Home Sleep Testing

Systems for diagnosing SDB

- Level I
- Level II
- Level III
- Level IV

Considerable evidence indicates that home sleep testing for SDB can be as specific and as reliable as sleep laboratory–based PSG recordings in properly referred patients

Not recommend

- *Restless legs syndrome*
- *Nocturnal seizures*
- *Central sleep apnea*
- *REM sleep behavior disorder*
- *Neuromuscular disease*
- *Severe pulmonary disease*
- *Congestive heart failure*

Increased pretest probability

- *Loud and irregular snoring*
- • Observed or reported nocturnal cessation of breathing
- • Excessive daytime sleepiness
- • Nonspecific mental problems such as fatigue, low performance, cognitive impairment
- • Movements during sleep
- • Morning dizziness, general headache, dry mouth
- • Impaired sexual function
- • Obesity
- • Arterial hypertension and cardiac arrhythmias

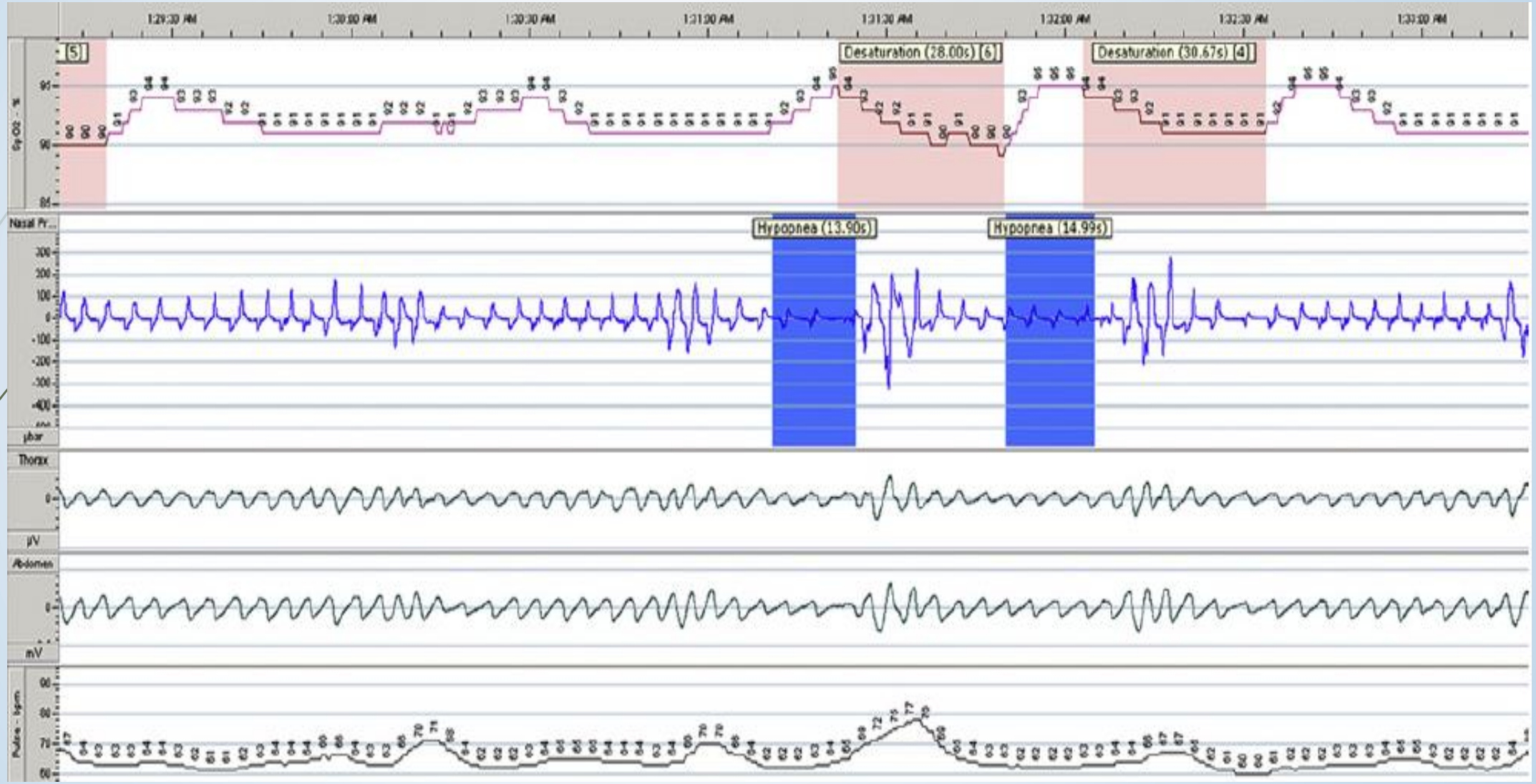
PSG AND HST DIFFERENCES

- PSG is a tool of discovery ↔ HST is a tool of verification
- Portable sleep study is that it can be conducted in patients' homes
- Quality, quantity, and position of sleep
- Portable testing may uncover clandestine sleep apnea or rem-related sleep apnea

