

Obstructive Sleep Apnea (OSA) versus Alveolar Hyperventilation Syndrome (AHS)

Dr Alison Bentley MBBCh PhD

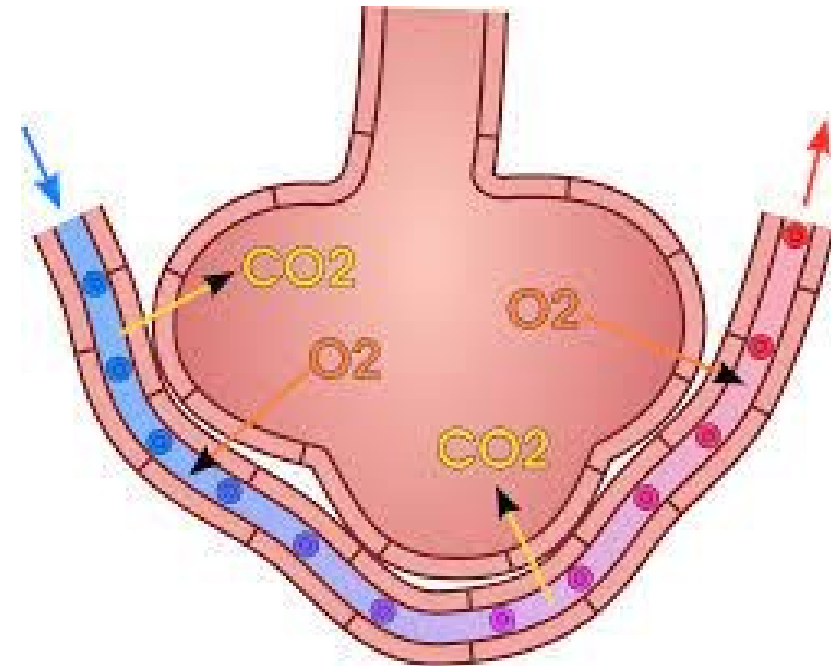
Restonic Ezintsha Sleep clinic

Parktown, Johannesburg



Disclaimer

- I know a fair bit about obstructive sleep apnea but last did alveolar hypoventilation when teaching physiology to second years
- No experience on diagnosing and managing alveolar hyperventilation
- Only have nocturnal data
- Imposter syndrome ++



Comparison

Obstructive sleep apnea

- Only diagnosed during sleep
- Pathogenesis – Pharyngeal collapse
- More likely in obese patients
- Usually diagnosed on oximetry readings

Alveolar hyperventilation

- Usually diagnosed during the day
- Pathogenesis – restriction of inspiration
- More likely in obese patients
- Usually diagnosed on CO₂ levels

