# Novinky v oblasti spánkové kardiologie

**Ondřej Ludka**

**Všeobecná interní klinika FN Brno a LF MU**

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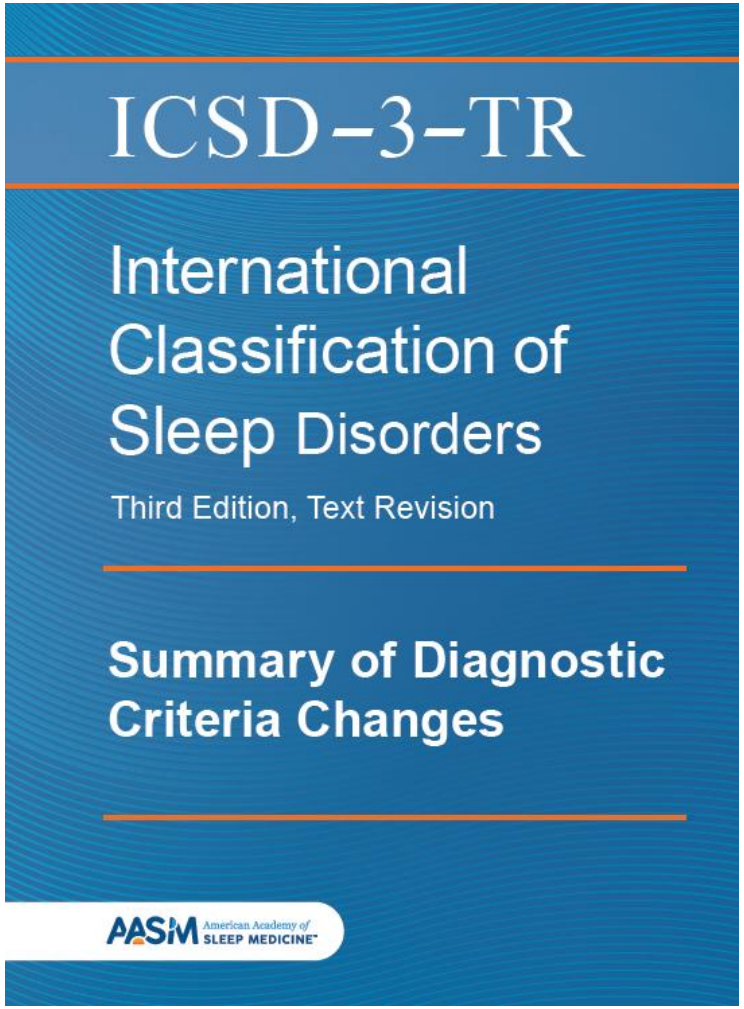
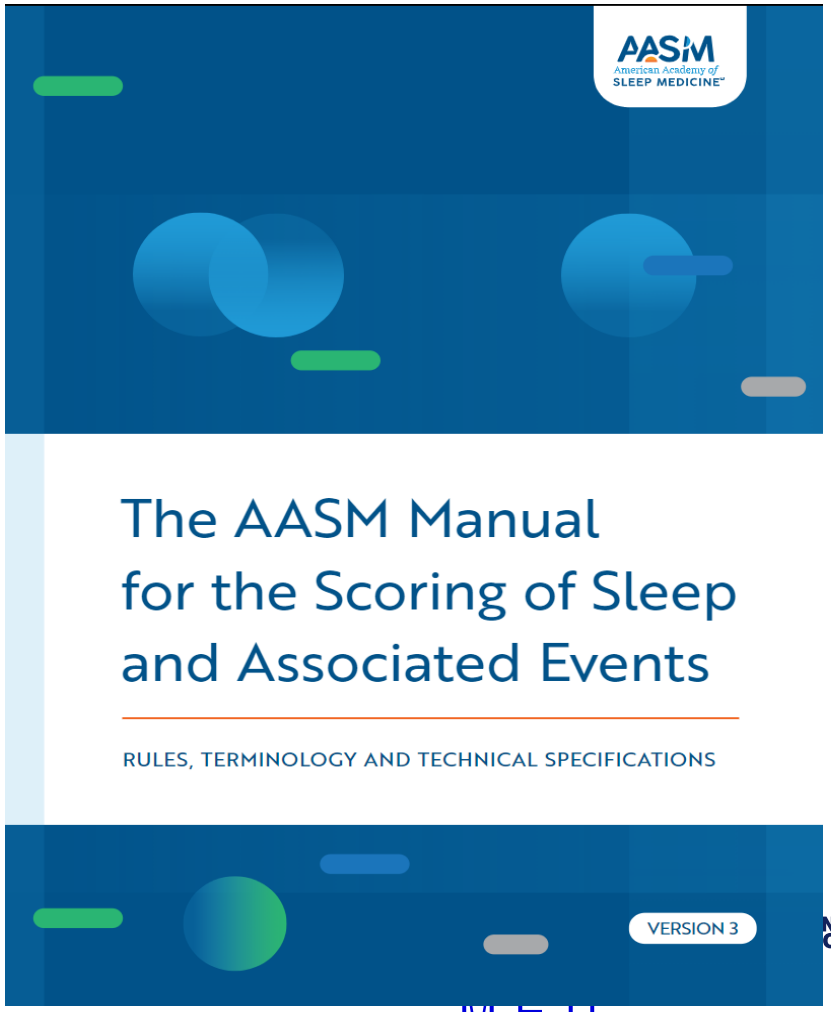
# Co je nového v diagnostických a skórovacích kritériích AASM




| | |
|---|---|
| 1990 | ICSD |
| 1997 | ICSD-R |
| 2005 | ICSD-2 |
| 2014 | ICSD-3 |
| 2023 | ICSD-3-TR |

- Verze 3.0 (2023)
- Verze 2.6 (2020)
- Verze 2.5 (2018)
- Verze 2.4 (2017)
- Verze 2.0.2-2.3 (2013-2016)
- Verze 2.0.1 (2013)
- Verze 2.0 (2012)
- První edice a její aktualizace – 2007-2011