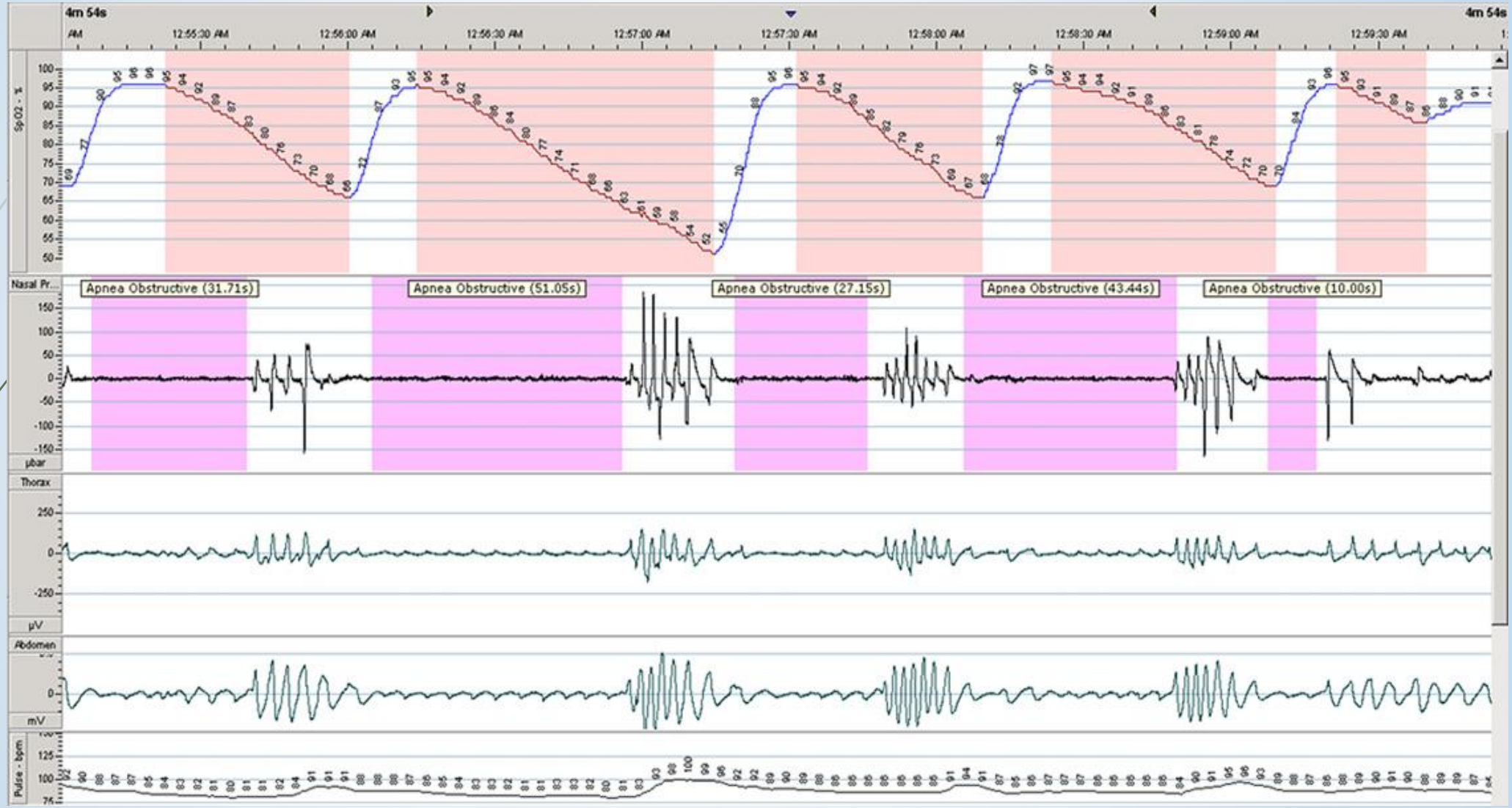
1–6 channel portable sleep apnea monitoring

- *21 surveyed European countries*
- *Widely employed in the UK and to some extent in finland, ireland, the netherlands, slovakia and spain*
- *Some countries do not use any portable monitoring at all, i.e., Belgium, Cyprus, and Lithuania*
- *Portable sleep apnea monitoring is currently reimbursed in 13 of 21 European countries*

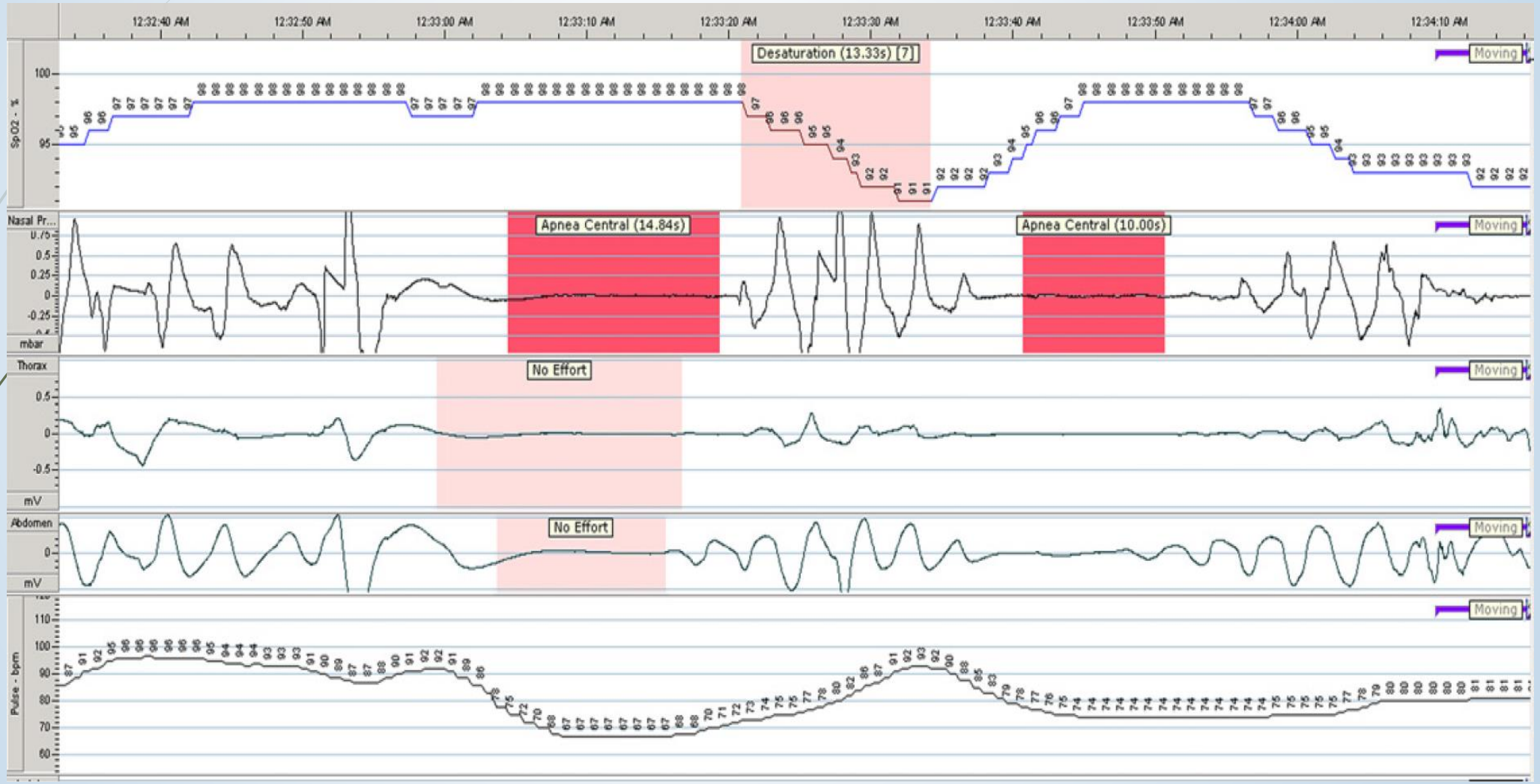
An example of hypopneas from a type 3 recording



An example of several obstructive apneas from a type 3 recording



Two central apneas from a type 3 recording



Positional sleep apnea

LIMITATIONS OF PORTABLE MONITORING

- Inability to record a sleep EEG
- Data loss caused by a lack of assembly or incorrect assembly
- Reduced signal quality
- Same-night treatment

