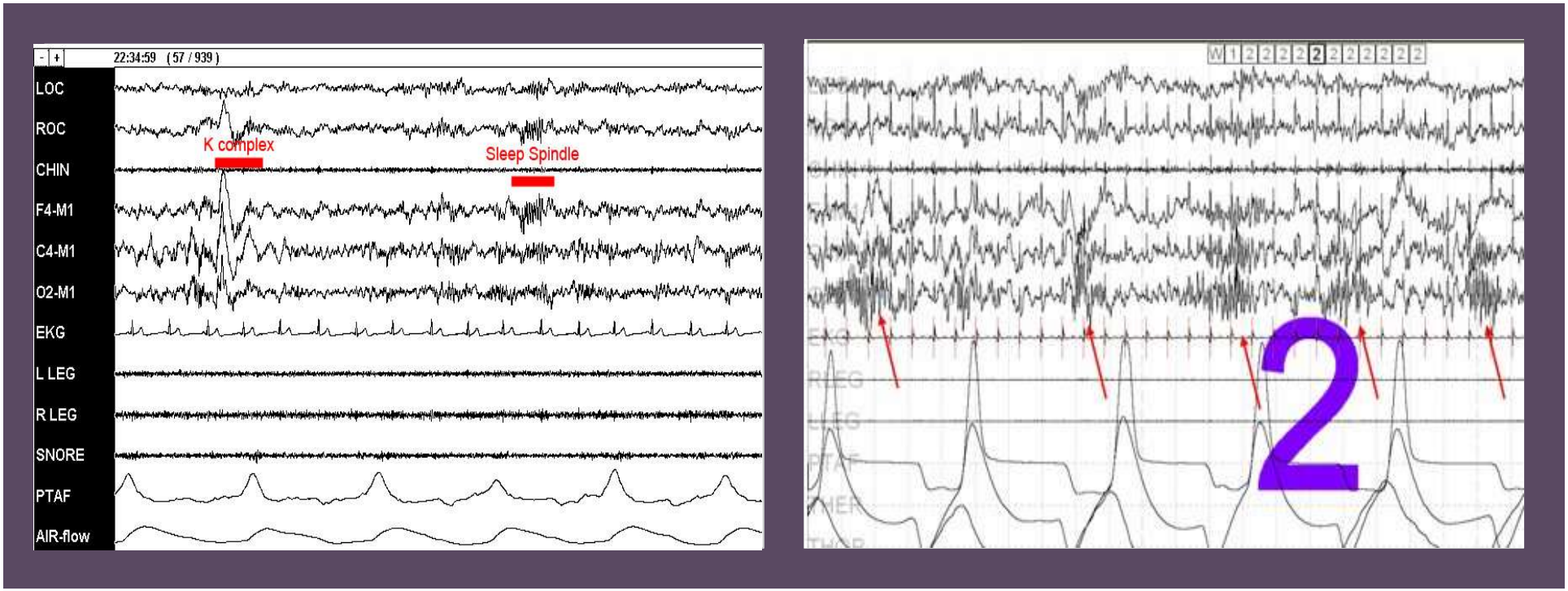
AMERICAN THORACIC SOCIETY WEBSITE. FROM HTTP://WWW.THORACIC.ORG/CLINICAL/SLEEP/SLEEP-FRAGMENT

AMERICAN THORACIC SOCIETY WEBSITE. FROM HTTP://WWW.THORACIC.ORG/CLINICAL/SLEEP/SLEEP-FRAGMENT



MICRO-ARCHITECTURE: EOG “NORMAL” IN REM VS “ABNORMAL” IN N2

AMERICAN THORACIC SOCIETY WEBSITE. FROM HTTP://WWW.THORACIC.ORG/CLINICAL/SLEEP/SLEEP-FRAGMENT



“NORMAL” MICRO-ARCHITECTURE IN N2 VS BENZODIAZEPINE ARTIFACT

AMERICAN THORACIC SOCIETY WEBSITE. FROM <HTTP://WWW.THORACIC.ORG/CLINICAL/SLEEP/SLEEP-FRAGMENT>

CATEGORIZE COMMON MEDICATIONS WHICH AFFECT SLEEP

USE “NORMAL” PSG TO CONTRAST MEDICATION EFFECTS

DETAIL SPECIFIC WAYS THAT MEDICATIONS AFFECT SLEEP

WHAT DOES THIS MEAN FOR SLEEP PROFESSIONALS?

GOALS FOR TODAY

“THE INFORMED TECHNICIAN”

- SHOW AN AWARENESS OF AND IDENTIFY MEDICATION-RELATED PSG ABNORMALITIES

- LET IT INFORM YOUR EFFORTS TOWARDS:
  - OBTAINING A CLEAN STUDY
  - SCORING ACCURACY (DON’T BE FOOLED!)
  - MAKING INFORMED COMMENTS IN THE REPORT

CLINICAL PATHWAY

COLLECT DETAILED HISTORY / MEDS

OR, HAVE REAL TIME EMR / EHR ACCESS

RECONCILE PSG WITH MEDICATION EFFECTS

DOCUMENT FINDINGS

OVERVIEW

MEDICATION USE→PSG→PATIENT CARE

TOOLS FOR CONNECTING THE DOTS BETWEEN MEDICAL HISTORY, SLEEP, AND CLINICAL CARE

CASE A: 22 YEAR OLD FEMALE

SYMPTOMS STARTED AT 12 YEARS OF AGE

WEAKNESS DURING LAUGHTER

PATIENT TAKING PROZAC

MSLT IS NEGATIVE FOR REM SLEEP

CASE B: 30 YEAR OLD MALE

PSG SHOWS BENZODIAZEPINE SPINDLES

PATIENT DID NOT REPORT USE/ABUSE OF BENZOS IN CASE HISTORY

PATIENT TAKING AN ANTIDEPRESSANT

PSG SHOWS REM-RELATED OSA WITH LOW OVERALL AHI AHI=9.2

CASE C: PATIENT IN ICU

TAKING MULTIPLE MEDICATIONS

INSOMNIA

GIVEN BENZODIAZEPINE FOR SLEEP

SLEEP IN THE ICU. CHEST, 136(1), 288

CASE D: 55 YEAR OLD FEMALE

OLD PSG SHOWS

SL = 120 MIN.

SE = 80%

PATIENT REPORTS ONGOING DIFFICULTY WITH SLEEP INITIATION

MEDICATION USE→PSG→FOLLOWUP CARE

CONCLUDING POINTS

- MEDICATION USE = COMMONPLACE
- UNDERSTAND NORMATIVE SLEEP CONTINUITY / ARCHITECTURE / MICRO-ARCHITECTURE
- GOOD TECHNICAL SKILLS = ACCURATE DETECTION OF ABNORMAL SLEEP
- UNDERSTANDING MEDICATION EFFECTS = GOOD PATIENT CARE

FOLLOW-UP
CONTACT FOR MATT ANASTASI, RPSGT
LiminaSleepConsulting
@Gmail.com

WITH GRATEFUL ACKNOWLEDGEMENTS…

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ROBIN ALEXANDER, MPA
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MICHAEL DIDOMENICO
MOST IMPORTANTLY, YOU!