Causes

Obstructive sleep apnea

Obesity

Supine Position

Jaw / tongue abnormalities

Nasal obstruction

Gastric reflux

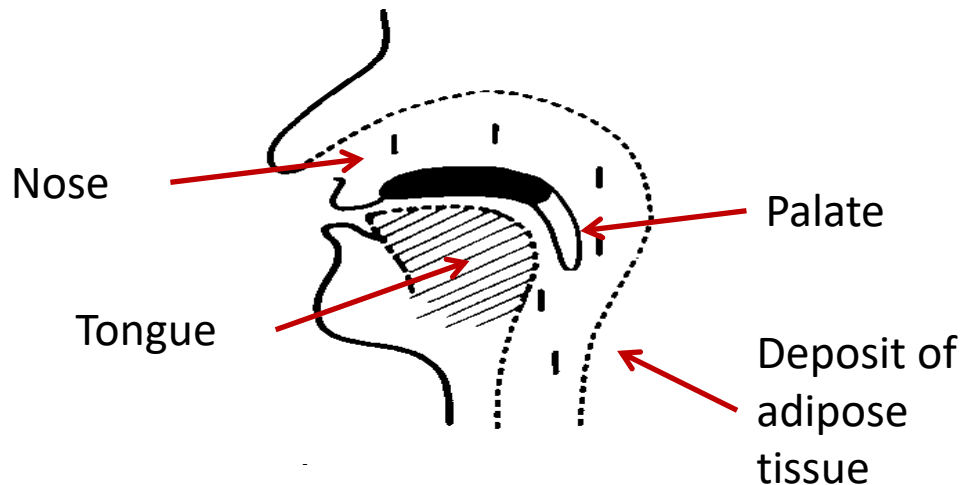
Low pharyngeal muscle tone - age

Alveolar hypoventilation

Obesity

Neuromuscular disorders

Restrictive lung disorders



Signs and Symptoms

Obstructive sleep apnea

Obesity

Snoring

Witnessed apneas

Hypertension

Nocturnal polyuria / headaches

Daytime sleepiness

Alveolar hypoventilation

(Obesity)

Dyspnea / laboured breathing

Cyanosis

Morning headaches

Daytime drowsiness / fatigue

Diagnostic Options

Obstructive sleep apnea only

Intermittent hypoxia can recover to baseline
24% South Africans aged 39-69 have AHI >15
per hour (*Benjafield 2019*)

Alveolar hyperventilation only

Drop in saturation baseline
1 in 3 obese pts OHS n

Overlap syndrome – both

1 in 6 OSA pts – OHS (*Goyal 2020*)
50% of OSA pts have sleep
hypoventilation (*Braganza 2020*)

OSA – STOP-BANG Questionnaire

- Four questions – all yes / no:
 - 1. Snoring:** Do you snore loudly (louder than talking or loud enough to be heard through closed doors?)
 - 2. Tired:** Do you often feel tired, fatigued or sleepy during daytime? (ALV HYP)
 - 3. Observed:** has anyone observed you stop breathing during your sleep?
 - 4. Blood Pressure:** Do you have or are you being treated for high blood pressure?

Examination

- Add to history – stop-bang
- **B**MI – independent predictor of OSA ($>30\text{kg,m}^{-2}$) (ALV HYP)
- **A**ge (>50 years),
- **N**eck circumference (>43 cm men and >41 cm women) and
- **G**ender - male

5 or more positive in men and 4 or more positive in women high predictor ($>80\%$) of positive finding for OSA

Epworth Sleepiness Scale

ESS scores drop from 16 to 8 in OHS with NIV (C-Pontarollo 2007)

How likely are you to doze off or fall asleep in the following situations after you've had your usual nights sleep: (circle one number for each)

	Would never doze	Slight chance	Moderate chance	High chance
a. Sitting and reading	0	1	2	3
b. Watching television	0	1	2	3
c. Sitting inactive in a public place	0	1	2	3
d. Passenger in a car for an hour without a break	0	1	2	3
e. Lying down to rest in the afternoon	0	1	2	3
f. Sitting and talking to someone	0	1	2	3
g. Sitting quietly after lunch with no alcohol	0	1	2	3
h. In a car, while stopped for a few Minutes in the traffic	0	1	2	3

>10/24 is pathological sleepiness

Home-Based Apnea Study

- Recognised to be as good as an overnight study if just looking for presence and severity of apnea
 - Don't get hung up on errors in AHI – 40 AHI with a 10% error is still severe and doesn't change management
- SASSH guidelines for reporting:
 - Total recording time
 - Total estimated sleep time (if possible)
 - AHI (apnea-hypopnea index) – central and obstructive as per international criteria
 - ODI (oxygen desaturation index) – usually measuring desaturations of 4% or more.
 - Minimum and mean oxygen saturation
 - Changes in AHI with changes in body position (particularly supine)
 - **Trend lines for all channels on one page**