LIMITATIONS OF PORTABLE MONITORING

- Multiple visits to the sleep center
- Underestimation of actual AHI
- May miss important incidental findings
- Trained technologist attaches, tests, and calibrates
- If a sensor detaches, it will likely remain detached
- If the patient awakens and turns on the television, there may be no way for the clinician reviewing the HST to know

Malfunction and detatchment

Good news ↔ Bad news

- The good news is that there are few ways these problems will produce false-positive test results
- The bad news is that all of these problems can decrease test sensitivity and produce false-negative tests results

INTERPRETATION

I. Inadequate to make a diagnosis

II. Compromised but adequate to diagnose some form of sleep-disordered breathing

III. Good, clearly indicating obstructive, central, or complex sleep apnea

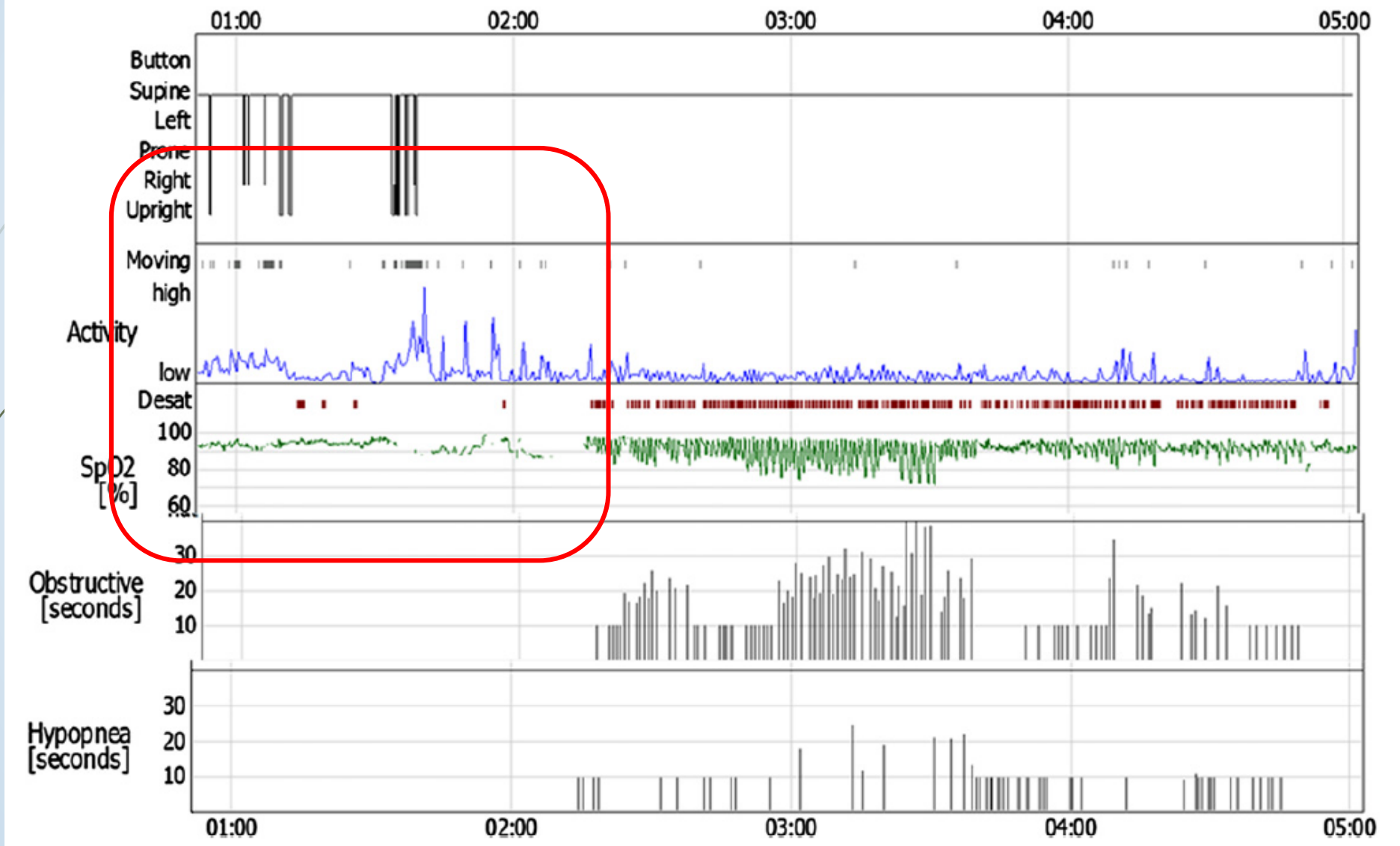
Margin of errors for AHI (or AHI corrected by interpretability index

AHI	Margin of Error
0–15	Does not meet diagnostic criteria
>15–20	High margin of error possible
>20–30	Moderate margin of error possible
>30	Low margin of error

