Epidemiology and diagnosis of sleep apnea

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Joint annual meeting SSC/SSCS-SSP 2016
Wisconsin Sleep Cohort Study

- **Apnea hypopnea index > 5/h**
  - Men: 27%
  - Women: 9%

- **Sleep apnea syndrome (AHI>5/h + Sleepiness)**
  - Men: 4%
  - Women: 2%

Young NEJM 1993
Prevalence of sleep-disordered breathing in the general population: the HypnoLaus study

R Heinzer, S Vat, P Marques-Vidal, H Marti-Soler, D Andries, N Tobback, V Mooser, M Preisig, A Malhotra, G Waeber, P Vollenweider, M Tafti,* J Haba-Rubio*

Lancet Respiratory Medicine 2015

2162 subjects aged 40 to 85 yrs have a full polysomnography at home

- EEG/EOG/EMG (sleep structure)
- Nasal pressure, chest and abdominal movements and SaO2
- Legs EMG
- ECG (1 channel)
# HypnoLaus Cohort study

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>2162</td>
</tr>
<tr>
<td>Age (y)</td>
<td>58.5 ± 11.0</td>
</tr>
<tr>
<td>Gender</td>
<td>50.4 % females</td>
</tr>
<tr>
<td>Body mass index (kg/m(^2))</td>
<td>26.2 ± 4.4</td>
</tr>
<tr>
<td>Epworth score (Mean± SD)</td>
<td>6.2 ± 3.9</td>
</tr>
<tr>
<td>Neck circumference (Mean± SD)</td>
<td>36.9 ± 3.9</td>
</tr>
</tbody>
</table>
Prevalence of sleep disorders breathing in the general population

HypnoLaus Cohort (N = 2121) aged 40-85 years old

<table>
<thead>
<tr>
<th>Category</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;5/h</td>
<td>83.8</td>
<td>60.9</td>
</tr>
<tr>
<td>&gt;15/h</td>
<td>49.7</td>
<td>23.4</td>
</tr>
<tr>
<td>&gt;30/h</td>
<td>22</td>
<td>7.6</td>
</tr>
</tbody>
</table>

Heinzer et al Lancet resp med 2015
Prevalence of sleep apnea syndrome
(sleep disordered breathing + Epworth >10)

HypnoLaus Cohort (N = 2121)

- AHI > 5/h
  - Males: 18.9%
  - Females: 10.8%
- AHI > 15/h
  - Males: 11.5%
  - Females: 4.8%
- AHI > 30/h
  - Males: 5%
  - Females: 1.8%

Heinzer et al Lancet resp med 2015
## Wisconsin-HypnoLaus differences

<table>
<thead>
<tr>
<th></th>
<th>Wisconsin 1993</th>
<th>HypnoLaus 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Subjects nb</strong></td>
<td>602</td>
<td>2162</td>
</tr>
<tr>
<td><strong>Selection</strong></td>
<td>State employees 80% snorers</td>
<td>General population</td>
</tr>
<tr>
<td><strong>Age Range</strong></td>
<td>30-60</td>
<td>40-85</td>
</tr>
<tr>
<td><strong>Setting</strong></td>
<td>Sleep laboratory</td>
<td>Home</td>
</tr>
<tr>
<td><strong>Hypopnea</strong></td>
<td>Discernible reduction in airflow + ≥ 4% O₂ desaturation</td>
<td>AASM 2013 (Chicago, AASM 07 rec)</td>
</tr>
<tr>
<td><strong>Sleepiness</strong></td>
<td>3 questions</td>
<td>Epworth</td>
</tr>
<tr>
<td><strong>Airflow signal</strong></td>
<td>Thermocouple and end-tidal CO₂</td>
<td>Nasal pressure</td>
</tr>
</tbody>
</table>
Nasal pressure vs. thermistor

Nasal pressure

Thermistor
Prevalence and Predictors of Sleep-Disordered Breathing in Patients With Stable Chronic Heart Failure

The SchlaHF Registry

Michael Arzt, MD,a Holger Woehrle, MD,b,c Olaf Oldenburg, MD,d Andrea Graml, Dipl. Stat,c Anna Suling, PhD,e Erland Erdmann, MD,f Helmut Teschler, MD,g Karl Wegscheider, PhD,e for the SchlaHF Investigators

JACC 2016

- 6,876 patients with stable chronic heart failure (LVEF < 45%)

- Prevalence of Sleep disordered breathing (AHI >15/h)

  - 36% in women (n: 1,448)
  
  - 49% in men (n: 5,428)

NB: No assessment of central vs obstructive sleep apnea
Sleep disordered breathing in stable heart failure

![Graph showing the prevalence of SDB (Sleep Disordered Breathing) with age and gender.](image-url)
SDB according to LV ejection fraction
Diagnostic of sleep disordered breathing

- Oximetry/Apnealink
- Respiratory polygraphy
- Polysomnography
Oximetry

100 sec
Polygraphy

Nasal pressure (Airflow)

SaO2

Thorax + abdomen

100 sec
Polysomnography

Nasal pressure (airflow)

SaO2

Thorax + abdomen

100 sec
Screening scores for SDB ?
# Berlin questionnaire

## Category 1: Snoring

**Q1.** Do you snore?  
- Yes (1)  
- No (0)  
- Do not know/refused

**Q2.** If you snore, your snoring is:  
- Slightly louder than breathing (0)  
- As loud as talking (0)  
- Louder than talking (1)  
- Very loud; can be heard in adjacent rooms (1)  
- Do not know/refused (0)

**Q3.** How often do you snore?  
- Nearly every day (1)  
- 3 to 4 nights per week (1)  
- 1 to 2 nights per week (0)  
- 1 to 2 nights per month (0)  
- Never or nearly never/do not know (0)