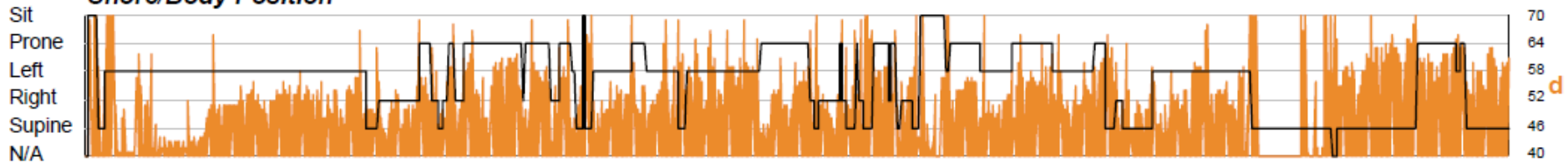
Obstructive Sleep Apnea Only

PAT Respiratory Events



AHI 96 per hour

Snore/Body Position

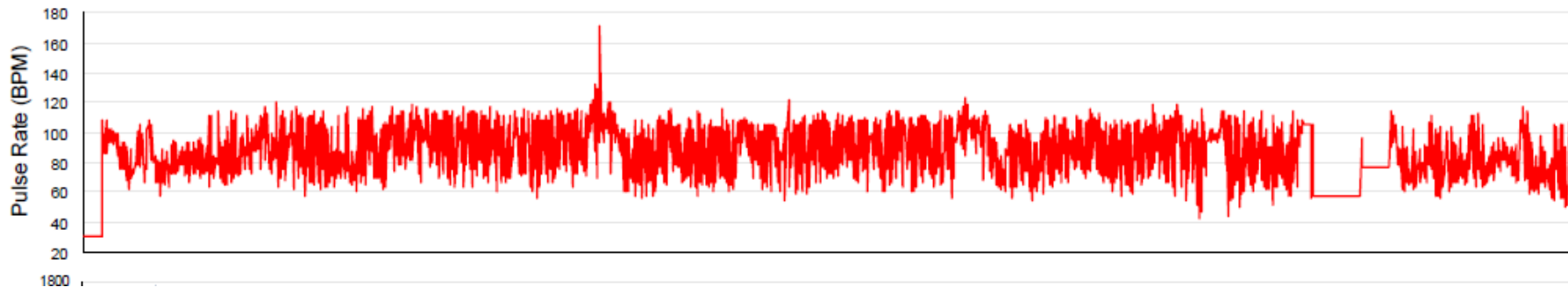
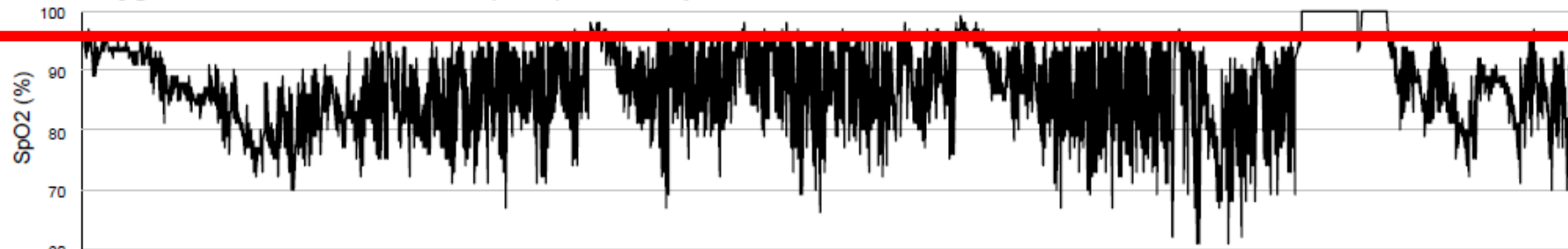


