

MODULE

**REPORT GENERATION OF A
POLYSOMNOGRAPHIC
STUDY**

REPORT GENERATION OF A POLYSOMNOGRAPHIC STUDY

OBJECTIVES:

At the end of this module the student must be able to:

- I. Verify the accuracy of a computer generated report by manually calculating:
 - A. Sleep Statistics, such as:
 1. Total Recording Time
 2. Total Sleep Time
 3. Total Stage Time
 4. Total Wake Time
 5. Total Movement Time
 6. Wake After Sleep Onset
 7. Sleep Efficiency
 8. % Sleep Stages

REPORT GENERATION OF A POLYSOMNOGRAPHIC STUDY

B. Latencies such as:

1. Sleep Latency
2. REM Latency
3. Mean Sleep Latency

C. Indices such as:

1. Apnea/Hypopnea Index
2. Respiratory Disturbance Index
3. Apnea Index
4. Hypopnea Index
5. Arousal Index
6. Periodic Limb Movement Index

REPORT GENERATION OF A POLYSOMNOGRAPHIC STUDY

- II. Summarize the Report which includes:
 - A. Patient Identification
 - B. Recording Conditions
 - C. Technical Documentations
 - D. Sleep Report
 - E. Respiratory Characteristics
 - F. Myoclonus/Leg Movements
 - G. Arousals
 - H. Behavioral Observations
 - I. Heart Rate/ECG Observation
 - J. Snoring
 - K. Summary

LESSON 1: MATH COMPUTATIONS

A. SLEEP STATISTICS

After the study is scored, the scoring software will calculate and generate a report. The report should provide a complete summary of the sleep parameters, including:

1. Total Recording Time
2. Total Sleep Time
3. Total Stage Time
4. Total Wake Time
5. Total Movement Time
6. Wake After Sleep Onset
7. Sleep Efficiency
8. % Sleep Stages

LESSON 1: MATH COMPUTATIONS

In any case, it is **IMPORTANT** to know **HOW** these statistics are derived in order to properly interpret the data.

LESSON 1: MATH COMPUTATIONS

A. SLEEP STATISTIC (cont'd)

RULE OF THE THUMB

Sleep studies are scored on an Epoch by Epoch basis
(30 seconds interval)

Make sure your units of measure are the SAME

- Epochs with Epochs
- Minutes with Minutes

(epochs to minutes) -to get time in minutes, take the
total # of epochs and divide by 2

- Hours with Hours

(minutes to hours) -to get time in hours, take the time
in minutes and divide by 60

LESSON 1: MATH COMPUTATIONS

A. SLEEP STATISTIC (cont'd)

1. TOTAL RECORDING TIME (TRT)

- The time from Lights out to Lights on
- AKA Time in Bed (TIB)

FORMULA:

- $TRT = \text{Lights on epoch} - \text{Lights out epoch} \div 2$
- $TRT = \text{Total Sleep Time (TST)} + \text{Total Wake Time (TWT)} + \text{Movement Time (TMT)}$

LESSON 1: MATH COMPUTATIONS

A. SLEEP STATISTIC (cont'd)

2. TOTAL SLEEP TIME (TST)

– The total time spent asleep

FORMULA:

- $TST = \text{Total Recording Time (TRT)} - \text{Total Wake Time (TWT)} - \text{Total Movement Time (TMT)}$
- $TST = \text{Total Stages N1, N2, N3, REM (in minutes)}$

LESSON 1: MATH COMPUTATIONS

A. SLEEP STATISTIC (cont'd)

3. TOTAL STAGE TIME

- The total amount of time spent on a particular stage of sleep

FORMULA:

- Total Stage N1 time (TSN1)= total # of St. N1 epochs \div 2
- Total Stage N2 time (TSN2)= total # of St. N2 epochs \div 2
- Total Stage N3 time (TSN3)= total # of St. N3 epochs \div 2
- Total REM time (TREM)= total # of St. N1 epochs \div 2

LESSON 1: MATH COMPUTATIONS

A. SLEEP STATISTIC (cont'd)

4. TOTAL WAKE TIME (TWT)

- Total amount of time awake during the recording

FORMULA:

- $TWT = \text{Total \# of wake epochs from Lights out to Lights on}$
- $TWT = \text{Total Recording Time (TRT)} - \text{Total Sleep Time (TST)} - \text{Total Movement Time (TMT)}$

LESSON 1: MATH COMPUTATIONS

A. SLEEP STATISTIC (cont'd)

5. TOTAL MOVEMENT TIME (TMT)

- Per R & K guidelines, epochs that cannot be scored because they were obscured by too much movement
- TMT is separated from wake and sleep and is thrown out of the recording statistics and computations

FORMULA:

- $TMT = \text{total \# of epochs labeled as MVT} \div 2$

LESSON 1: MATH COMPUTATIONS

A. SLEEP STATISTIC (cont'd)

6. WAKE AFTER SLEEP ONSET (WASO)

- The total amount of wake time after the first epoch of sleep
- AKA Intermittent awakenings

FORMULA:

- $WASO = \text{total \# of wake epochs after sleep onset} \div 2$

LESSON 1: MATH COMPUTATIONS

A. SLEEP STATISTIC (cont'd)

7. SLEEP EFFICIENCY (%)

- The percentage of time asleep compared to the time spent in bed
- Basically the quality of one's sleep
- Normal adult value is 90% or greater
- The “laboratory effect” allows for a 75% efficiency in the sleep lab environment

FORMULA:

- $SE \% = \frac{\text{Total Sleep Time (TST)}}{\text{Total Recording Time (TRT)}} \times 100\%$

LESSON 1: MATH COMPUTATIONS

A. SLEEP STATISTIC (cont'd)

8. % OF SLEEP STAGES

- The Total Time of a particular sleep stage divided by Total Sleep Time (TST)
- Can be calculated for Stages N1, N2, N3 & REM
- Normal Adults values are:
 - % Stage N1 (5%)
 - % Stage N2 (50%)
 - % Stage N3 (20-25%)
 - % REM (20-25%)

LESSON 1: MATH COMPUTATIONS

A. SLEEP STATISTIC (cont'd)

8. % OF SLEEP STAGES (cont'd)

FORMULA:

- % Stage N1= Total St. N1 (in minutes) \div TST x 100%
- % Stage N2= Total St. N2 (in minutes) \div TST x 100%
- % Stage N3= Total St. N3 (in minutes) \div TST x 100%
- % REM= Total REM (in minutes) \div TST x 100%
- % Non-REM= Total St. N1+ N2+ N3 (in minutes) \div TST x 100%

LESSON 1: MATH COMPUTATIONS

B. LATENCY

- It is a time delay between the moment something is initiated, and the moment one of its effects begins or becomes detectable.
- Also means intermission, time interval or access time.
- In sleep, it means a time interval from a specific stage of sleep to another.

LESSON 1: MATH COMPUTATIONS

B. LATENCY (cont'd)

1. SLEEP LATENCY (SL)

- Time it takes to fall asleep after Lights out
- The amount of time from Lights out to Sleep Onset
- Normal SL= 10-20 minutes

SLEEP ONSET (SO)

- The first epoch of sleep no matter what stage (usually Stage N1)

FORMULA:

- $SL = SO \text{ epoch} - L. \text{ Out epoch} \div 2$

LESSON 1: MATH COMPUTATIONS

B. LATENCY (cont'd)

2. REM LATENCY (RL)

- The time it takes to get into REM sleep from sleep onset
- The first epoch of sleep to first epoch of REM
- Normal RL= 90-120 minutes

REM ONSET (RO)

- The first epoch of REM period

FORMULA:

- $RL = RO \text{ epoch} - SO \text{ epoch} \div 2$

LESSON 1: MATH COMPUTATIONS

B. LATENCY (cont'd)

3. MEAN SLEEP LATENCY (for MSLT)

- The average time it takes for individual to fall asleep in a series of naps

FORMULA:

- $\mu\text{SL} = \text{Add all sleep latencies (including no sleep= 20 minutes)} \div \# \text{ of naps}$

LESSON 1: MATH COMPUTATIONS

C. INDICES

- Represents the frequency of certain events per given time of sleep
- Levels of Severity (for all the indices such as AHI, PLMI, ArI etc) are as follows:
 - Normal= 0-5 events/hr
 - Mild=6-15 events/hr
 - Moderate=16-30 events/hr
 - Severe=>30 events/hr