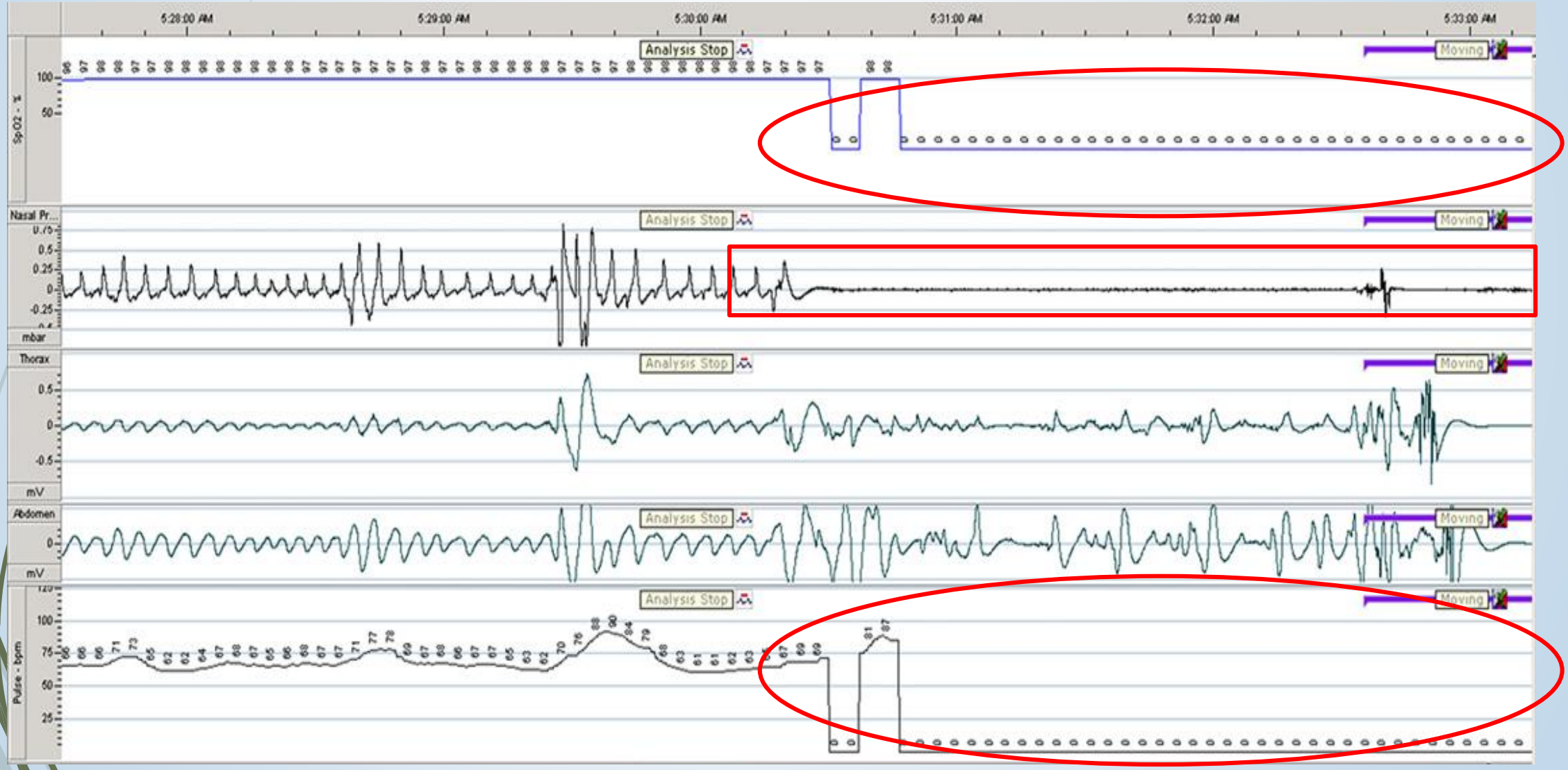
Outcomes measures

Studies that have compared in-laboratory polysomnography with home portable diagnostic testing plus CPAP auto-titration ***have found no difference in outcomes measures****, such as CPAP adherence and quality of life*

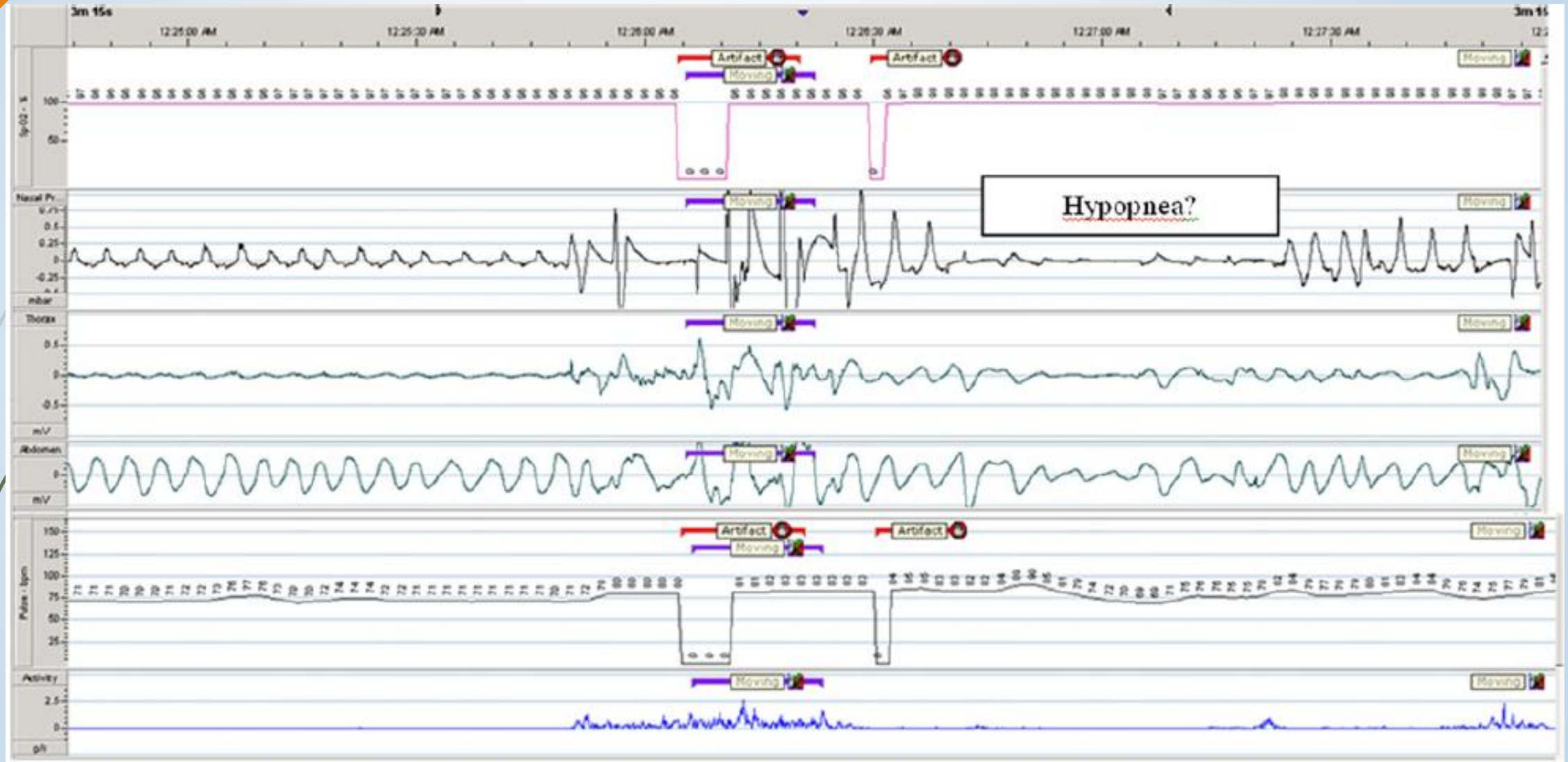
Nocturnal actigraphy from a type 3 recording



Loss of data


5:28:00 AM
5:29:00 AM
5:30:00 AM
5:31:00 AM
5:32:00 AM
5:33:00 AM
Analysis Stop
Moving
Sp02 - %
Nasal Pr...
mbar
Thorax
mV
Abdomen
mV
Pulse - bpm