Mean sat 85%

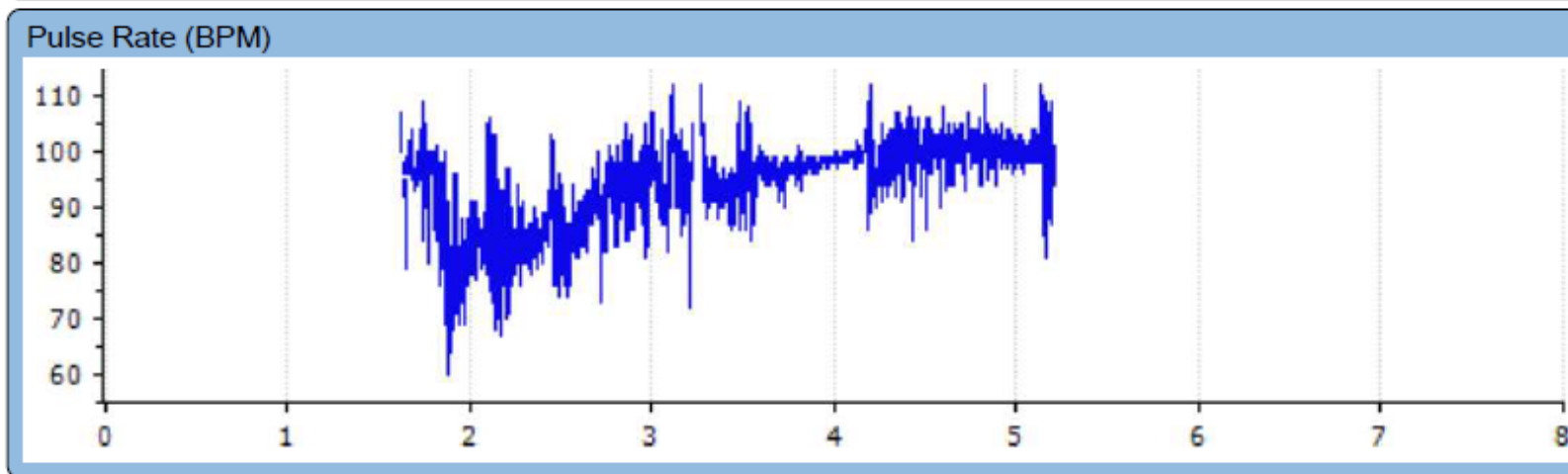
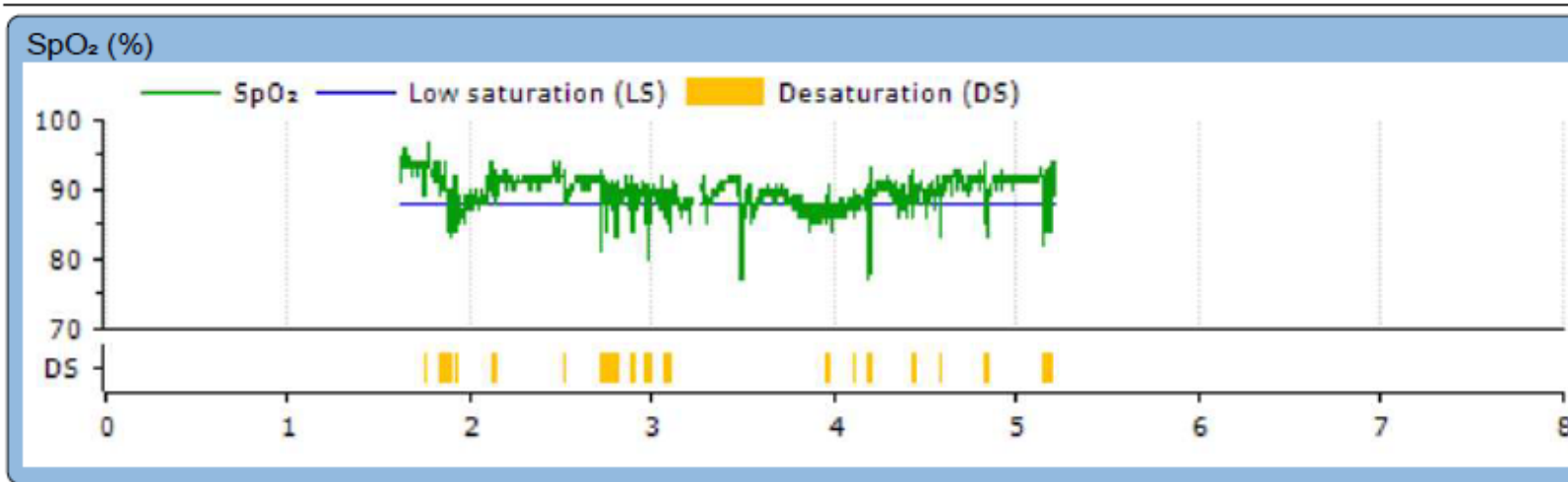
Min Sat 61%

