Obstructive Sleep Apnea:

From Risk to Results

Arthur Jones, EdD, RRT

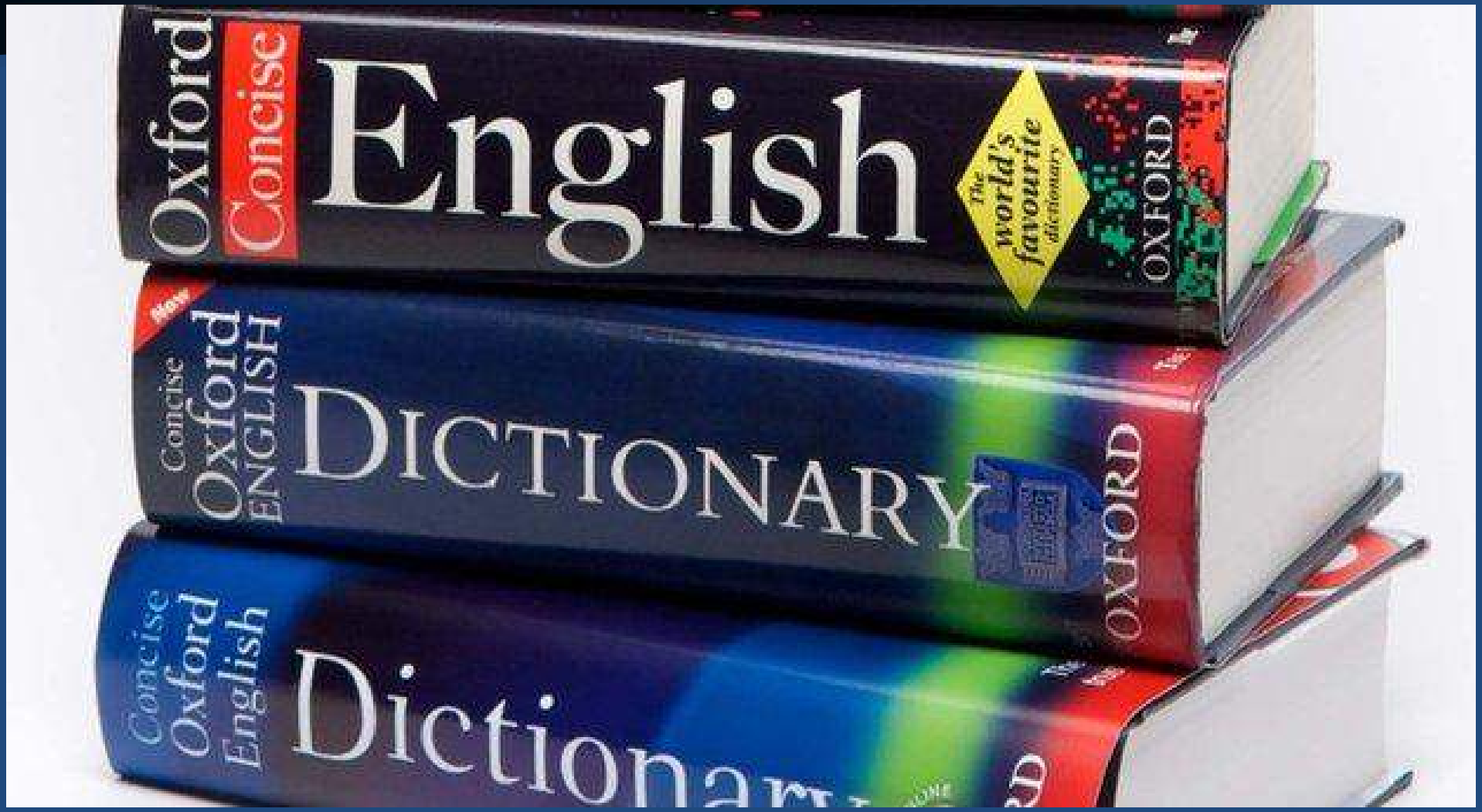
Keith Varnes, RRT, RRT-NPS, RRT-ACCS, AE-C

This Presentation is Approved for
1 CRCE Credit Hour

Learning Objectives

- Describe the epidemiology, risk factors and complications of obstructive sleep apnea (OSA)
- Explain the pathophysiology of OSA.
- Identify the manifestations of OSA
- Describe diagnostic techniques applied to OSA.
- Outline management techniques for OSA, including strategies to increase patient compliance.

Definitions



Obstructive Sleep Apnea

What is it?

Central Sleep Apnea

What is it?

