



Report Generation

Chapter 33 – Fundamentals of Sleep Technology,
2nd Edition

Back in the Day...

- Studies were recorded on paper
 - 800-1,000 pages in length
- Reports were a way to summarize the data
- Scoring guidelines were created for consistency
- Manual scoring was a daunting task
 - Had to calculate everything by hand
- Digital polysomnography revolutionized the sleep study report
 - Systems now could tabulate the data

Problems with Digital PSG

Allows for automated functions which have not been fully validated

Auto scoring still is not 100% accurate

Automatic data tabulation can lead to issues with the sleep tech's knowledge base as they don't learn theory, concepts, and formulation if the system does it for them

Purpose of a Sleep Study Report

Depends on the needs of the end user

Reports can contain multiple tables, statistics, graphs, customized charts, event tabulations, percentages, and indices

Histograms for graphical overview of studies

Needs to be relevant, concise, and easily understood by the referring physician

Typically includes summary of sleep architecture, respiratory events, O2 saturation levels, limb movements, arousals, and HR

DME
Requirements

TRT

TST

AHI

O2 saturation nadir



AASM Recommended Recording Parameters

- EEG
- EOG
- Chin EMG
- Leg EMG
- Respiratory effort
- Oxygen saturation
- Body position
- Can also add:
 - CO2 Monitoring
 - Esophageal Monitoring

Sleep Scoring Data

- Lights out
- Light on
- TRT
- TST
- SL
- REM latency
- WASO
- SE
- Time in each stage in minutes
- % of TST for each stage
- # of arousals
- Arousal Index (Arl)

Respiratory Events

- # of OA
- # of MA
- # of CA
- # of hypopneas
- # of apneas and hypopneas
- Apnea Index (AI)
- Hypopnea Index (HI)
- AHI
- # of RERAs
- # of O2 desats $\geq 3\%$
or $\geq 4\%$
- O2 desat index
- Mean continuous O2 saturation
- O2 nadir during sleep
- Occurrence of hypoventilation
- Occurrence of CSR

Cardiac Events

- Average HR during sleep
- Highest HR during sleep
- Highest HR during recording
- Presence of the following arrhythmias:
 - Bradycardia
 - Asystole
 - Sinus tachycardia during sleep
- Narrow complex tachycardia
- Wide complex tachycardia
- Atrial fibrillation
- Heart blocks
- Any ventricular rhythm
- Early beats

Movement Events

- # of PLMS
- # of PLMS with arousals
- PLMS index
- PLMS arousal index

Summary Statements

- Findings related to diagnosis
- EEG abnormalities
- ECG abnormalities
- Behavioral observations
- Sleep hypnogram

Sleep Summary

- EEG Data: sleep architecture & arousals

Sleep Summary – Whole Night:

Time at Lights Off	21:50:57	Sleep Onset Latency (SL)	27.8 min.
Time at Lights On	05:50:42	Number of Stage N1 Shifts	36
Total Recording Time (TRT)	479.8 min.	Number of Stage Shifts	206
Sleep Period Time (SPT)	452.0 min.	Number of Awakenings	17
Total Sleep Time (TST)	413.5 min.		
Sleep Efficiency (SE)	86.2%	REM Latency	141.0 min.

Sleep Stage Summary – Whole Night:

Stage	Duration (min)	% TST	% SPT	Latency (min)
WASO	38.5	-	8.5	-
Stage N1	30.0	7.3	6.6	0.0
Stage N2	242.0	58.5	53.5	2.0
Stage N3	64.5	15.6	14.3	22.5
Stage REM	77.0	18.6	17.0	141.0

Sleep Continuity – Whole Night:

Source of Arousals	NREM Count	NREM Index	REM Count	REM Index	Total Count	Total Index
Spontaneous	0	0.0	0	0.0	0	0.0
Apneas / Hypopneas	72	12.8	31	24.2	103	14.9
RERAs	45	8.0	7	5.5	52	7.5
Snoring	0	0.0	0	0.0	0	0.0
PLM / Limb Movements	0	0.0	0	0.0	0	0.0
Total Arousals	117	20.9	38	29.6	155	22.5

Sleep Summary

- Events by sleep stage & position

Respiratory Summary – Pre-Treatment:

Types of Respiratory Events		
Respiratory Events	Number	Index
Obstructive Apneas	65	22.3 /hr
Mixed Apneas	0	0.0 /hr
Central Apneas	0	0.0 /hr
Total Apneas	65	22.3 /hr
Total Hypopneas*	48	16.5 /hr
Apneas + Hypopneas*	113	38.9 /hr