LESSON 1: MATH COMPUTATIONS

C. INDICES (cont'd)

1. APNEA-HYPOPNEA INDEX (AHI)

- The average number of Apneas and Hypopneas in an hour of sleep

FORMULA:

- $AHI = \frac{\text{total \# of Apneas (obstructive, mixed, central) + Hypopneas}}{\text{Total Sleep Time (TST)}} \times 60$

LESSON 1: MATH COMPUTATIONS

C. INDICES (cont'd)

2. RESPIRATORY DISTURBANCE INDEX (RDI)

- The average number of Apneas (obstructive, central and mixed), Hypopneas, and Respiratory Effort Related Arousals (RERAs) in an hour of sleep

FORMULA:

- $RDI = \frac{\text{total \# of Apneas (obstructive, central and mixed)} + \text{Hypopneas} + \text{RERAs}}{\text{Total Sleep Time (TST)}} \times 60$

LESSON 1: MATH COMPUTATIONS

C. INDICES (cont'd)

3. APNEA INDEX

- The average number of Apneas (obstructive, central, mixed) in an hour of sleep

FORMULA:

- $AI = \frac{\text{total \# of Apneas (obstructive, central and mixed)}}{\text{Total Sleep Time (TST) x 60}}$

LESSON 1: MATH COMPUTATIONS

C. INDICES (cont'd)

4. HYPOPNEA INDEX

- The average number of Hypopneas in an hour of sleep

FORMULA:

- $HI = \frac{\text{total number of Hypopneas}}{\text{Total Sleep Time (TST)}} \times 60$

LESSON 1: MATH COMPUTATIONS

C. INDICES (cont'd)

5. AROUSAL INDEX

- The average # of arousals in an hour of sleep
- An arousal is a “micro-awakening” that interrupts the quality of sleep
- Can be broken down into Total Respiratory, Spontaneous or PLM arousals

LESSON 1: MATH COMPUTATIONS

C. INDICES (cont'd)

5. AROUSAL INDEX (cont'd)

- There are 3 Major Types of Arousals
 - Respiratory Arousals are microawakenings caused by respiratory events
 - Movement Arousals are micro-awakenings (sometimes to full awakenings) caused by Periodic Limb Movements in Sleep which are either (or both) arms or legs jerking;
 - Spontaneous Arousals are micro-awakenings that may be caused by either suspected Upper Airway Resistance Syndrome, snoring, or other physical or environmental factors

FORMULA:

- $A_{rl} = \text{total \# of Arousals} \div \text{Total Sleep Time (TST)} \times 60$

LESSON 1: MATH COMPUTATIONS

C. INDICES (cont'd)

6. Periodic Limb Movement Index (PLMI)

- The average number of Periodic Limb Movement in an hour of sleep

FORMULA:

- $PLMI = \text{total \# of PLMs} \div \text{Total Sleep Time (TST)} \times 60$

LESSON 1: MATH COMPUTATIONS

BREAKDOWN OF STATISTICS

- All of the data can be further subdivided into REM/Non-REM sleep
- All of the data can be further subdivided into Supine/Non-supine sleep
- All of the data can be further subdivided into Events (Respiratory, PLM)/Events with arousals

LESSON 2: GENERATED REPORT

DATA ANALYSIS AND REPORTING

The results of the overnight PSG procedures must be presented in the form of a comprehensive, but concise report that summarizes all observations. These documents must also provide an integrated report highlighting the technician's observations of possible medical significance of the findings to the interpreting physician. The report is the single most important element of the PSG examination and the preparation should be thorough and systematic. The following sections delineate the minimal information that should be included in the report.

LESSON 2: REPORT GENERATION

1. PATIENT IDENTIFICATION

The report should be clearly labeled on each page with the patient's full name and inclusive dates of the study. The report should also include the patient's age and any identification numbers required for retrieval of filed supplementary information. Likewise, long term storage medium should be adequately labeled.