Central/Obstructive Sleep Apnea

Definitions

- **Hypopnea**
- **Apnea**

OSA

AHI

- Mild 5-14
- Moderate 15-29
- Severe ≥ 30

ODI / RDI

- RERAs

Epidemiology & Burden

Prevalence 10–30%, underdiagnosed

Higher in men, post-menopausal women

Obesity, craniofacial anatomy, ethnic factors

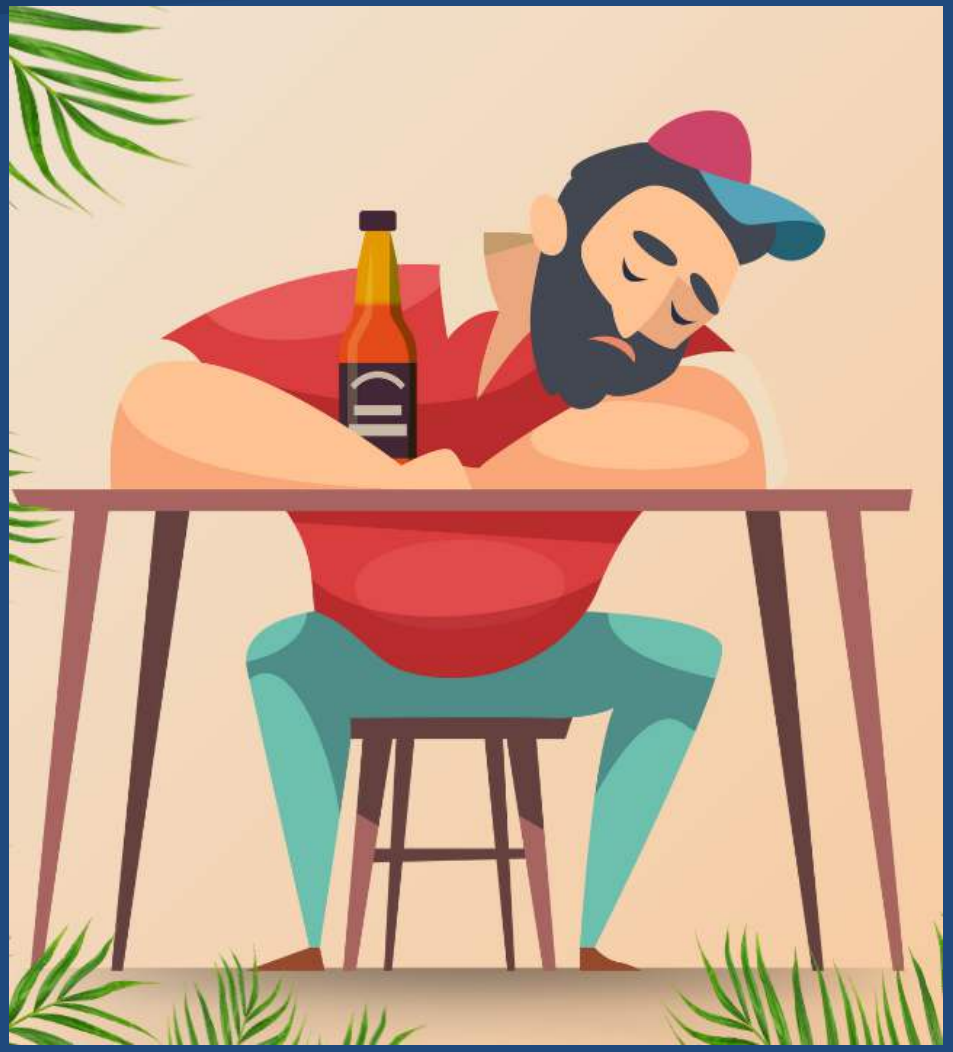
Economic & societal impact

Non-Modifiable Risk Factors

- **Age**
- **Sex**
- **Family History**
- **Race**

Modifiable Risk Factors

- Obesity/Pregnancy
- Alcohol/Sedatives
- Smoking
- Nasal obstruction
- Shift workers