>90% 32%

Oxygen Saturation: / Pulse Rate (BPM) / PAT Amplitude



Treated with CPAP – Return to Baseline



Time Spent in SpO₂ Range

AHI 4 per hour

ODI 11 per hour

Mean saturation 90%

Minimum saturation
77%

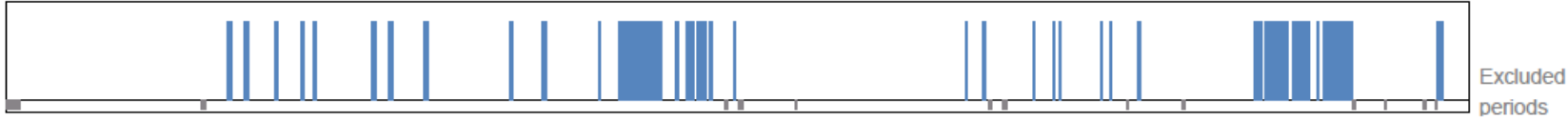
AHI 96 per hour

Mean sat 85%

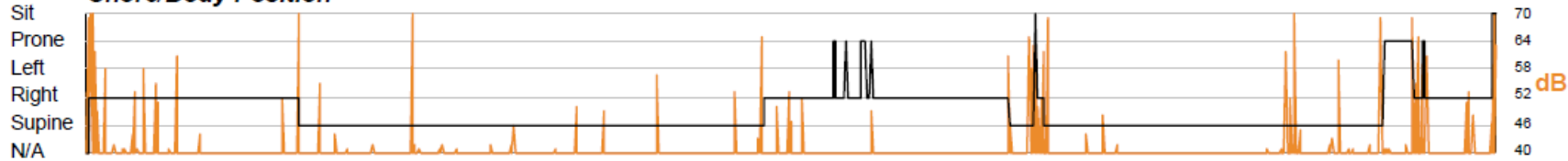
Min Sat 61%

Hypoventilation > Apnea

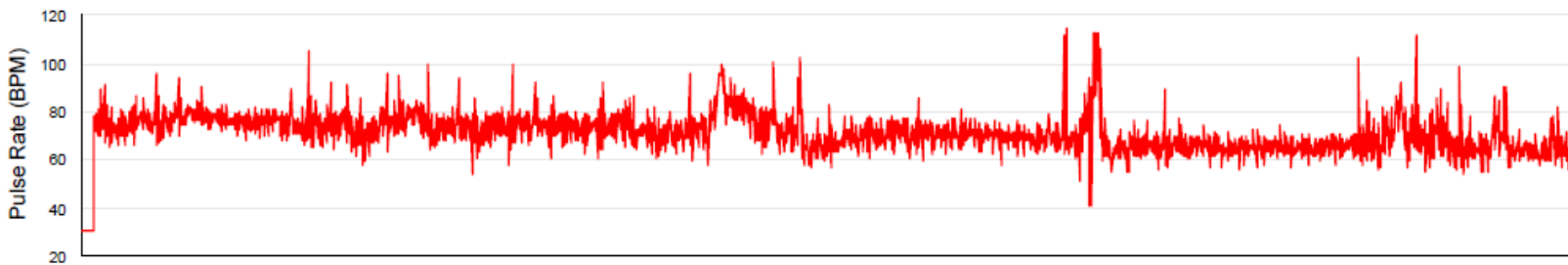
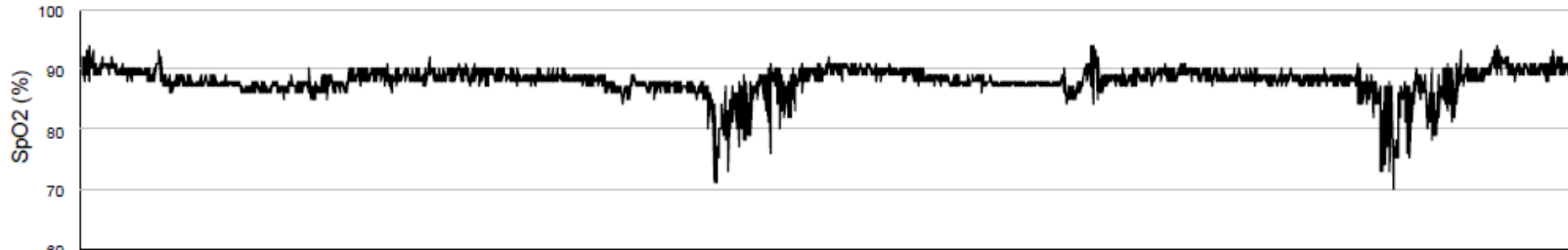
PAT Respiratory Events