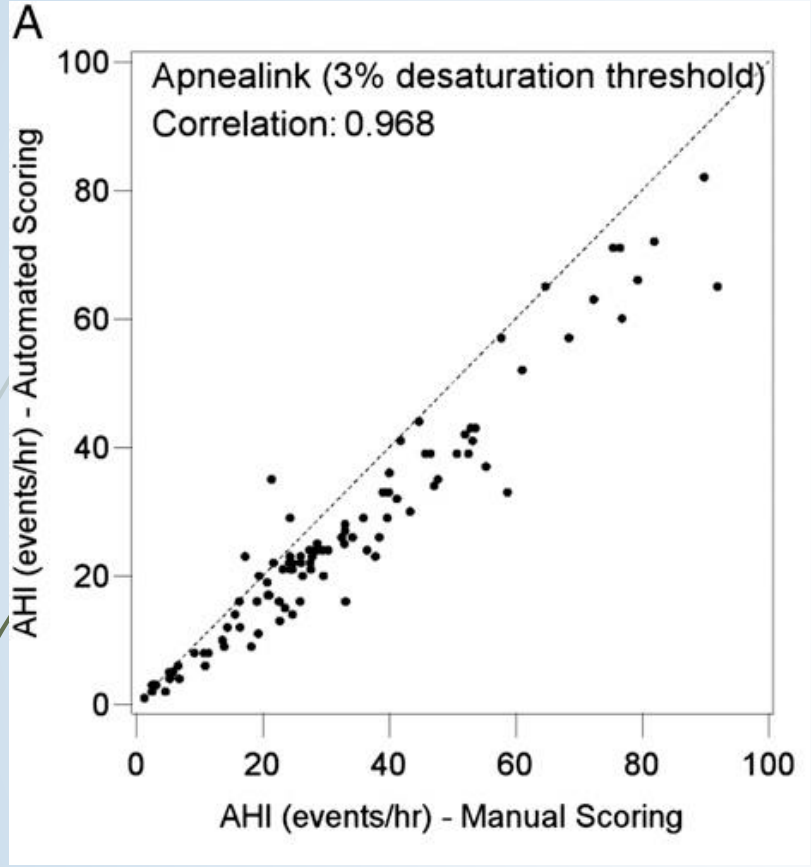
loss of data - irregular breathing effort - mouth breathing

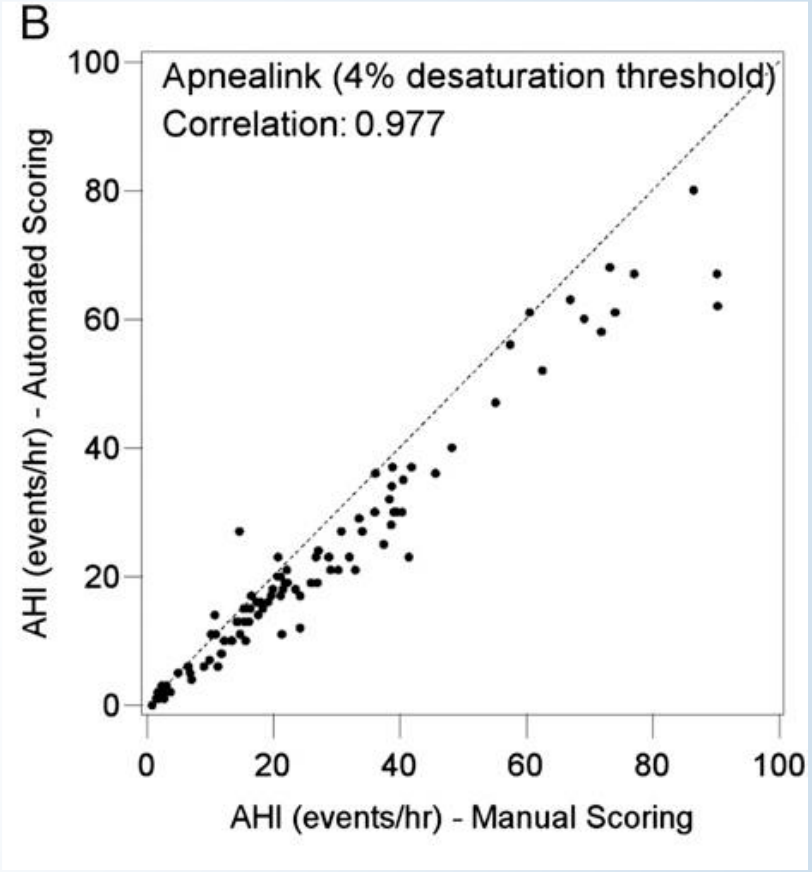


False-positive diagnoses is low

- If systems incorporate a thoughtful selection of physiologic measures, have good signal acquisition, and use a good signal processing technique
- A high pretest probability reduces the number of false-positive diagnoses

Scatter plots of automated vs manual scoring of the AHI for the ApneaLink Plus (A, B) and Embletta (C, D) monitors