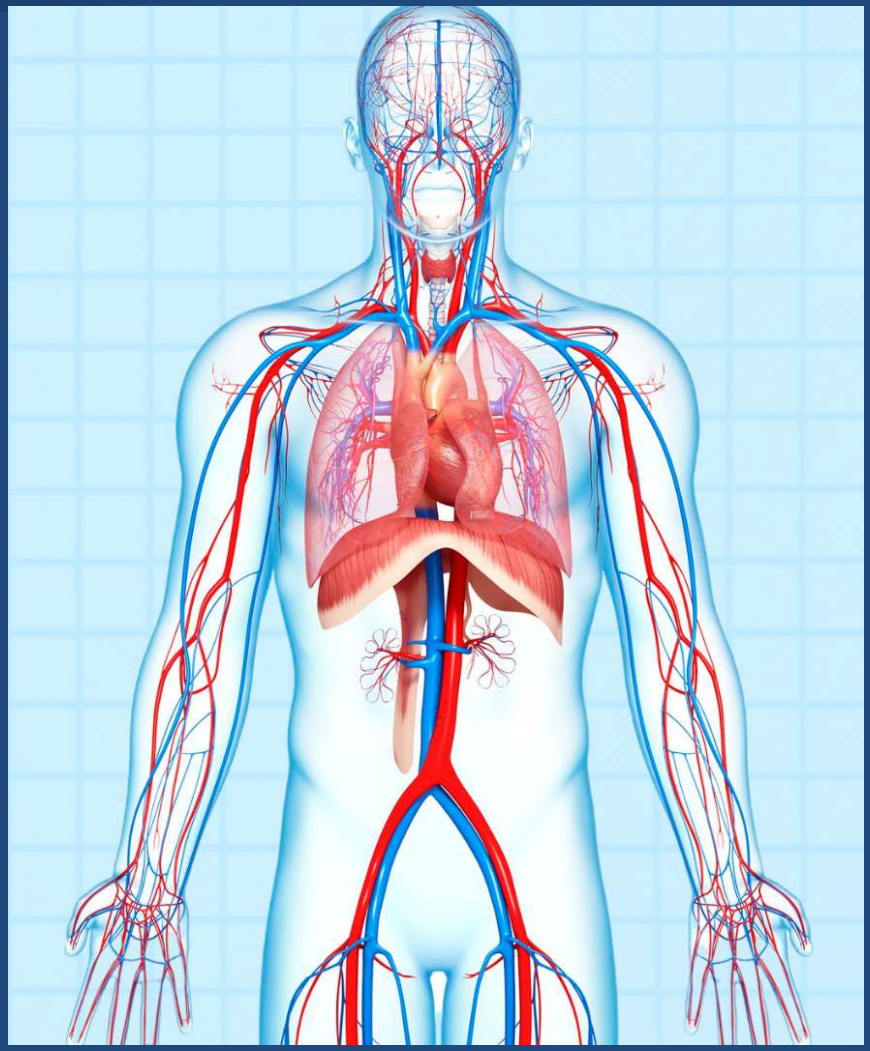


Anatomic/Physiologic Contributors

- Craniofacial abnormalities
- Brachycephaly
- Micrognathia
- Macroglossia
- Large neck circumference

Complications: Why OSA Matters

- **Cardiovascular**
  - **Hypertension**
  - **CAD & MI**
  - **Arrhythmias**
  - **Heart Failure**
  - **Stroke/CVA**
  - **Pulmonary Hypertension**

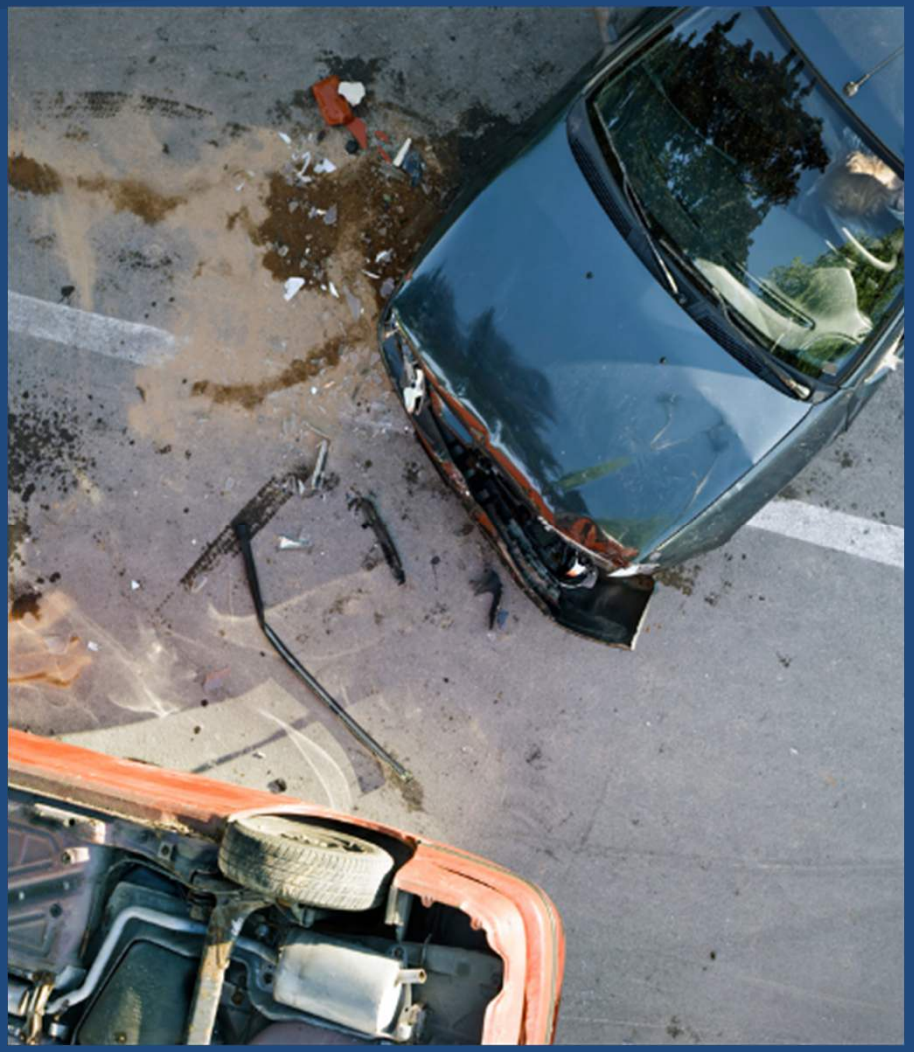


Complications: Why OSA Matters

- **Metabolic**
  - **Insulin Resistance and T2DM**
  - **Oxidative stress**
  - **Vasodilator Response**
  - **Metabolic syndrome**
  - **Dyslipidemia**
  - **Nonalcoholic fatty liver disease**
  - **Weight gain & Hormonal dysregulation**