# ICSD-3 vs ICSD-3-TR

| *Sleep-Related Breathing Disorders* | |
|---|---|
| **Obstructive Sleep Apnea (Adult)** | |
| A. The presence of one or more of the following:<br><br>1. The patient complains of sleepiness, nonrestorative sleep, fatigue, or insomnia symptoms.<br><br>4. The patient has been diagnosed with hypertension, a mood disorder, cognitive dysfunction, coronary artery disease, stroke, congestive heart failure, atrial fibrillation, or type 2 diabetes mellitus | A. The presence of one or more of the following:<br><br>1. The patient complains of sleepiness, fatigue, insomnia, or other symptoms leading to impaired sleep-related quality of life.<br><br>4. Deleted |
| **Central Sleep Apneas** | |
| Snoring | Snoring has been removed as a symptom criterion in all central sleep apnea disorders. |

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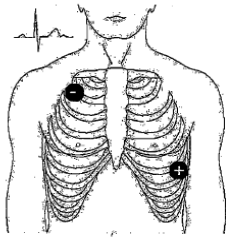
# Cardiac rules

## 1. TECHNICAL SPECIFICATIONS [RECOMMENDED]

**A. A single modified electrocardiograph Lead II using torso electrode placement is recommended.**



*Notes:*

1. *Additional leads may be placed if clinically-indicated at the discretion of the practitioner.*
2. *Increasing image size on display may improve detection of arrhythmias.*
3. *While classically Lead II is derived from electrodes placed on the right arm and left leg, the electrodes may be placed on the torso aligned in parallel to the right shoulder and left hip.*
4. *Standard ECG electrode applications are superior to EEG electrodes in minimizing artifact.*

## 2. SCORING RULES [RECOMMENDED]

**A. Score sinus tachycardia during sleep for a sustained sinus heart rate of greater than 90 beats per minute for adults.**

**B. Score bradycardia during sleep for a sustained heart rate of less than 40/minute for ages 6 years through adult.**

**C. Score asystole for cardiac pauses greater than 3 seconds for ages 6 years through adult.**

**D. Score wide complex tachycardia for a rhythm lasting a minimum of 3 consecutive beats at a rate greater than 100 per minute with QRS duration of greater than or equal to 120 msec.**

**E. Score narrow complex tachycardia for a rhythm lasting a minimum of 3 consecutive beats at a rate of greater than 100 per minute with QRS duration of less than 120 msec.**

**F. Score atrial fibrillation if there is an irregularly irregular ventricular rhythm associated with replacement of consistent P waves by rapid oscillations that vary in size, shape, and timing.**

*Notes:*

1. *Significant arrhythmias such as heart block should be reported if the quality of the single lead is sufficient for accurate scoring.*
2. *Ectopic beats should be reported if felt to be clinically significant.*
3. *Sinus rates vary according to age in children, with faster rates in young children as compared to adults. For typical sinus rates in children, refer to the Cardiac Task Force review paper.*

## VI. Cardiac Rules

### A. Technical Specifications

1. Use a single modified electrocardiograph Lead II on the torso with electrode placement as shown in Figure 1. M1, M2, M3, M6 RECOMMENDED

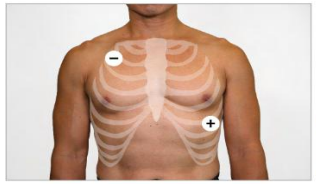


Figure 1. Diagram of Lead II placement on torso during cardiac recording. Illustration may not be to scale.



2. Use a single modified electrocardiograph Lead I on the torso with electrode placement as shown in Figure 2. If an artifact-free signal cannot be obtained using the modified Lead I, a modified Lead II must be placed. M5 OPTIONAL

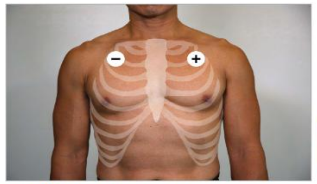


Figure 2. Diagram of Lead I placement on torso during cardiac recording. Illustration may not be to scale.



**Note 1.** Additional leads may be placed if clinically indicated at the discretion of the practitioner.

**Note 2.** Observing the ECG using a 10 or 15-second page duration may improve detection of arrhythmias.

**Note 3.** Lead II is typically derived from electrodes placed on the right arm and left leg, but the negative electrode can be placed below the right clavicle at the mid-clavicular line and the positive electrode on the left lower chest at the anterior axillary line in the 6th or 7th intercostal space.

**Note 4.** Standard ECG electrode applications are superior to EEG electrodes in minimizing artifact.

**Note 5.** Lead I is typically derived from electrodes placed on the right arm and left arm, but the negative electrode can be placed below the right clavicle at the mid-clavicular line and the positive electrode below the left clavicle at the mid-clavicular line.





### B. Scoring Cardiac Events M1, M2, M3

1. Score sinus tachycardia during sleep for a sustained (> 30 seconds) sinus heart rate of >90 beats per minute for adults. M4, M5 RECOMMENDED
2. Score sinus bradycardia during sleep for a sustained (> 30 seconds) sinus heart rate of <40 beats per minute for ages 6 years through adult. M5 RECOMMENDED
3. Score asystole for cardiac pauses during sleep >3 seconds for ages 6 years through adult. RECOMMENDED
4. Score wide complex tachycardia for a rhythm lasting a minimum of 3 consecutive beats at a rate >100 per minute with QRS duration of ≥120 msec. RECOMMENDED
5. Score narrow complex tachycardia for a rhythm lasting a minimum of 3 consecutive beats at a rate >100 per minute with QRS duration of <120 msec. RECOMMENDED
6. Score atrial fibrillation if there are irregularly irregular QRS complexes associated with replacement of consistent P waves by rapid oscillations that vary in size, shape, and timing. RECOMMENDED
7. Score second (identify as Mobitz I or Mobitz II) or third degree atrioventricular (AV) heart block. Mobitz I (Wenckebach) is suggested by the PR interval that becomes longer until a non-conducted P wave occurs. Mobitz II is suggested by the two fixed PR intervals prior to the non-conducted P wave. Third degree AV block (complete heart block) is suggested by complete AV dissociation with atrial (P waves) and ventricular (QRS complexes) activity being independent of each other. (see Figure 3, A-D) RECOMMENDED
8. Score cardiac pacemaker rhythm. The presence of cardiac paced rhythm will be manifested by sharp vertical spikes either immediately preceding the onset of P wave (atrial pacing) or QRS complex (ventricular pacing) or both on the ECG. (see Figure 3E) M6 RECOMMENDED