Automated scoring underestimated the AHI compared with manual scoring

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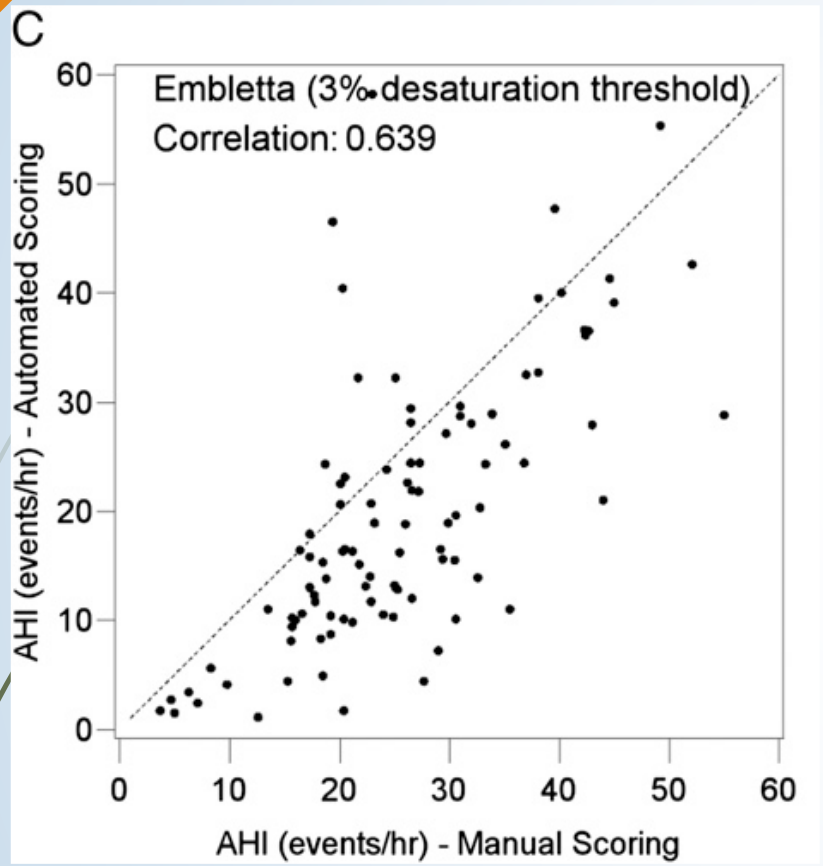
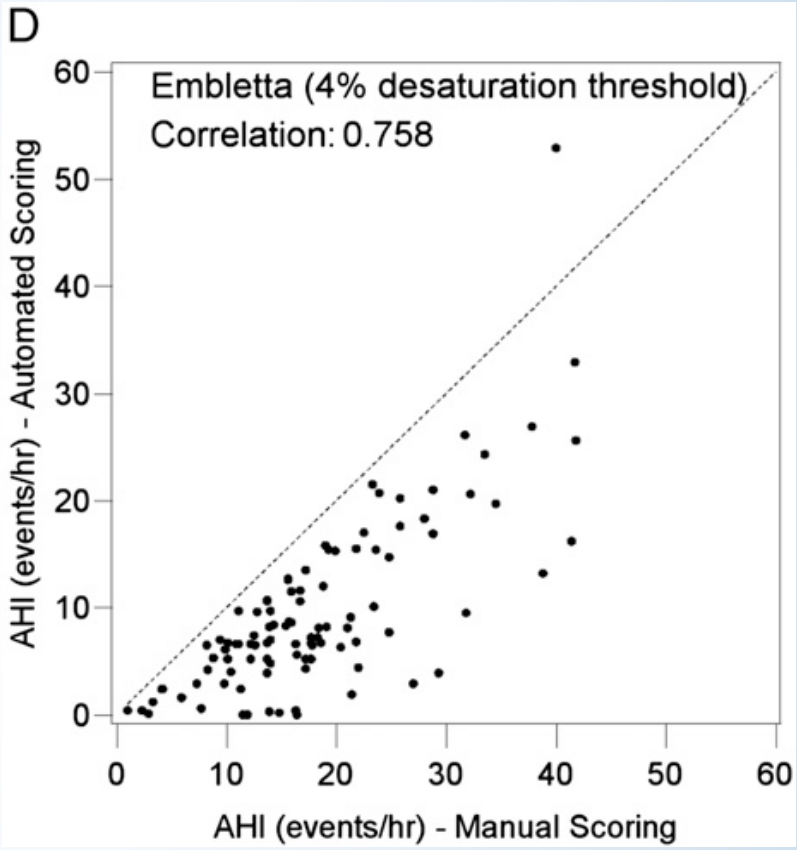




Automated scoring underestimated the AHI compared with manual scoring

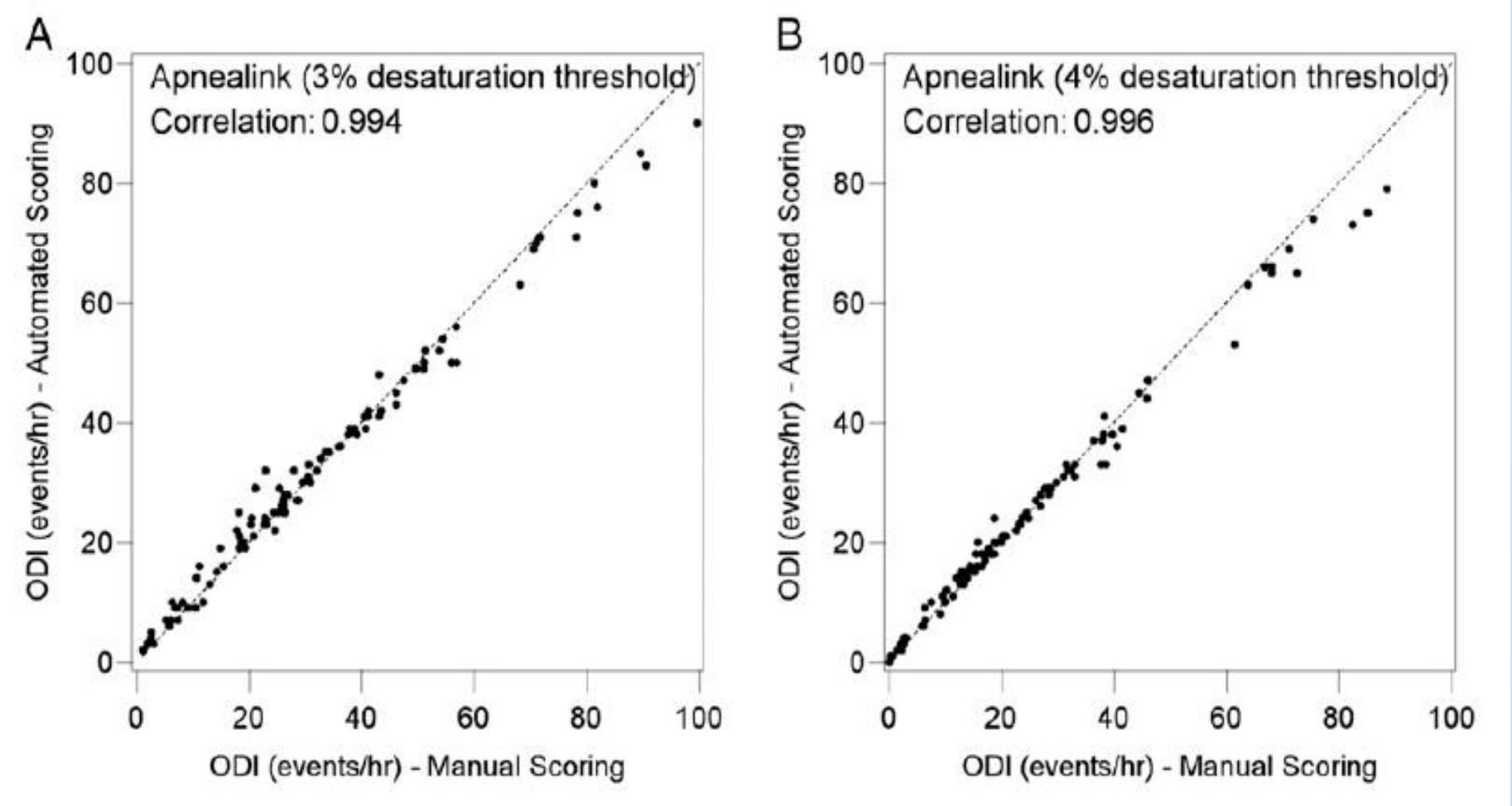
Visual (manual) scoring of portable monitoring data is superior to automated scoring