Complications: Why OSA Matters

- **Neurocognitive & Safety**
  - **Daytime sleepiness**
  - **Mood disorders**
  - **Impaired concentration/fatigue**
  - **Crash risk**



Complications: Why OSA Matters

- Other items
  - Nocturia
  - Sexual dysfunction
  - headaches
  - GERD
  - Perioperative risk

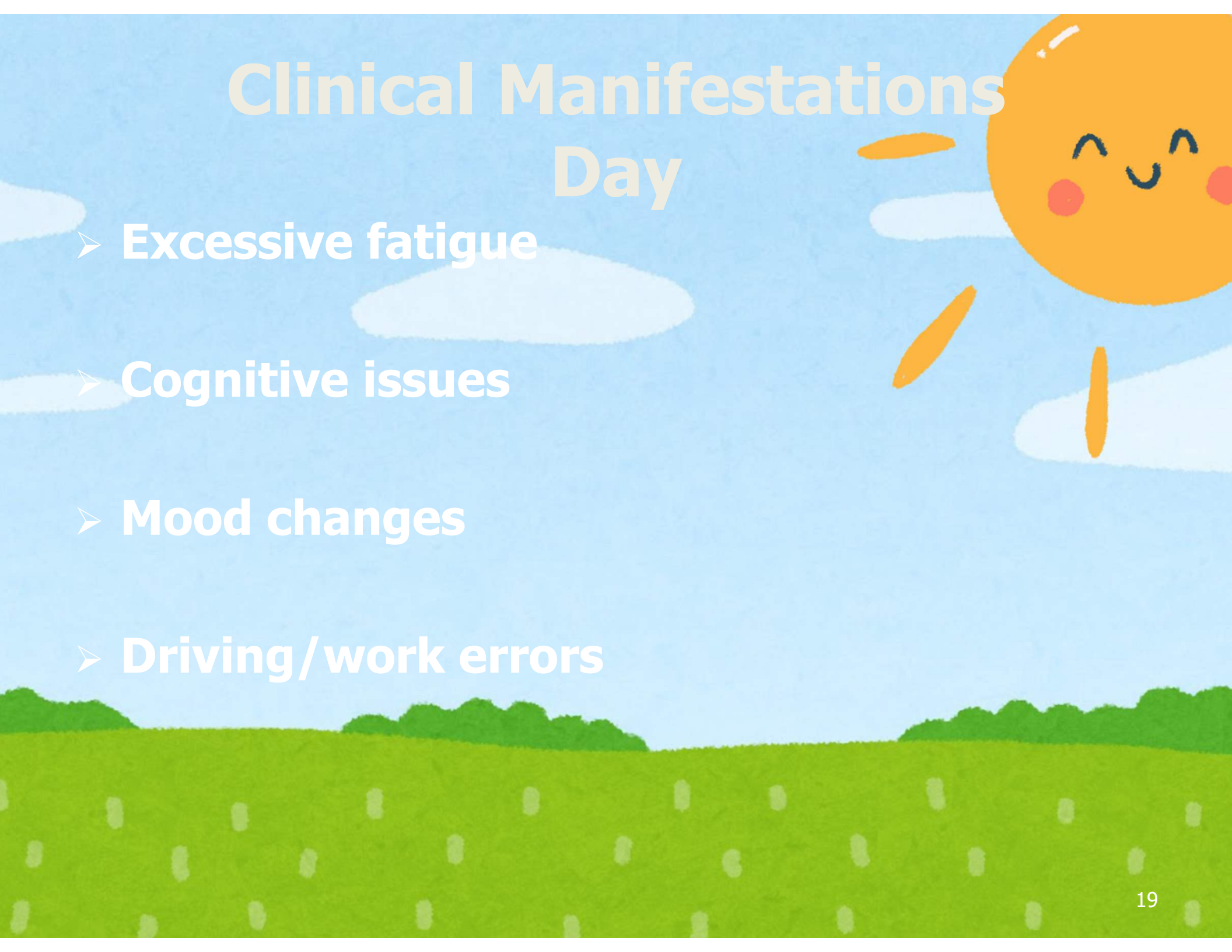
Complications: Why OSA Matters

Clinical Manifestations Night

- Loud snoring
- Restless sleep
- Dry mouth
- Morning headache

Clinical Manifestations Day

- **Excessive fatigue**
- **Cognitive issues**
- **Mood changes**
- **Driving/work errors**



Epworth Sleepiness Scale

EPWORTH SLEEPINESS SCALE (ESS)

Patient name:	
Date:	

Situation:	Would never doze (0)	Slight chance of dozing (1)	Moderate chance of dozing (2)	High chance of dozing (3)
1. Sitting and reading	○	○	○	○
2. Watching TV	○	○	○	○
3. Sitting, inactive in a public place (e.g., a theatre or a meeting)	○	○	○	○
4. As a passenger in a car for an hour without a break	○	○	○	○
5. Lying down to rest in the afternoon when circumstances permit	○	○	○	○
6. Sitting and talking to someone	○	○	○	○
7. Sitting quietly after a lunch without alcohol	○	○	○	○
8. In a car, while stopped for a few minutes in traffic	○	○	○	○