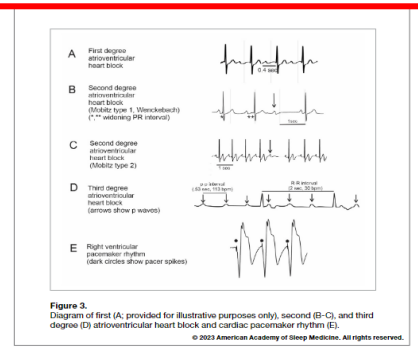



Figure 3. Diagram of first (A; provided for illustrative purposes only), second (B-C), and third degree (D) atrioventricular heart block and cardiac pacemaker rhythm (E).





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# Hypopnoe



**D. Scoring of Hypopneas**

**1.A Score a respiratory event as a hypopnea if ALL the following criteria are met:** N1, N2, N3 **(see Figure 3)** RECOMMENDED

a. The peak signal excursions drop by ≥30% of pre-event baseline using nasal pressure (diagnostic study), PAP device flow (titration study), or an *alternative* hypopnea sensor (diagnostic study).
b. The duration of the ≥30% drop in signal excursion is ≥10 seconds.
c. There is a ≥3% oxygen desaturation from pre-event baseline or the event is associated with an arousal.

**1.B Score a respiratory event as a hypopnea if ALL the following criteria are met:** N1, N2, N3 OPTIONAL

a. The peak signal excursions drop by ≥30% of pre-event baseline using nasal pressure (diagnostic study), PAP device flow (titration study), or an *alternative* hypopnea sensor (diagnostic study).
b. The duration of the ≥30% drop in signal excursion is ≥10 seconds.
c. There is a ≥4% oxygen desaturation from pre-event baseline.

Scoring hypopneas as central or obstructive events is OPTIONAL as noted in chapter II. Parameters to be Reported Part 1: Rules for Reporting Polysomnography, section F.

**2. If electing to score obstructive hypopneas, score a hypopnea as obstructive if ANY of the following criteria are met:** RECOMMENDED

a. There is snoring during the event.
b. There is increased inspiratory flattening of the nasal pressure or PAP device flow signal compared to baseline breathing.
c. There is an associated thoracoabdominal paradox that occurs during the event but not during pre-event breathing.

**3. If electing to score central hypopneas, score a hypopnea as central if NONE of the following criteria are met:** RECOMMENDED

a. There is snoring during the event.
b. There is increased inspiratory flattening of the nasal pressure or PAP device flow signal compared to baseline breathing.
c. There is an associated thoracoabdominal paradox that occurs during the event but not during pre-event breathing.

**Note 1.** The criteria used to score a respiratory event as a hypopnea should be specified in the PSG report. It is the responsibility of the individual practitioner to confirm and follow the criteria that should be used for reporting to the patient's payer in order to be reimbursed and qualify the patient for therapy.

**Note 2.** For *alternative* hypopnea sensors see rule A.4 in this chapter.

**Note 3.** Supplemental oxygen may blunt desaturation. There are currently no scoring guidelines for when a patient is on supplemental oxygen and no desaturation is noted. If the diagnostic study is performed while the individual is on supplemental oxygen, its presence should be mentioned in the narrative summary of the study.

Redukce toku vydechovaného vzduchu o 30% oproti baseline trvající 10s a více (jako baseline flow hodnotíme epochu před a po událostí) a k tomu navíc:

A) Pokles saturace o 3% oproti baseline (těsně před událostí) nebo **arousal** (probouzecí reakce – lze použít pouze u PSG)

B) Pokles saturace o 4 % oproti baseline

Pravidla nutno udržet konzistentně u všech záznamů na jednom pracovišti a zapsat do protokolu, které pravidlo pro hypopnoe je používáno!!

**Pokud provádíme PSG a počítáme i arousals tak zvýšíme záchyt OSA!!**

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# Co se má zaznamenávat v průběhu PSG?

***Nově kromě již zavedených hodnot:***

- zaznamenat minimální a maximální TF

- zaznamenat hodnoty procenta času spánku v saturaci pod 95%, 90%, 85%...

- zaznamenat přítomnost chrápání – povinně u dětí (u dospělých doporučeno)

Alfa rytmus/alfa aktivita má být nyní označována jako **zadní dominantní rytmus** (posterior dominant rhytm) – vzhledem k tomu, že jeho aktivita je maximální u všech věkových kategorií v okcipitálním cortexu, ale jeho frekvence se mění (klesá) jak stárneme…

# Léčba OSAS pomocí CPAP a hypertenze

## 4 metaanalýzy randomizovaných studií

- Bazzano et al. - 16 studií (818 osob), změna systolického TK o 2,46 mm Hg, změna diastolického TK o 1,83 mm Hg
- Alajmi et al. - 10 studií (587 osob), změny malé a nesignifikantní
- Mo et al. - 7 studií (471 osob), změny malé, signifikantní pouze pro 24 hod diastolický TK
- Haentjens et al. - 12 studií (572 osob), signifikantní změny pouze pro střední a systolický TK v noci, závislost na tíži apnoe a na adherenci k terapii