LESSON 2: REPORT GENERATION

1. PATIENT IDENTIFICATION includes:

Patient's identifiers such as:

- name, date of birth, gender
- study type, referring MD, chief complaint

Vital Signs such as:

- heart rate (HR), respiratory rate (RR), blood pressure (BP), oxygen saturation (SpO₂)
- height/weight, BMI
- neck size

LESSON 2: REPORT GENERATION

2. PATIENT HISTORY

The report should contain sufficient history information to document the reason why the study was recommended, any significant existing medical conditions, current medications, special therapy (eg. supplemental O2).

Any previous special procedures the patient has had that might influence the study results (eg. LAUP, UPPP, somnoplasty)

LESSON 2: REPORT GENERATION

3. RECORDING CONDITIONS

The report should document the exact periods of time the patient was monitored during the overall study period and should indicate the conditions of each session. The physiological parameters actually recorded during each monitoring session should be listed.

LESSON 2: REPORT GENERATION

4. TECHNICAL DOCUMENTATION

A concise description of the polysomnographic characteristics of each monitoring session should be provided. The physiological parameters actually recorded should be listed.

LESSON 2: REPORT GENERATION

5. SLEEP REPORT

It consists of:

- The overall sleep architecture
- %'s of Sleep stages
- Sleep stage distribution
- Latencies to sleep stages

LESSON 2: REPORT GENERATION

6. RESPIRATORY CHARACTERISTICS

The report should summarize the results of the analysis of respiratory characteristics with respect to sleep state. Information should be provided concerning the:

- respiratory rate while awake and asleep
- presence or absence of snoring
- presence of paradoxical pattern
- number and index of apneic and/or hypopneic events
- longest apneic and/or hypopneic event
- mean and nadir oxygen desaturation
- if sleep state or body position is related to RDI and/or desaturation.

LESSON 2: REPORT GENERATION

7. MYOCLONUS/LEG MOVEMENTS

Myoclonic activity recorded from the extremities must be evaluated in terms of:

- frequency of occurrence and periodicity
- sleep/wake status
- presence or absence of subsequent arousal

Movements that follow EEG signs of arousals

- often seen at the end of apneic events or spontaneous arousals
- movements that clearly precede and cause arousal from sleep (true nocturnal myoclonus)
- movements that occur in the absence of any alterations in sleep or respiration

must be clearly differentiated.

LESSON 2: REPORT GENERATION

8. AROUSALS

Arousals entail:

- Total # of arousals
- Arousal index
- Arousals related to:
 - limb movements
 - respiratory events
 - spontaneous

LESSON 2: REPORT GENERATION

9. BEHAVIORAL OBSERVATIONS

Any unusual or atypical behavioral events should be documented during sleep and wakefulness by the technician during the overnight standard PSG. The technician should describe in detail what the behavior is and how it relates to the polysomnographic documentation. When arousals are noted during the preceding overnight PSG, the technician should document the cause of the arousal (eg. as the result of apneic events or myoclonus or spontaneous arousal)

LESSON 2: REPORT GENERATION

10. HEART RATE/ECG OBSERVATION

Typical heart rate values while awake and asleep (REM and NREM) should be provided, and the report should document extreme values occurring transiently.

Arrhythmias should be documented with respect to frequency of occurrence and type. It is particularly important to describe the occurrence of heart rate changes or arrhythmias with respect to the ongoing respiratory characteristics such as O₂ desaturations.

LESSON 2: REPORT GENERATION

10. HEART RATE/ OXYGENATION (cont'd)

Heart rate entails:

- high, low, mean values
- evidence of arrhythmias

Oxygenation entails:

- %'s of SpO₂ >90, >80, etc
- nadir, mean, # of desaturation events

LESSON 2: REPORT GENERATION

11. SNORING

Snoring entails:

- Total time of snoring
- # of snoring episodes
- % of sleep time snoring
- Subjective assessment as to snoring intensity

LESSON 2: REPORT GENERATION

12. SUMMARY

Consists of:

- Summary of Findings
- Overall Impressions
- Treatment Plan/Follow-up
- Description of scoring rules and definitions of events for the laboratory

REPORT GENERATION OF A POLYSOMNOGRAPHIC STUDY

REFERENCE:

AAST 29TH Annual Meeting Basic Course Manual, 2007