Calculate Total Score: | Previous score: | Date:

Interpretation:

Score	
0-9	Normal (a low score does not exclude significant daytime sleepiness)

Pathophysiology

Normal Sleep Patterns

- 4-6 cycles per night
- 90-110 min/cycle
- 4 stages each cycle
- Non-REM/REM

Normal Sleep Patterns

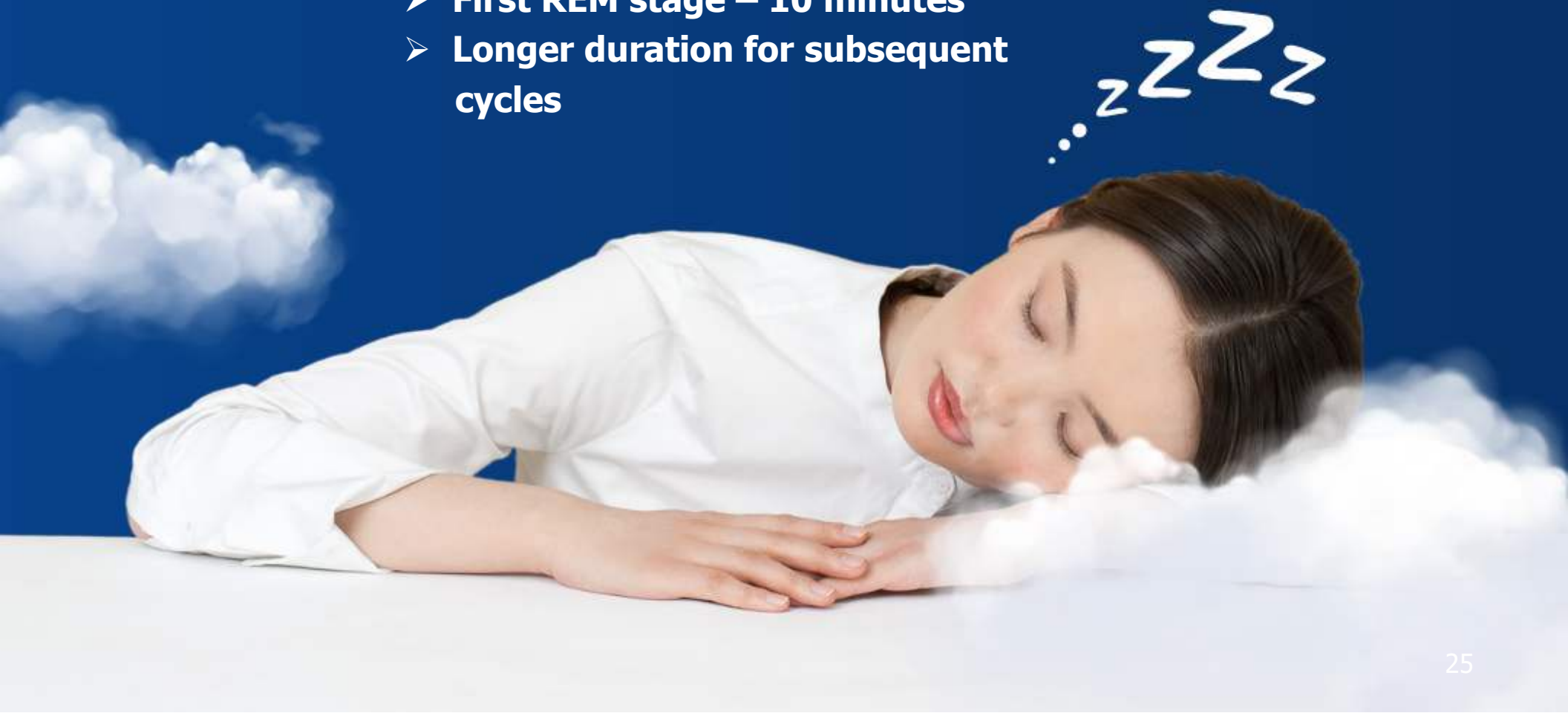
- **Non-REM (NREM) Stages**
  - **Stage One – dozing**
  - **Stage Two – light sleep**
  - **Stage Three – deep sleep (slow wave)**

Normal Sleep Patterns

- **Non-REM (NREM) Stages**
  - **Slow (delta) EEG waves**
  - **Reduced sympathetic tone = < HR & BP**
  - **Deep Sleep = Regular, slow breathing**
  - **pCO2 > 5**
  - **pO2 < 5**

Normal Sleep Patterns

- **REM Sleep**
  - **Increased HR, RR**
  - **Muscular paralysis**
  - **First REM stage – 10 minutes**
  - **Longer duration for subsequent cycles**



Manifestations

Sleep Apnea

- **Central**
  - **Absence of ventilatory effort**
  - **Absence of flow**
- **Obstructive**
  - **Presence of effort**
  - **Absence of flow**
- **Mixed**