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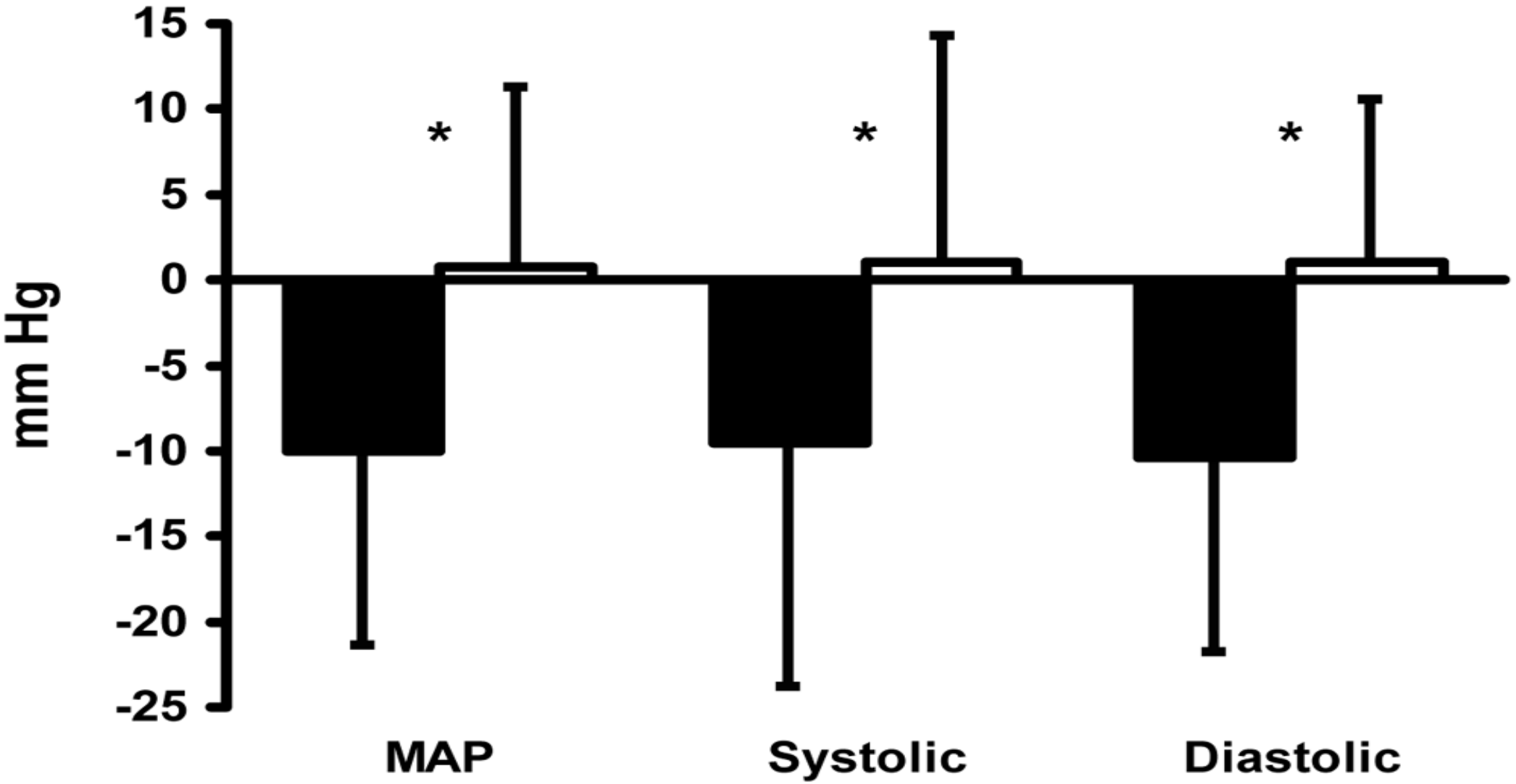
Bazzano LA et al., Hypertension 2007, Alajmi M et al., Lung 2007, Mo L et al., Zhonghua Yi Za Zhi 2007, Haentjens P et al., Arch Intern Med 2007