Automated algorithms tend to underestimate the AHI compared with manual scoring

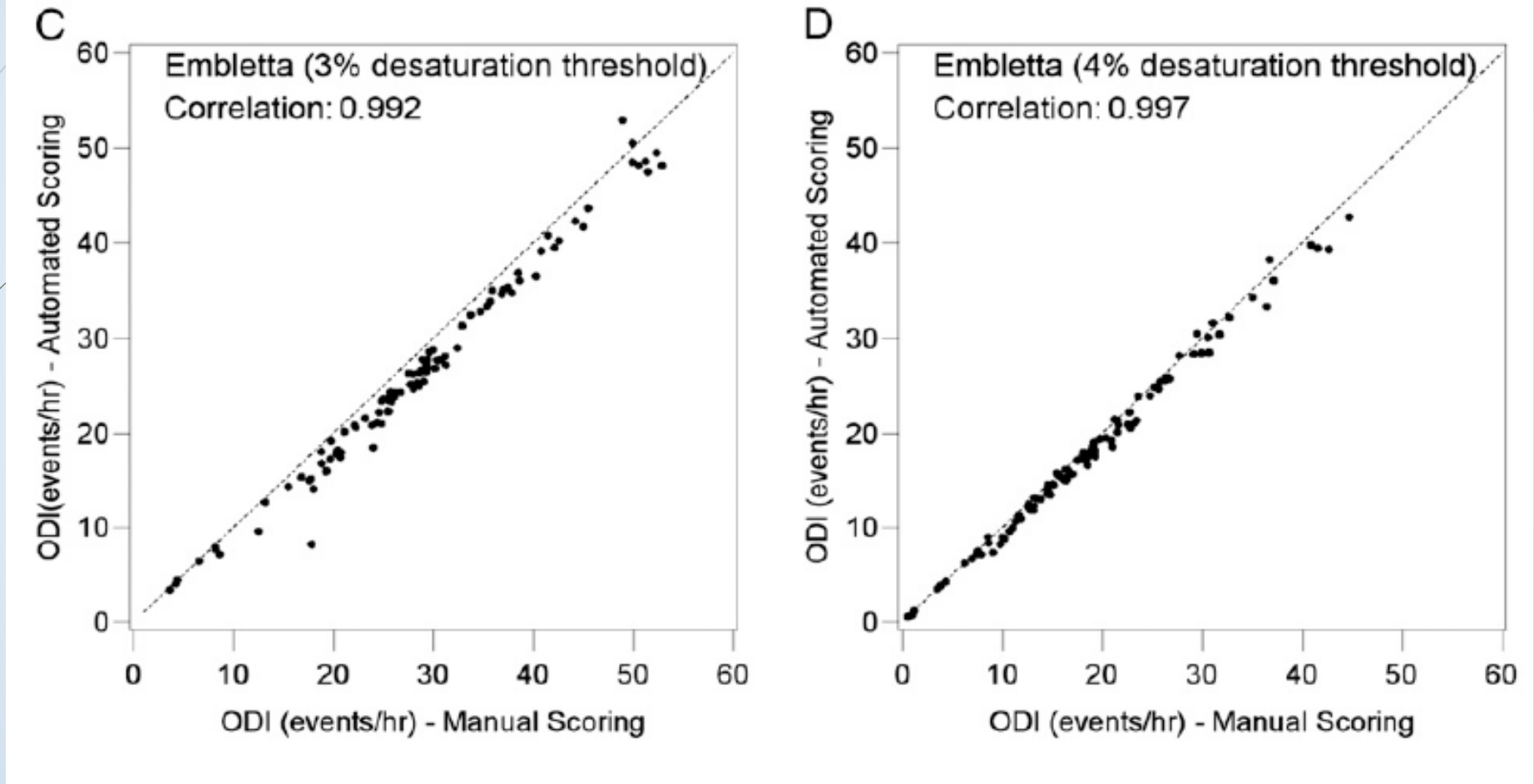
Underestimation of the AHI → misclassification of

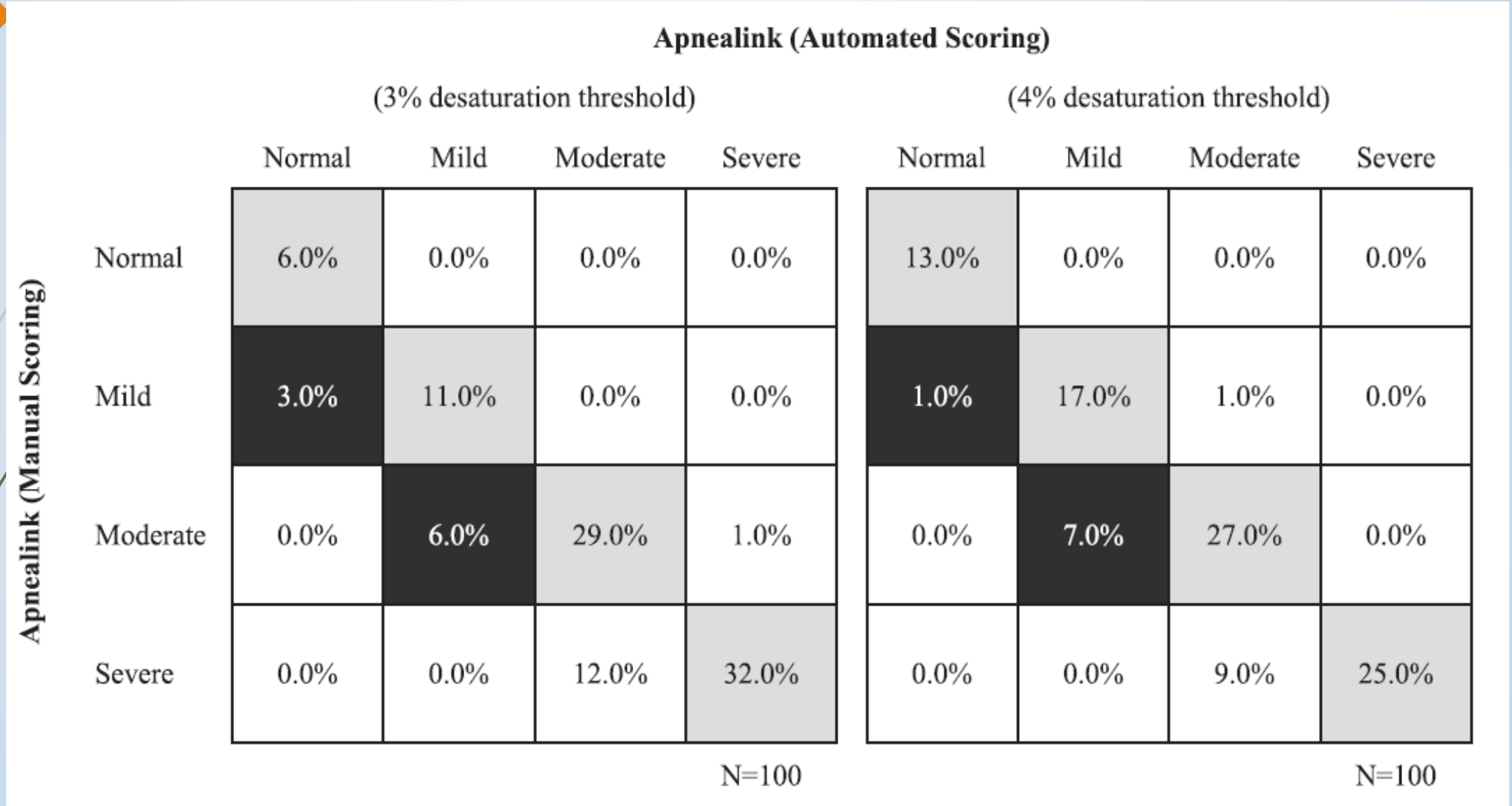
patients with mild OSA → limits screening for OSA