Symptoms

- Snoring – disruptive 70% predictive
- Witness apnea – >85% predictive
- Sleep complaints
  - Insomnia
  - Disrupted sleep
  - Daytime somnolence

Symptoms

- **Cognitive deficits**
- **Sexual dysfunction**
- **Gastroesophageal reflux (GERD)**

Clinical Signs

- Obesity
- Large neck circumference
  - Male ≥ 17 inches
  - Females ≥ 15 inches
- Airway abnormalities
  - Sever nasal obstruction
  - Low-hanging soft palate
  - Large (hypertrophied) uvula
  - Enlarges tonsils or adenoids
  - Macroglossia

Manifestations – Severe OSA

- Loud snoring, witnessed apneas, daytime sleepiness
- Systemic hypertension
- Pulmonary hypertension (in advanced cases)
- Right ventricular failure /Cor Pulmonale (if hypoxemia is severe)
- Polycythemia
- Obesity is common but not required

Diagnosis

Screening in Clinic

- **STOP-BANG (Snoring, Tired, Observed apnea, Pressure, BMI, Age, Neck, Gender)**
- **Berlin questionnaire**
- **NoSAS**
- **ESS (sleepiness severity, not diagnostic)**

Diagnostic Pathway

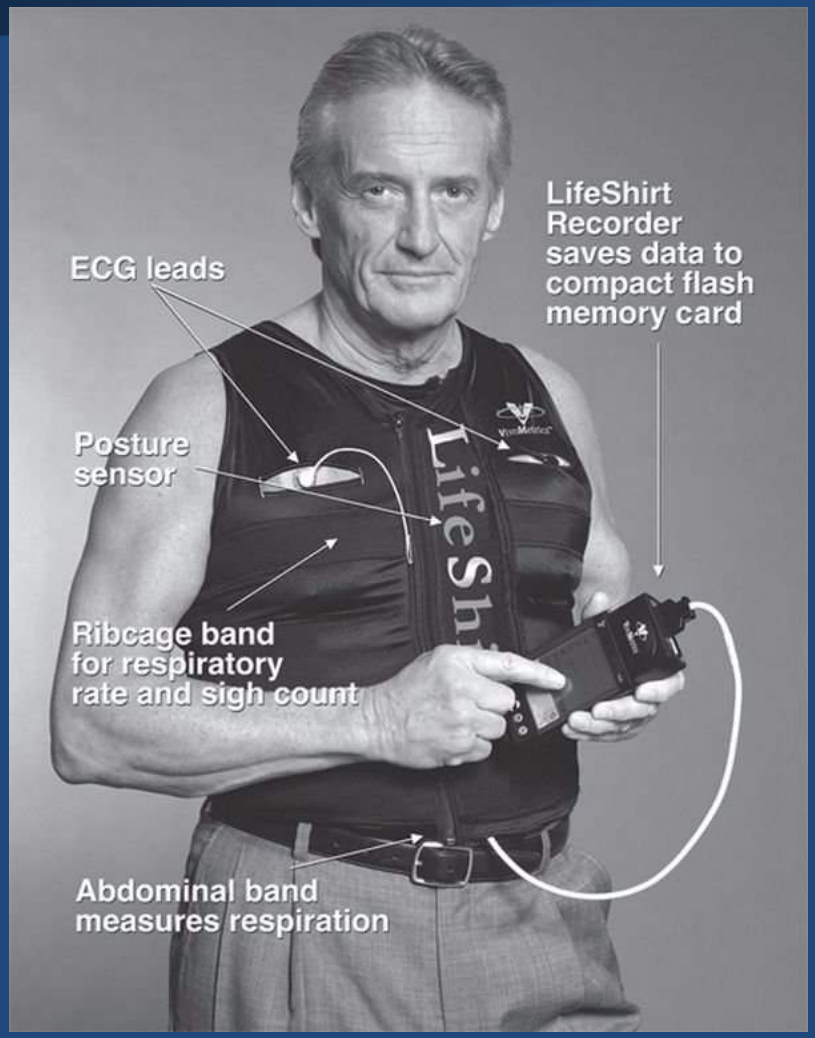
- **Gold standard – in lab polysomnography (PSG)**
  - **EEG**
  - **EOG**
  - **EMG**
  - **RIP**
  - **Airflow**
  - **SpO2**
  - **ECG**
  - **Leg Movements**
- **Home Sleep Apnea Testing (HSAT/Type III)**

Comparison of Sleep Study Types

Test Type	Channels Measured	Sleep Staging	Best Use Case	Limitations
In-lab PSG (Type I)	EEG, EOG, EMG, ECG, airflow, effort, SpO_2, leg movements	Yes (gold standard)	All sleep disorders; comprehensive evaluation	Expensive, resource-intensive
Portable PSG (Type II)	Same as PSG but done at home	Yes	Full PSG at home when lab not feasible	Rarely used; complex setup
HSAT Type III	≥4: airflow, effort, SpO_2, HR ± snoring/position	No (estimates REI from recording time)	Moderate–high suspicion of uncomplicated OSA	Misses central events; underestimates severity
HSAT Type IV	1–2: oximetry ± airflow	No	Screening only; limited utility	Low accuracy; high false negatives