# Léčba OSAS pomocí CPAP a hypertenze

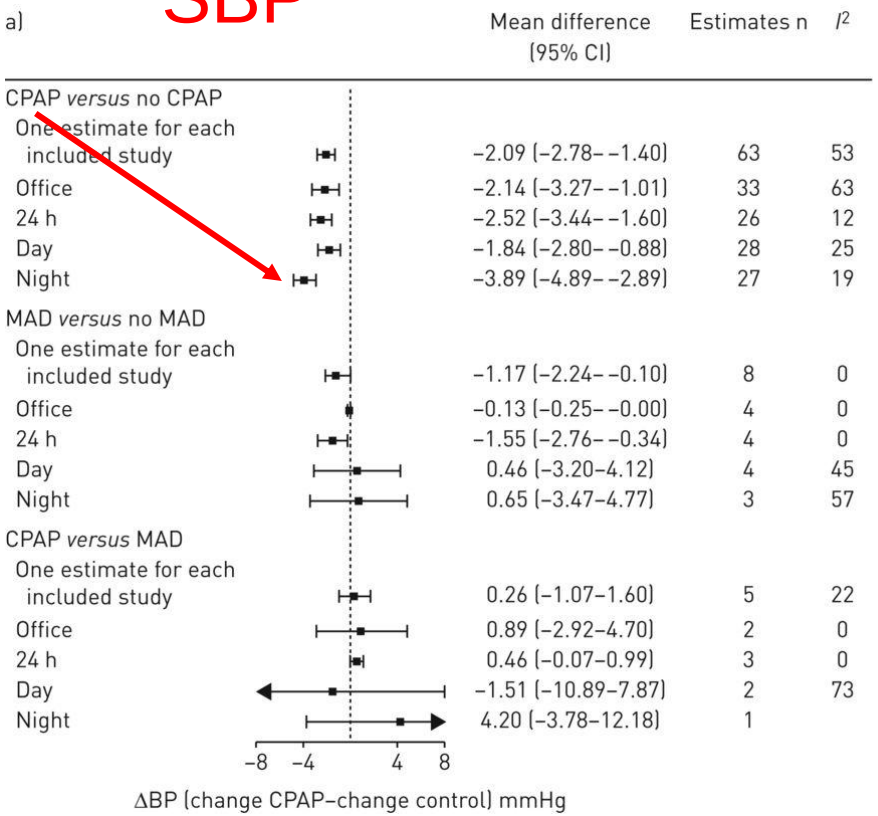



Kara et al., Mayo Clinic Cardiology

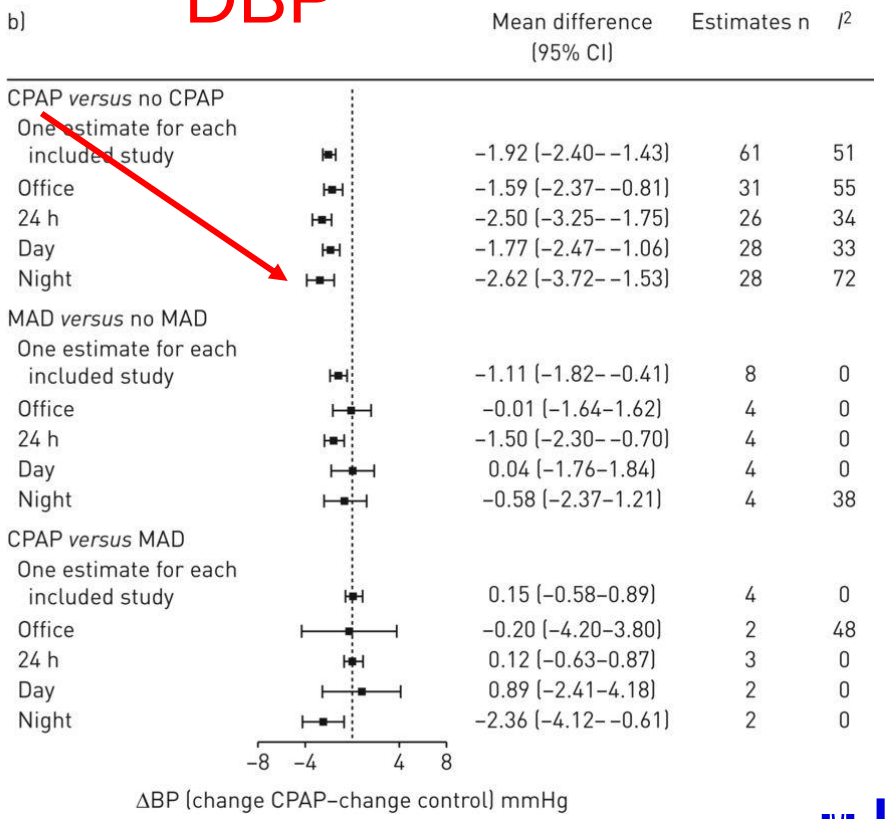
# Benefity léčby CPAP u OSAS

**Overall a) systolic and b) diastolic blood pressure (BP) changes comparing continuous positive airway pressure (CPAP) versus passive treatment, mandibular advancement devices (MADs) versus passive treatment and CPAP versus MADs considering all studies toget...**

SBP




DBP

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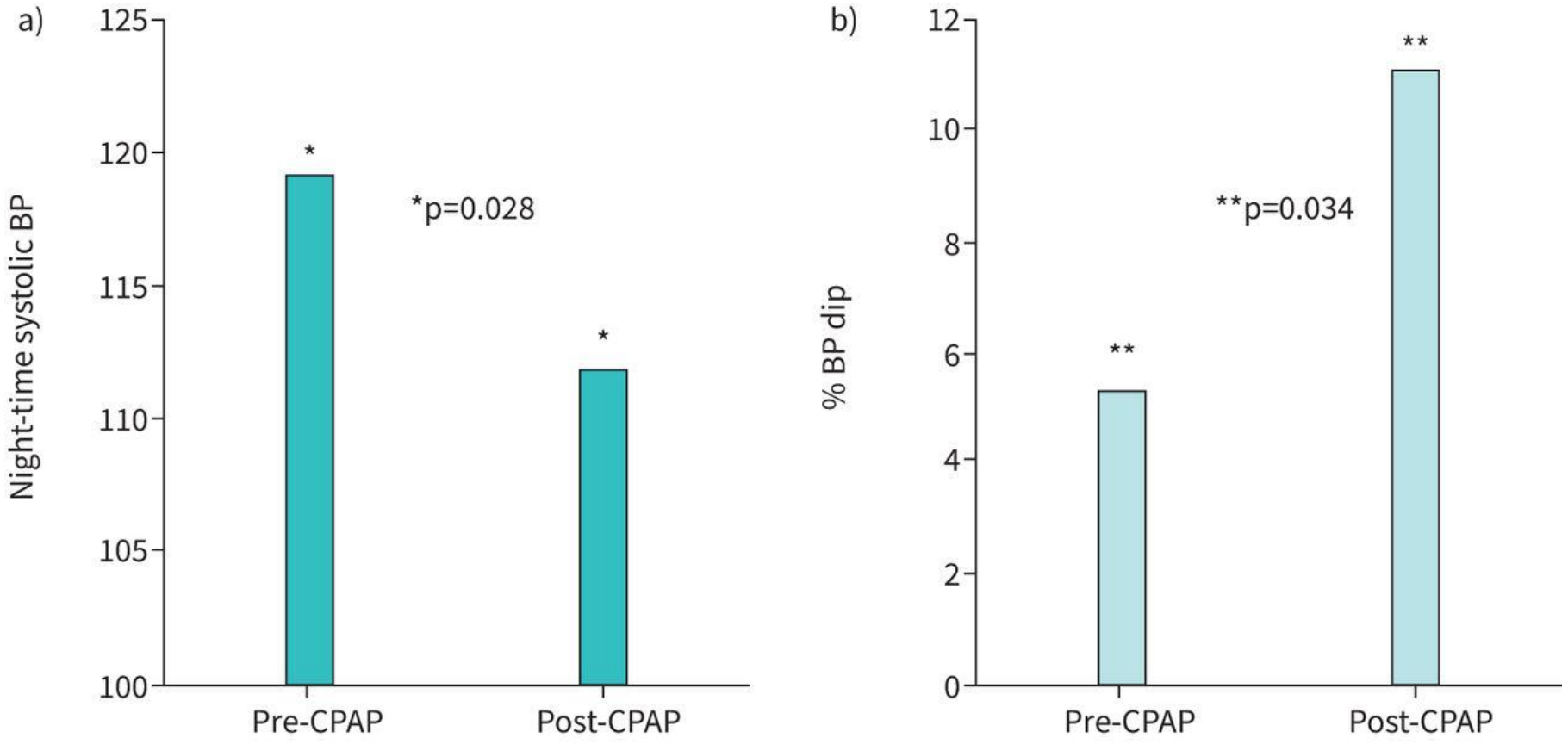
Pengo MF et al. Eur Respir J 2020