**Q4.** Has your snoring ever bothered other people?  
- Yes (1)  
- No (0)  
- Do not know/refused (0)

**Q5.** Has anyone noticed that you quit breathing during your sleep?  
- Nearly every day (2)  
- 3 to 4 times a week (2)  
- 1 to 2 times a week (0)  
- 1 to 2 times a month (0)  
- Never or nearly never/do not know/refused (0)

## Category 2: Fatigue

**Q6.** How often do you feel tired or fatigued after your sleep?  
- Nearly every day (1)  
- 3 to 4 times a week (1)  
- 1 to 2 times a week (0)  
- 1 to 2 times a month (0)  
- Never or nearly never/do not know/refused (0)

**Q7.** During your wake time, do you feel tired, fatigued, or not up to par?  
- Nearly every day (1)  
- 3 to 4 times a week (1)  
- 1 to 2 times a week (0)  
- 1 to 2 times a month (0)  
- Never or nearly never/do not know/refused (0)

**Q8.** Have you ever nodded off or fallen asleep while driving a vehicle?  
- Yes (1)  
- No (0)  
- Do not know/refused (0)

**Q9.** If yes, how often does it occur?  
- Nearly every day (1)  
- 3 to 4 times a week (1)  
- 1 to 2 times a week (0)  
- 1 to 2 times a month (0)  
- Never or nearly never/do not know/refused (0)

## Category 3: BMI and HT

**Q10.** Do you have high BP?  
- Yes (1)  
- No (0)  
- Do not know/refused (0)

**Q11.** BMI, kg/m$^2$  
- $>30$ (1)  
- $\leq 30$ (0)

## Scoring

- Category 1 is positive with $\geq 2$ positive responses to questions 1–5.  
- Category 2 is positive with $\geq 2$ positive responses to questions 6–9.  
- Category 3 is positive with a self-report of high blood pressure and/or a BMI of $>30$ kg/m$^2$.

**High risk of OSA** Two or more categories scored as positive.  
**Low risk of OSA** Less than two categories scored as positive.

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**High risk of OSA If 2 of the 3 categories are positive**
STOP-BANG

S = Snoring
T = Tired
O = Observed apnea
P = Pressure (high blood pressure)
B = BMI > 25 kg/m2
A = Age > 50 ans
N = Neck circumference > 40 cm
G = Gender (men)

A score ≥ 3 is considered positive (High risk for OSA)
STOP BANG score in a clinical population

Figure 3  Distribution of patients according to STOP-Bang score.

El Sayed EJCDT 2012
### “NoSAS” score

**Lancet Resp Med, June 17th 2016**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Points</th>
</tr>
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<tbody>
<tr>
<td>Neck circumference &gt; 40 cm</td>
<td>4 points</td>
</tr>
<tr>
<td><strong>Obesity</strong></td>
<td></td>
</tr>
<tr>
<td>BMI ≥ 25 kg/m² and &lt; 30 kg/m²</td>
<td>3 points</td>
</tr>
<tr>
<td>BMI ≥ 30 kg/m²</td>
<td>5 points</td>
</tr>
<tr>
<td><strong>Snoring (self-reported)</strong></td>
<td>2 points</td>
</tr>
<tr>
<td>Age &gt; 55 years</td>
<td>4 points</td>
</tr>
<tr>
<td><strong>Sex Male</strong></td>
<td>2 points</td>
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NoSAS ≥ 8 High probability of SDB
The NoSAS score: a screening tool for sleep disordered breathing in the general population

Helena Marti-Soler, PhD¹, Camila Hirotsu, PhD², Pedro Marques-Vidal, MD³, Peter Vollenweider, MD³, Gérard Waeger, MD³, Martin Preisig, MD³, Mehdi Tafti, PhD⁵, Sergi Brasil Tufik, MD⁷, Lia Bittencourt, PhD², Sergi Tufik, PhD², *José Haba-Rubio, MD⁵, *Raphael Heinzer, MD⁵,⁸

*Lancet Resp Med, June 17th 2016*

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<th>Estimated prevalence</th>
<th>AUC</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>PPV</th>
<th>NPV</th>
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<tr>
<td>NoSAS</td>
<td>(40-80 y.o.)</td>
<td>43.3</td>
<td>0.74</td>
<td>0.69</td>
<td>0.47</td>
<td>0.90</td>
</tr>
<tr>
<td>STOP-Bang</td>
<td></td>
<td>69.0</td>
<td>0.67</td>
<td>0.94</td>
<td>0.35</td>
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<td>Berlin</td>
<td></td>
<td>24.8</td>
<td>0.63</td>
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| EPISONO           | (20-80 y.o)         |      |             |             |       |       |
| NoSAS             |                      | 11.4 | 0.81        | 0.85        | 0.33  | 0.98  |
| STOP-Bang         |                      | 11.6 | 0.68        | 0.72        | 0.64  | 0.21  |
| Berlin            |                      | 11.5 | 0.65        | 0.61        | 0.68  | 0.20  |

|                | Estimated prevalence | AUC  | Sensitivity | Specificity | PPV   | NPV   |
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Performance of the scores according to different AHI thresholds

Area under the curve

- NoSAS
- STOP-Bang
- Berlin

Free «NoSAS» application available for iPhones and Android smartphones
Conclusion

- Sleep disordered breathing is highly prevalent in the middle to older age general population

- SDB is frequent in stable heart failure patients (LVEF <45%)

- Polygraphy (with respiratory effort channels) is the minimum standard to diagnose SDB

- Screening scores/oximetry can help deciding which patients should be sent for PG/PSG
HypnoLaus Team

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Daniela Andries

Helena Marti-Soler

Supported by:

Leenaards foundation, Fond national suisse, GSK, Ligue pulmonaire vaudoise