In-Lab Study

Home Study


LifeShirt Recorder saves data to compact flash memory card
ECG leads
Posture sensor
Ribcage band for respiratory rate and sigh count
Abdominal band measures respiration

Home Study

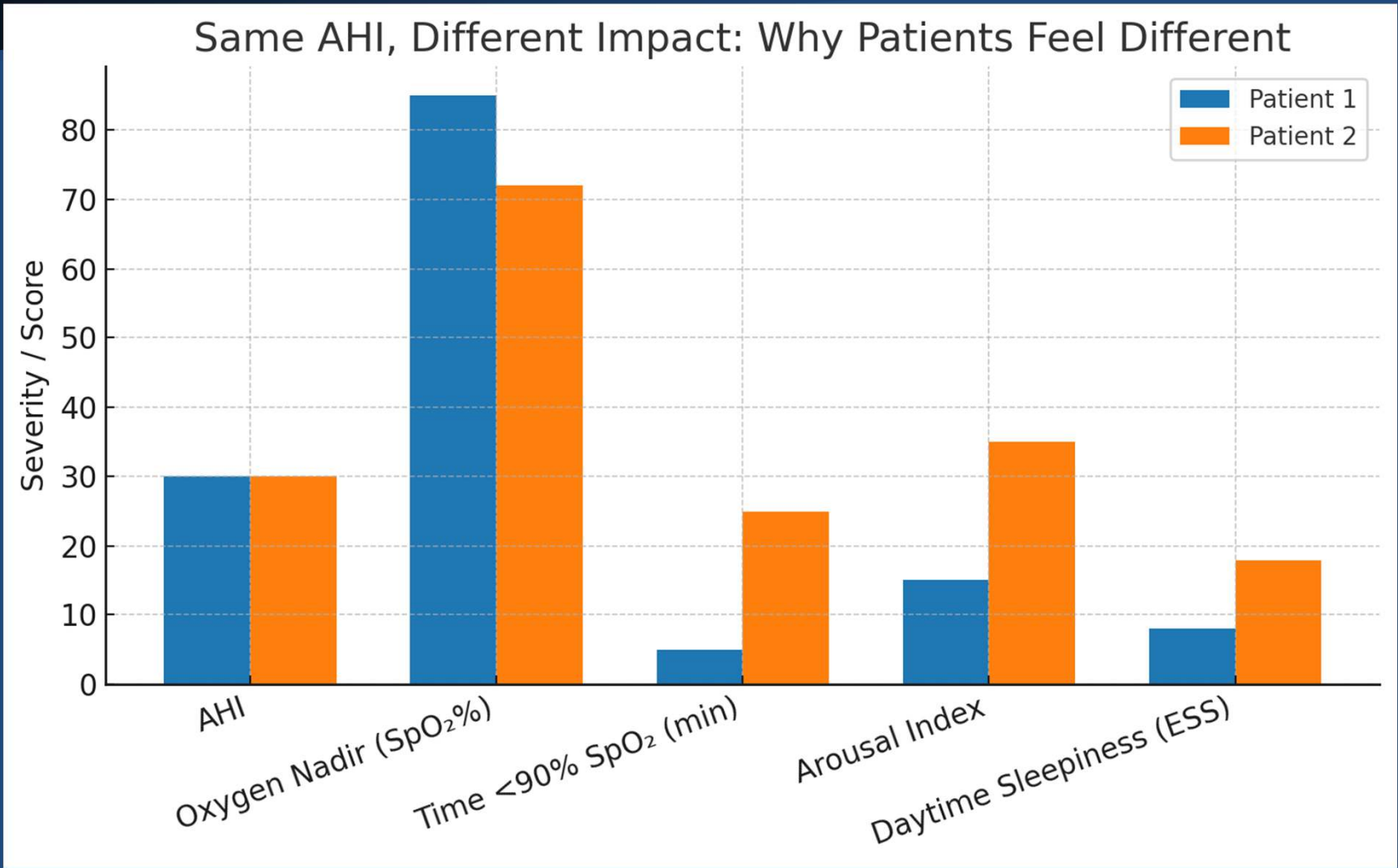
Home Monitoring

Home Monitoring

Interpreting Results

- **AHI**
  - **Mild 5-15/hr**
  - **Moderate 15-30/hr**
  - **Severe >30/hr**

Interpreting Results



Management

Management

- **Central Sleep Apnea**

  Low level oxygen
  carbon dioxide
  Respiratory stimulants
    - **Acetazolamide (carbonic anhydrase inhibitor)**
    - **Theophylline (methylxanthine)**
    - **Progesterone / Medroxyprogesterone**
    - **Caffeine**
    - **Doxapram (rare/experimental)**

  NIPPV w/ backup rate

Management

- **Obstructive/Mixed Sleep Apnea**
  - **Weight loss**
  - **Medications – rare for OSA**
  - **Oral appliances – mandibular advancement splints**

Management

- **Obstructive/Mixed Sleep Apnea**
  - **Tracheostomy**
  - **Reconstructive surgery**
    - **Maxillomandibular advancement**
    - **Uvulopalatopharyngoplasty (UPPP)**
    - **pharyngeal flap (rare)**
    - **radiofrequency ablation or tongue reduction**
    - **tonsillectomy**