# Benefity léčby CPAP u OSAS

**a) Night-time systolic blood pressure (BP) and b) per cent (%) of BP dip in a subset of subjects pre- and post-treatment with continuous positive airways pressure (CPAP).**



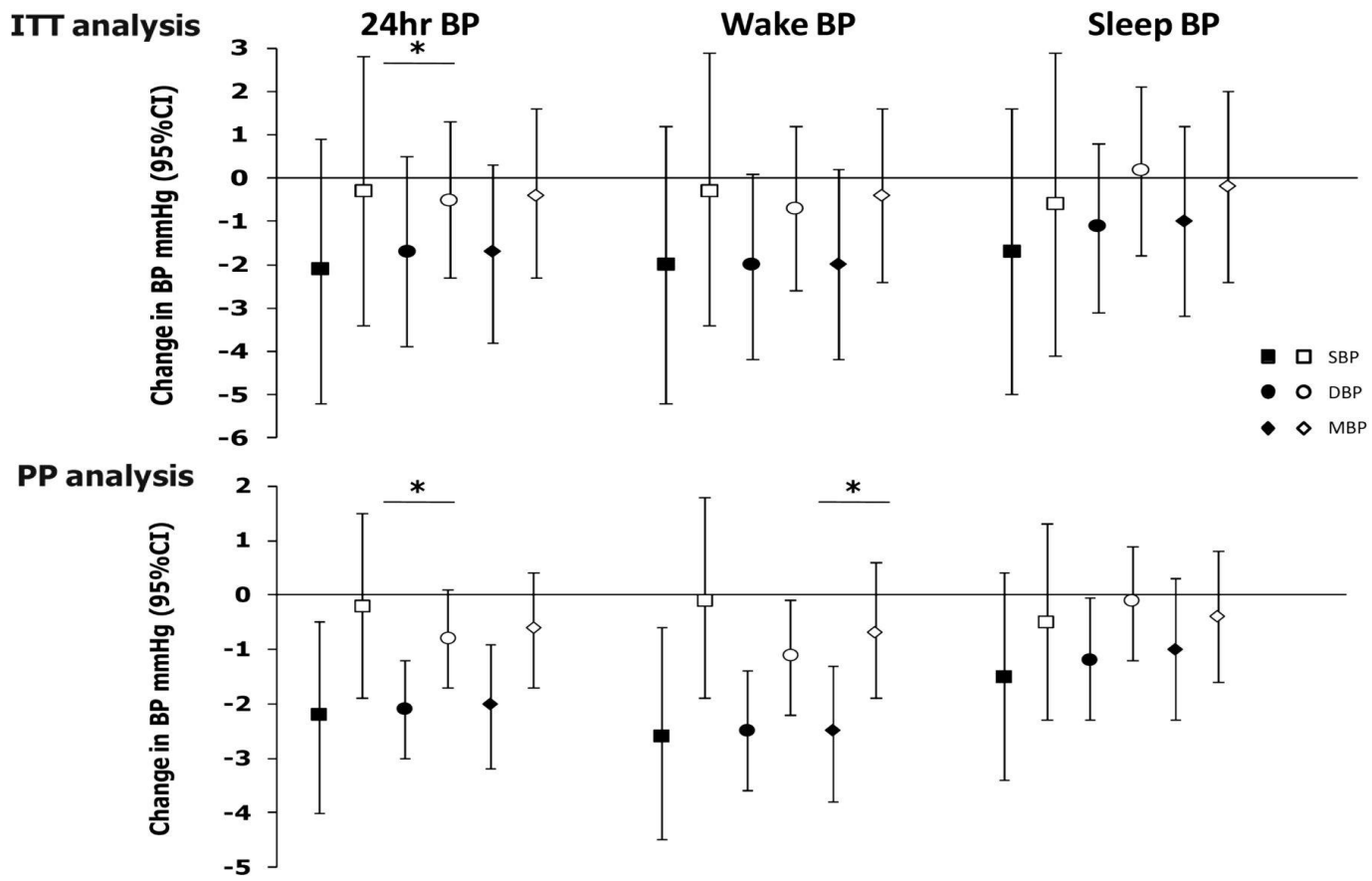

**U normotenzních bez nočního poklesu obnovuje dipping.**

Crinion SJ et al. ERJ Open Res 2021

# Benefity léčby CPAP u OSAS

APAP zvyšuje četnost arousals a tím i aktivitu sympatiku

**Change from baseline in 24 h blood pressure variables.**




**On fixed pressure CPAP (closed symbols) and AutoCPAP (open symbols) Intention-to-treat (ITT) analysis. Per-protocol (PP) analysis. *p<0.05.**

Pokud není silná vazba apnoí na polohu/fázi spánku, tak je mnohem **výhodnější fixní tlak!!**

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Pépin JL et al. Thorax 2016

# Klinické studie v sekundární kardiovaskulární prevenci

| Authors | Study | Patients (n, CPAP versus Controls) | Eligible Patients | Follow-up (months) | Diagnosis of OSA | Groups | Primary Outcome | Results | Secondary Analysis |
|---|---|---|---|---|---|---|---|---|---|
| Secondary Prevention | | | | | | | | | |
| Peker et al. 2016[52] | RICCADSA | 122/122 | Revascularised CAD | 57 | AHI ≥15 + ESS <10 | CPAP versus control | MACE‡ | HR 0.80 (95% CI [0.46–1.41]) | ≥4 h/night: HR 0.29 (95% CI [0.10–0.86]) |
| McEvoy et al. 2016[53] | SAVE | 1,346/1,341 | CVD | 43 | ODI ≥12 (≥4%) + ESS ≤15 | CPAP versus control | MACE§ | HR 1.10 (95% CI [0.91–1.32]) | ≥4 h/night: HR 0.52 (95% CI [0.30–0.90]) for cerebral events |
| Sánchez-de-la-Torre et al. 2020[54] | ISAACC | 633/631 | ACS | 40.2 | AHI ≥15 + ESS ≤10 | CPAP versus control | MACE‖ | HR 0.89 (95% CI [0.68–1.17]) | ≥4 h/night: 0.80 (95% CI [0.52–1.23]) |

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# PAP terapie u OSA a ICHS

Špatná adherence k PAP léčbě - možná lepší výsledky, kdyby byli zahrnuti pacienti s více symptomy, vzhledem k tomu, že nadměrná denní spavost je známkou závažnosti onemocnění.