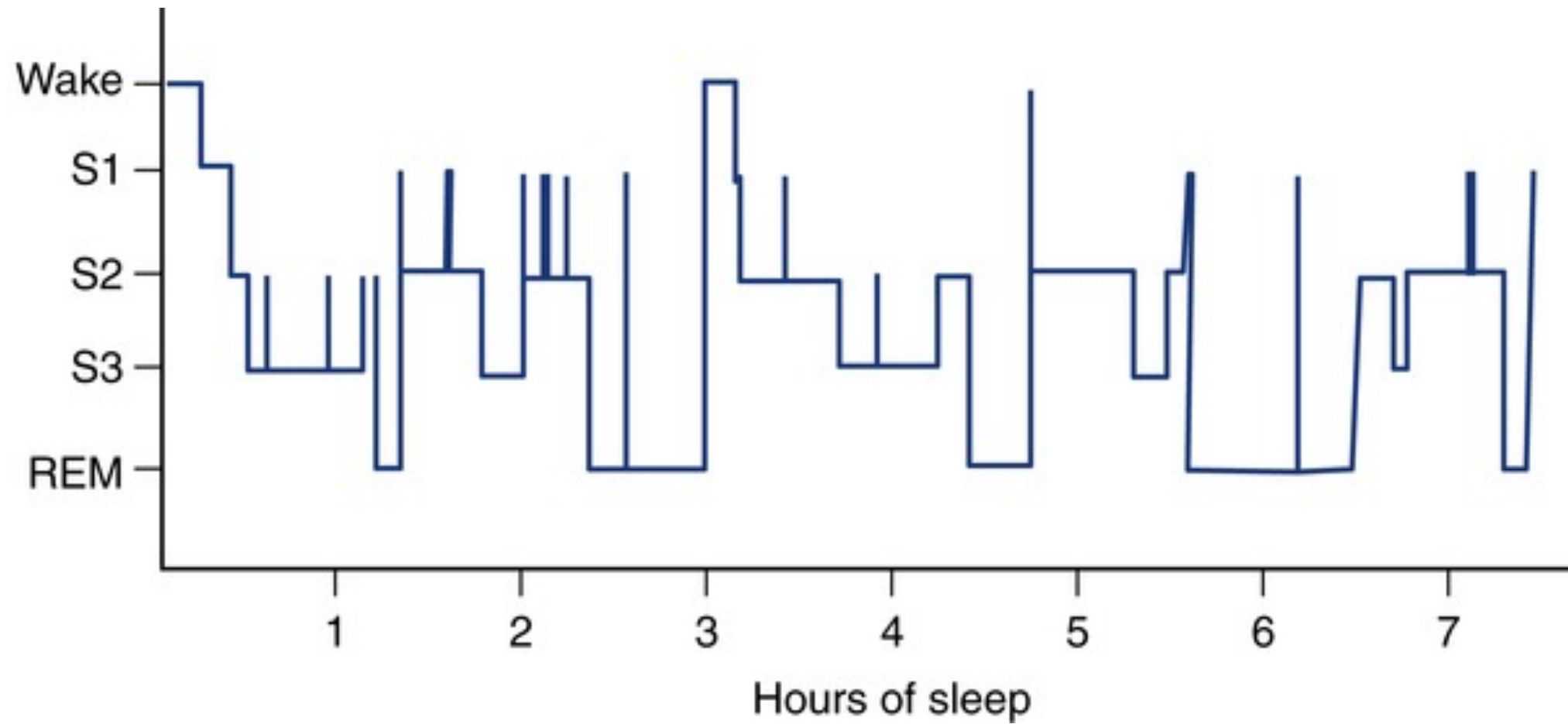
Respiratory Effort Related Arousal (RERA) Events		
Parameter	Total	Index
Total:	24	8.3
Non-REM:	23	8.3
REM:	1	6.7
Supine:	24	8.3
Lateral:	N/A	N/A
Prone:	N/A	N/A

Oxygen Saturation Summary – Pre-Treatment:

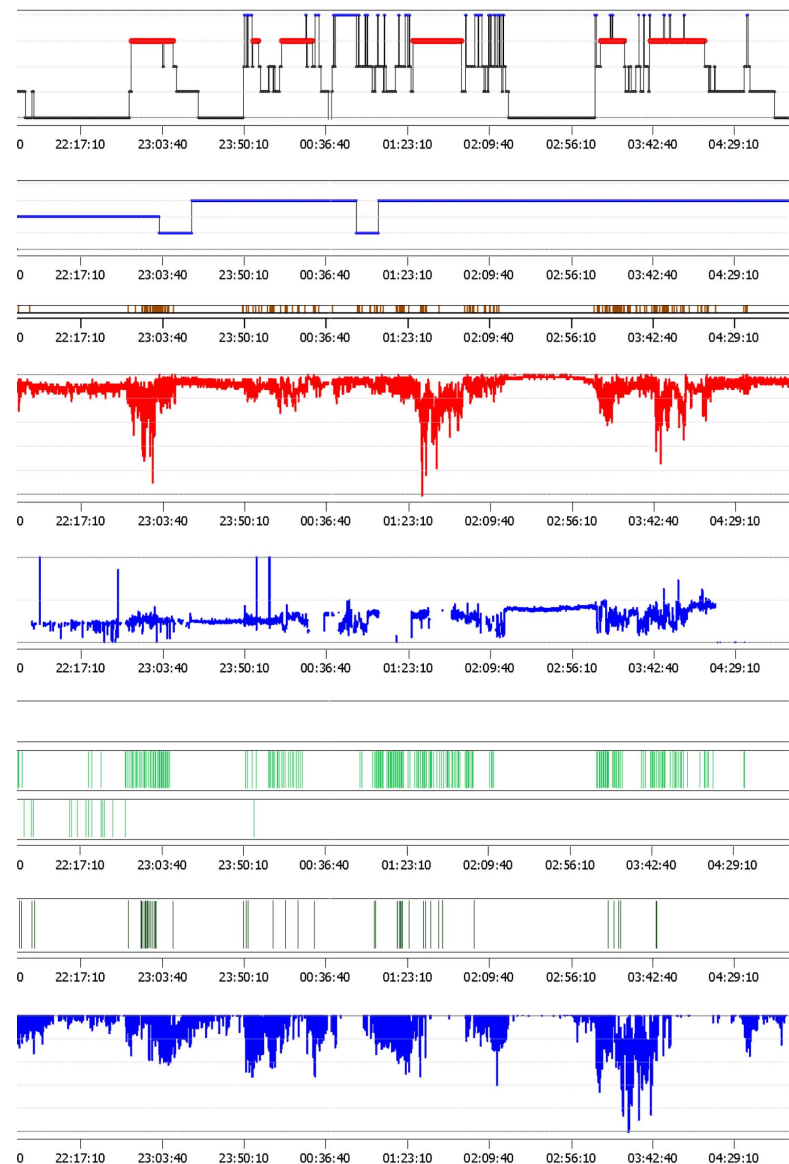
Mean SaO₂: 95.2%
% TST SaO₂ < 90%: 2.3%
% TST SaO₂ < 89%: 1.7%
Minutes SaO₂ < 90%: 4.0
Minutes SaO₂ ≤ 88%: 5.5

Lowest SaO₂: 79.0%
Desaturation 4% or >: 91
Desaturation Index: 31.3
NREM Desaturations Index: 28.6
REM Desaturations Index: 80.0