Management

- **Obstructive/Mixed Sleep Apnea**
  - **CPAP**
  - **BiPAP**
  - **APAP**

Management - Appliances

Barriers

- **Discomfort with interface**
- **Claustrophobia**
- **Nasal congestion**

Management

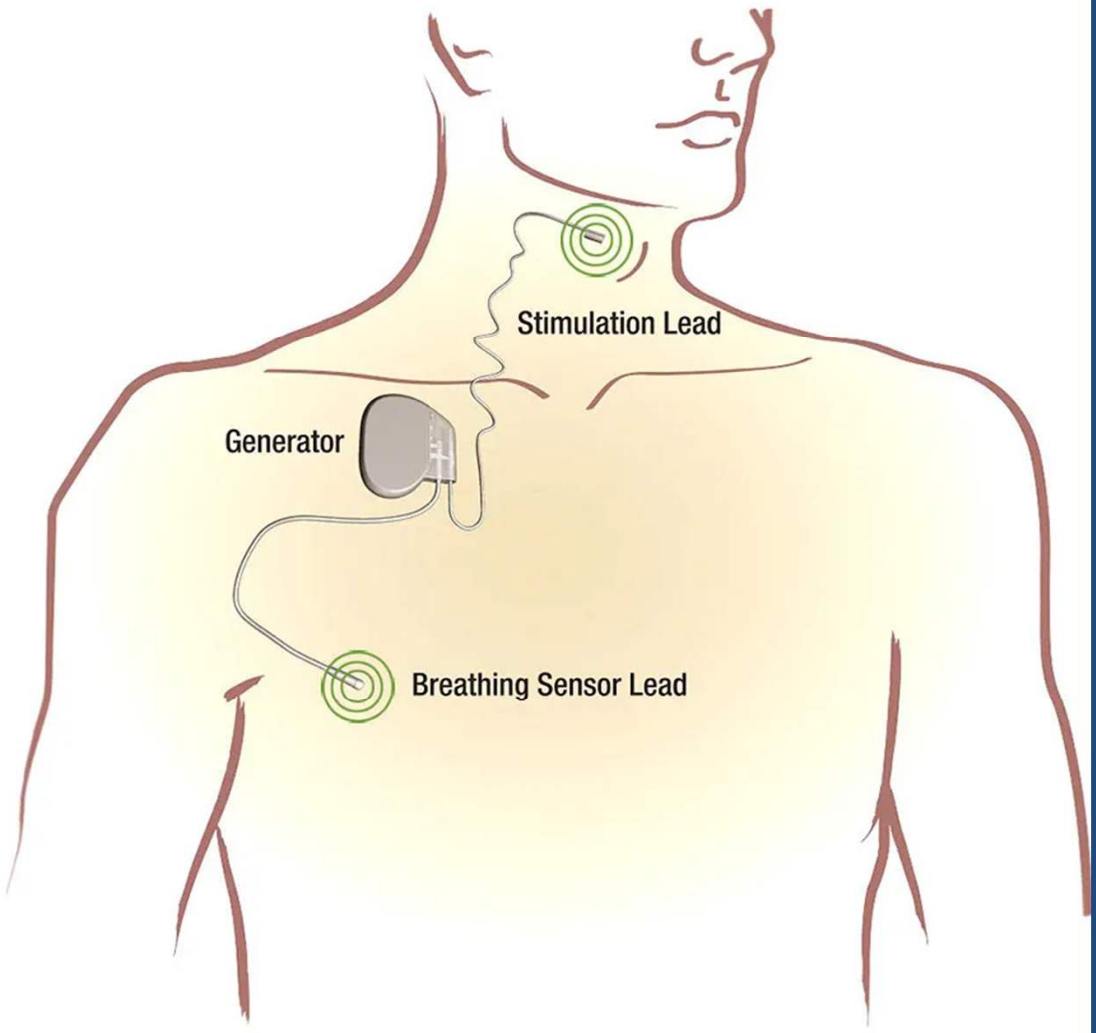
Management

Management

ULTepap

Inspire


6.5hr
Inspire


Stimulation Lead
Generator
Breathing Sensor Lead

Sommetrics aerSleep

Summary & Review

- **Epidemiology**
  - **Definitions**
  - **Prevalence**
  - **Risk factors**
  - **Complications**

Summary & Review

- **Pathophysiology**
  - **Normal sleep cycles, stages**
  - **Obstructive apnea events**

- **Manifestations**
  - **Types of sleep apnea**
  - **Symptoms**
  - **Signs**

Summary & Review

- **Diagnosis**
  - **Screening questionnaires**
  - **Polysomnography**
  - **Unattended**
  - **Cutoff scores**

Summary & Review

- **Management**
  - **Weight loss**
  - **Oral appliances**
  - **Surgical interventions**
  - **Noninvasive ventilatory support**
  - **Compliance issues**
  - **New technologies**

Take Home Messages

- **OSA is Common**
- **Consequential**
- **Treatable**
- **Don’t use AHI Alone**
- **PAP is effective**

The End