AHI nebere v úvahu důležité aspekty respiračních událostí (délka, velikost desaturace, přítomnost probuzení atd.) - velmi heterogenní skupiny pacientů s různými fenotypy. Použití nových diagnostických a/nebo prognostických kritérií u pacientů s OSA, které umožňují lepší stratifikaci rizika, stejně jako použití biomarkerů schopných identifikovat podskupiny pacientů s OSA s vysokým rizikem KV nebo metabolických příhod, může usnadnit přehodnocení role a účinnosti léčby OSA.

Léčba OSA pomocí CPAP nemusí být účinná při snižování recidivujících KV příhod u pacientů s pokročilým nebo symptomatickým aterosklerotickým vaskulárním onemocněním, jako byli pacienti zahrnutí do studií SAVE a ISAACC.

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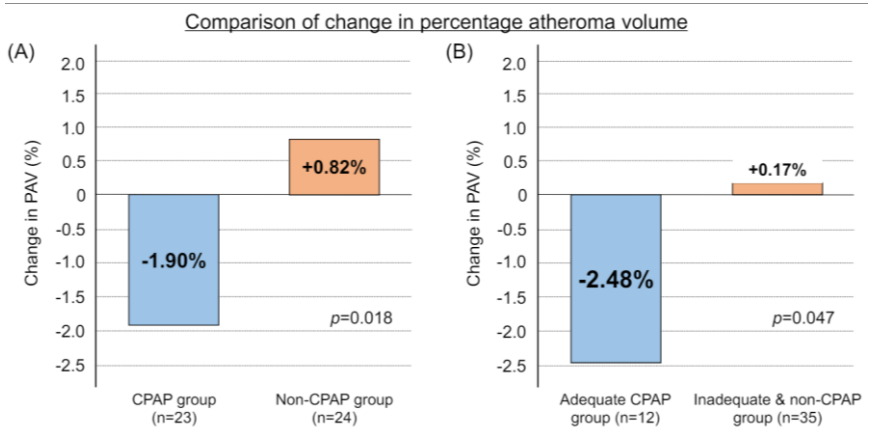
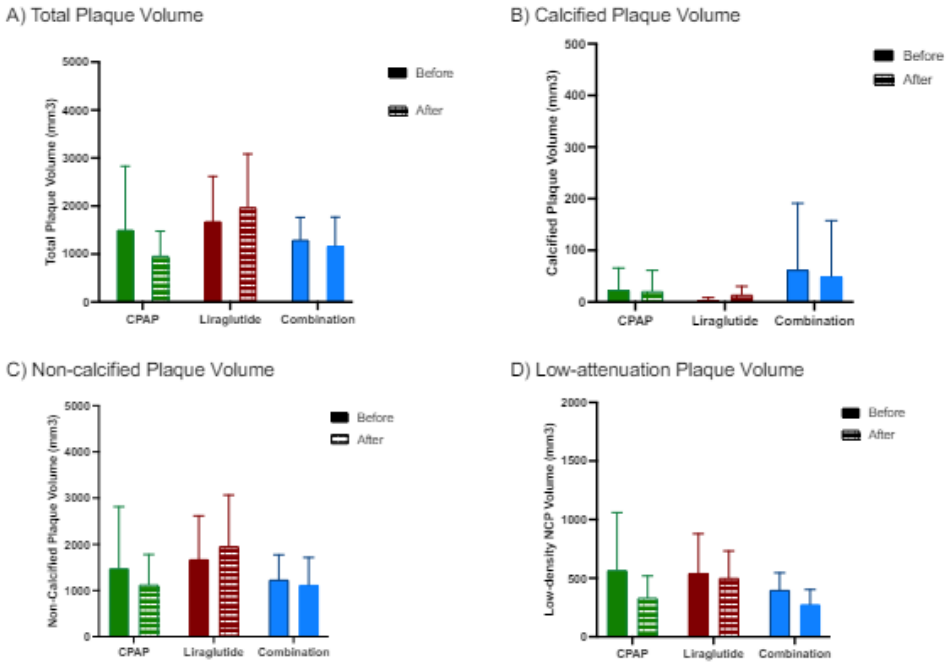
Van Ryswyk E et al, Sleep 2019

# CPAP a ateropláty - další dobrá zpráva

Effects of CPAP on Atherosclerotic Coronary Plaques in Patients with Sleep-Disordered Breathing: the ENTERPRISE Trial




Continuous positive airway pressure but not Liraglutide-mediated weight loss 2 improves early cardiovascular disease in obstructive sleep apnea: Data from a 3 randomized proof-of-concept study.