Snore/Body Position



Oxygen Saturation: / Pulse Rate (BPM) / PAT Amplitude



AHI 9 per hour

Mean saturation 87%

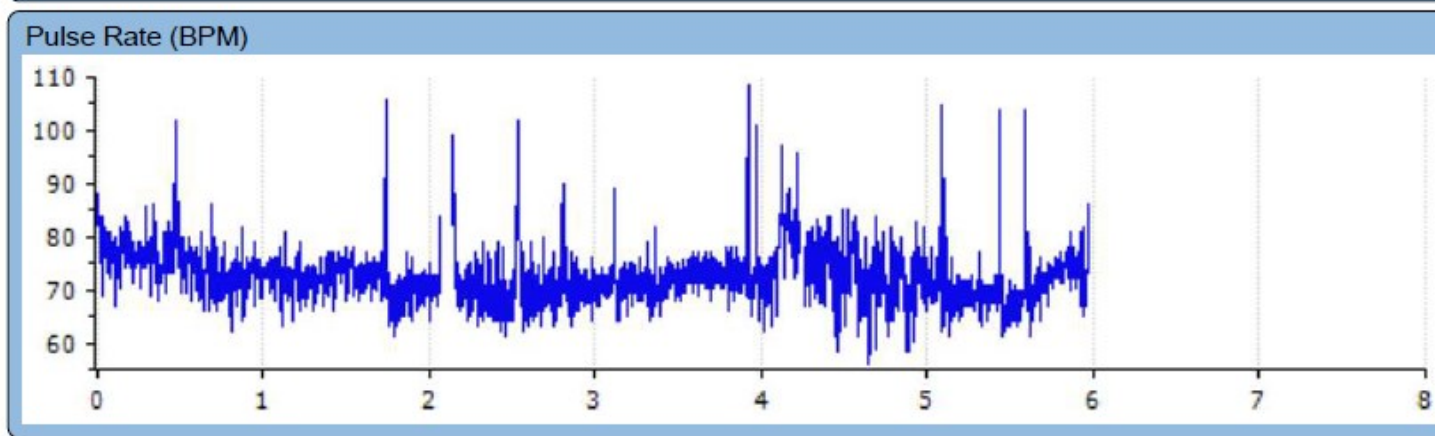
Min sat 70%

17% over 90%

BMI 44 kg.m⁻²

40 years old

On CPAP



Mean saturation 90%

Min saturation 84%

% over 90% 96%

AHI 9 per hour

Mean saturation 87%

Min sat 70%

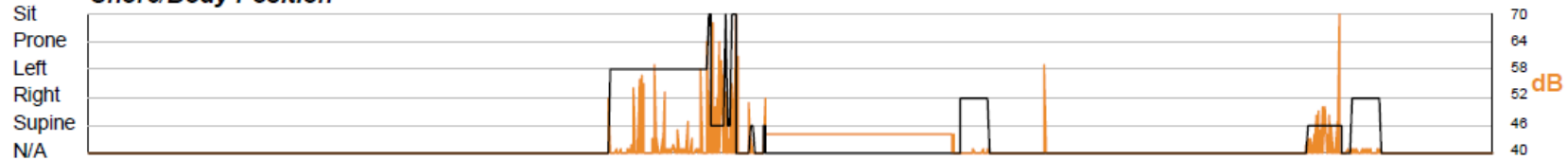
17% over 90%

Overlap Syndrome

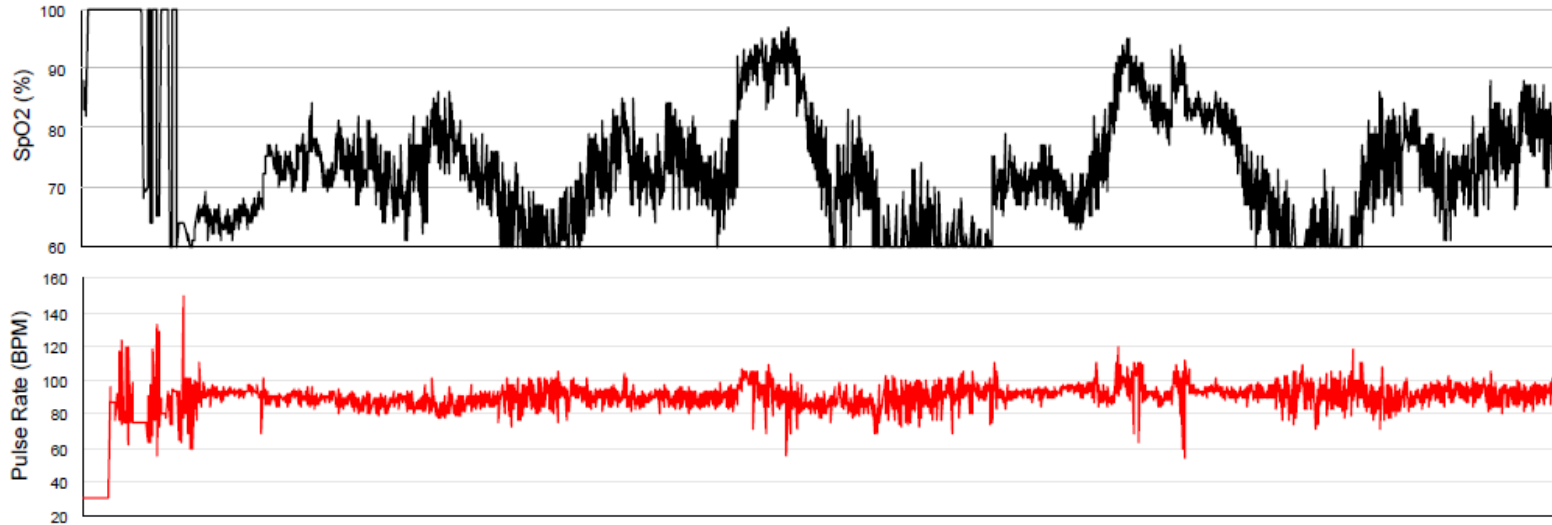
PAT Respiratory Events



Snore/Body Position



Oxygen Saturation: / Pulse Rate (BPM) / PAT Amplitude



AHI – 71 per hour

Mean saturation – 72%