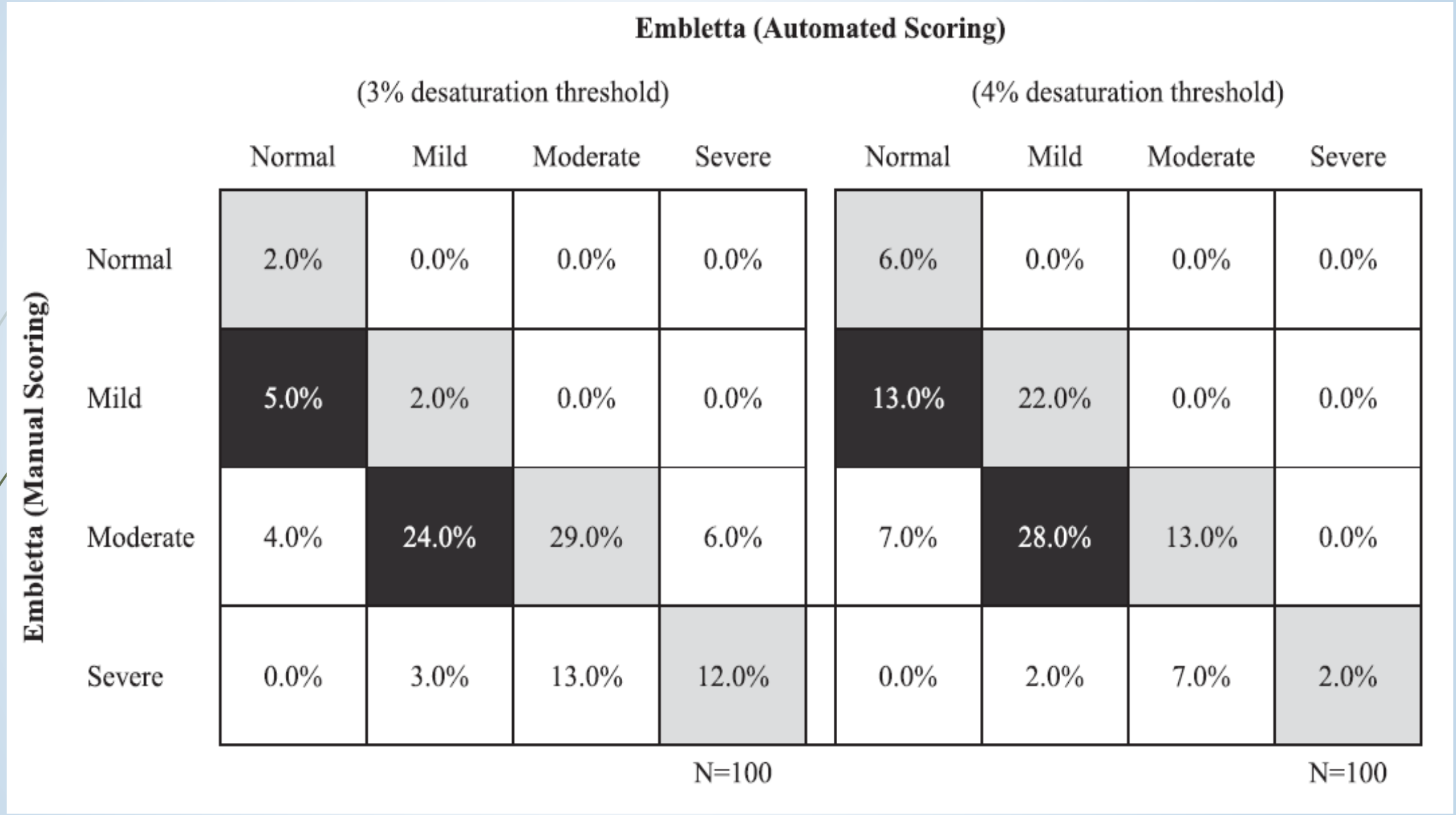
Scatter plots of automated vs manual scoring of the ODI for the ApneaLink Plus (A, B) and Embletta (C, D) monitors



Scatter plots of automated vs manual scoring of the ODI for the ApneaLink Plus (A, B) and Embletta (C, D) monitors




Apnealink (Automated Scoring)
(3% desaturation threshold)
(4% desaturation threshold)
Apnealink (Manual Scoring)
Normal
Mild
Moderate
Severe
6.0%
0.0%
0.0%
0.0%
3.0%
11.0%
0.0%
0.0%
0.0%
6.0%
29.0%
1.0%
0.0%
0.0%
12.0%
32.0%
13.0%
0.0%
0.0%
0.0%
1.0%
17.0%
1.0%
0.0%
0.0%
7.0%
27.0%
0.0%
0.0%
0.0%
9.0%
25.0%
N=100
N=100


Embletta (Automated Scoring)
(3% desaturation threshold)
(4% desaturation threshold)
Normal
Mild
Moderate
Severe
Normal
Mild
Moderate
Severe
Embletta (Manual Scoring)
Normal
2.0%
0.0%
0.0%
0.0%
6.0%
0.0%
0.0%
0.0%
Mild
5.0%
2.0%
0.0%
0.0%
13.0%
22.0%
0.0%
0.0%
Moderate
4.0%
24.0%
29.0%
6.0%
7.0%
28.0%
13.0%
0.0%
Severe
0.0%
3.0%
13.0%
12.0%
0.0%
2.0%
7.0%
2.0%
N=100
N=100

- The potential for misclassification of disease severity with portable sleep monitoring is greatest in those with mild disease
- Mild or no OSA required approximately 10 min
- Moderate or severe OSA required 60 to 90 min

Take Home Message

- HST is only recommended in patients for whom there is already a high clinical suspicion of SRBD
- HST can rule-in but not rule-out sleep-disordered breathing
- Thus, contrary to popular parlance, HST is not a screening test (ie, a test applied to nonsymptomatic populations like purified protein derivative (PPD) skin test for tuberculosis)