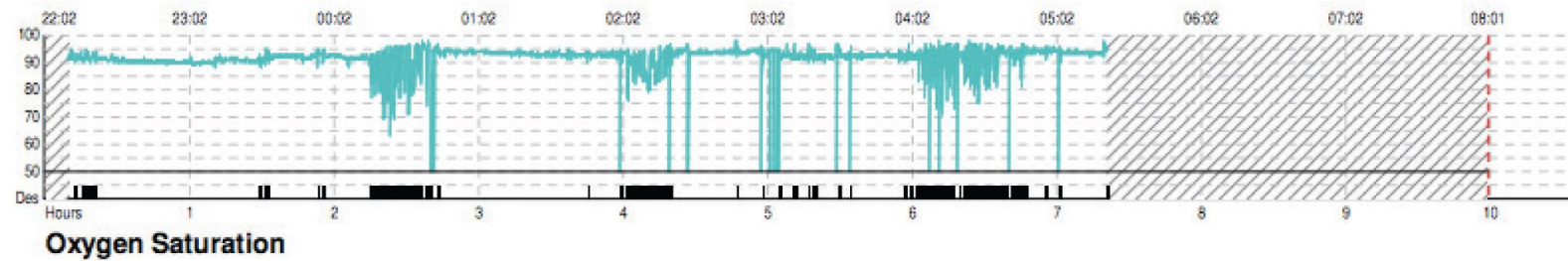
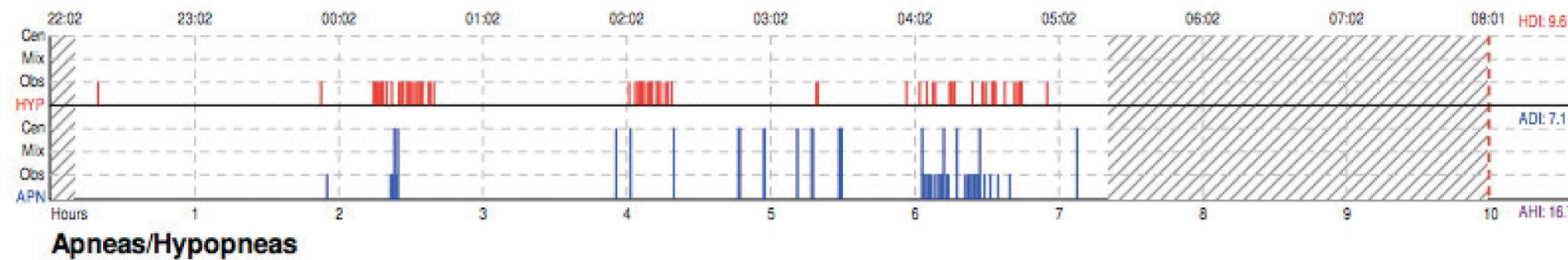
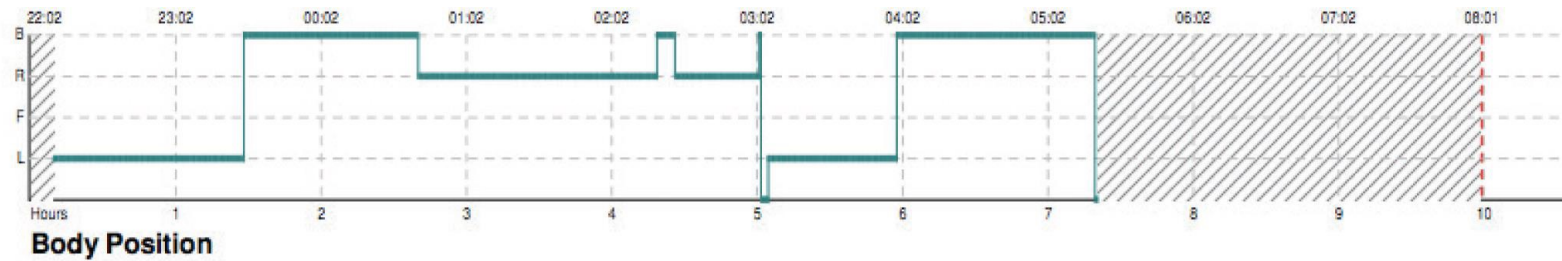
Histograms



Histograms



Histograms



Dictated Summary

- Findings related to sleep diagnosis:
 - Patient history and indications for the study
 - Description of monitoring parameters and recording montage
 - Description of sleep architecture
 - Respiratory events and O2 saturation levels
 - PLMs
 - Arousals
- Cardiac events
- Other events (EEG abnormalities, parasomnias, behavioral observations)
- Impression
- Comments
- Recommendations

Technologist Comments

- Tech notes can add further insight into the study
 - What is the patient's physical and emotional status?
 - Audible breathing or snoring sounds
 - Any atypical findings not evident in the scoring data
 - Alpha intrusion
 - Medication effects
 - Atypical motor activity during REM
 - Parasomnia-like activity
- Tech notes typically should be for the reading physician and not distributed to insurers, referral sources, or DME/homecare vendors

Data Archiving and Storage

- Data must be stored for a period of time
 - Typically 7 years
 - Regulated by state statutes
- Archiving involves removing data and video/audio recording to a remote server for access by the interpreter
 - Long-term archiving is on a large file server with off-site backup
 - Other options are on external hard drives or CD/DVD media
 - Should copy data rather than move data when archiving
 - Safety net to prevent loss of data due to corruption during transfer
 - Move process deletes data from original source as the transfer is being completed so higher risk of data loss
 - Check integrity of data on the archival medium before deleting original