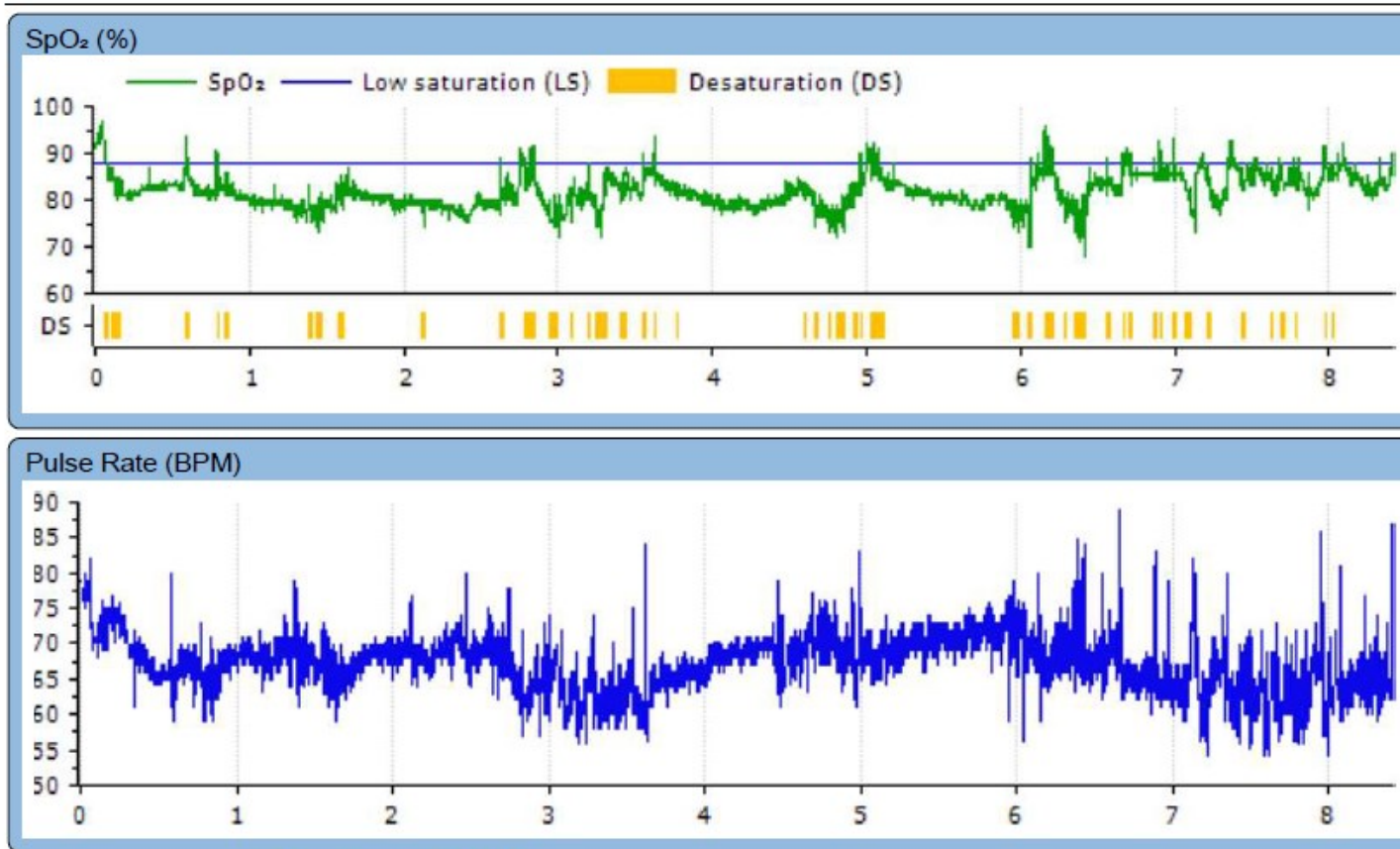
Min 51%

17% over 90%

52 years old

BMI – 48 kg.m⁻²

Not Enough Improvement on CPAP



Mean saturation 82%

Min saturation 68%

% over 90% - 4%

AHI – 2 per hour

AHI – 71 per hour

Mean saturation – 72%

Min 51%

17% over 90%

Why is the Overlap Important?

- Different treatments:
 - OSA – nasal CPAP
 - Hypoventilation – supplemental oxygen
- More likely to have cardiac complications. hospital admissions, higher health costs
- Nasal CPAP more likely to fail in overlap disease (*Braganza et al 2020*)
- Severity of daytime hypoventilation does not predict severity of nocturnal hypoxia (*Berry 2009*)



Conclusion

- All patients with symptoms suggestive of nocturnal apnea
 - Waking, snoring, apneas, headaches, nonrestorative sleep, EDS should be
- screened for OSA
 - STOP BANG questionnaire
 - Epworth sleepiness scale
- If high risk - have a home-based apnea diagnostic study – as good technically as possible and ask for all the data
- Oximetry is essential during the CPAP titration
- If oxygen saturation does not return to normal with nasal CPAP
 - Add supplemental oxygen to the CPAP
 - Or Non-invasive ventilation