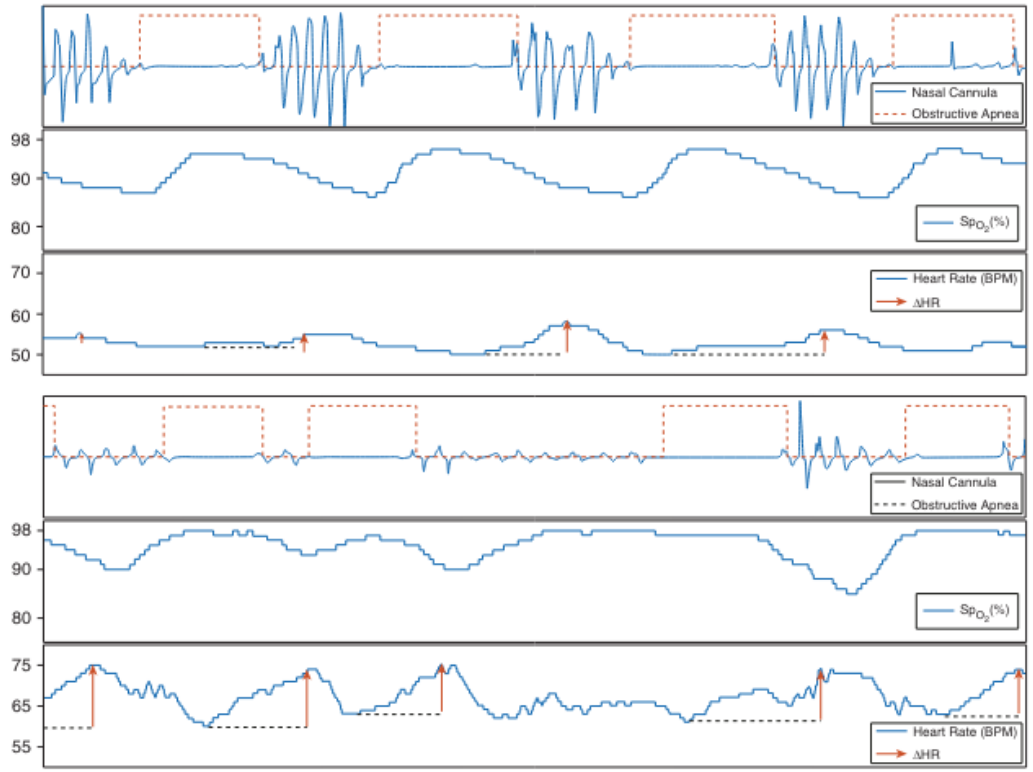


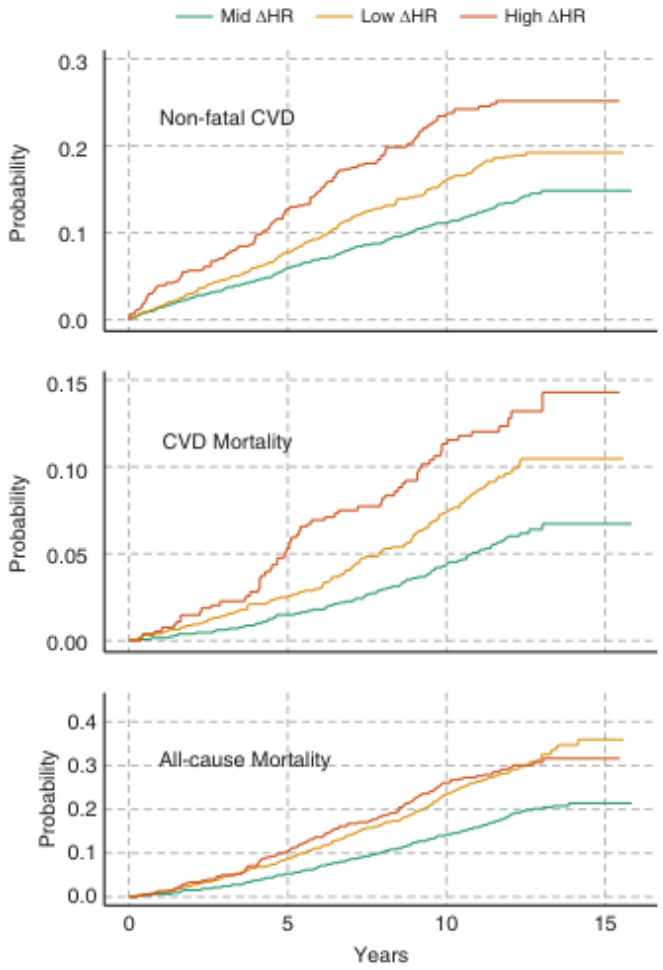

Change in CT coronary artery plaque volumes from baseline to 24-week of 735 intervention.

Fukase T et al., medRxiv 2023, O´Donnell C et al., Ann Am Thorac Soc 2024

# Markery možného KV rizika u pacientů s OSAS

Vysoká pulse-rate response zvyšuje pravděpodobnost KV příhod




Multi-Ethnic Study of Atherosclerosis (1395 pts.)
Sleep Heart Health Study (4575 pts.)

Azarbarzin A te al., Am J Respir Crit Care Med 2021

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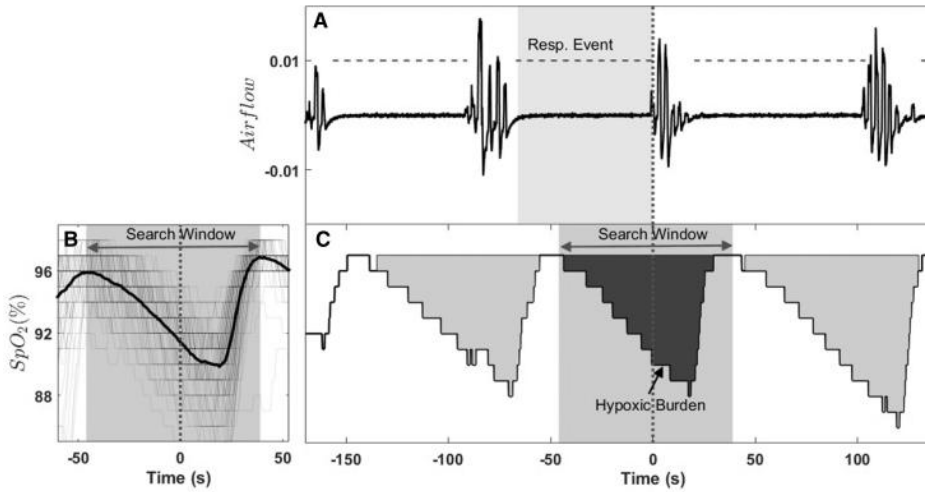
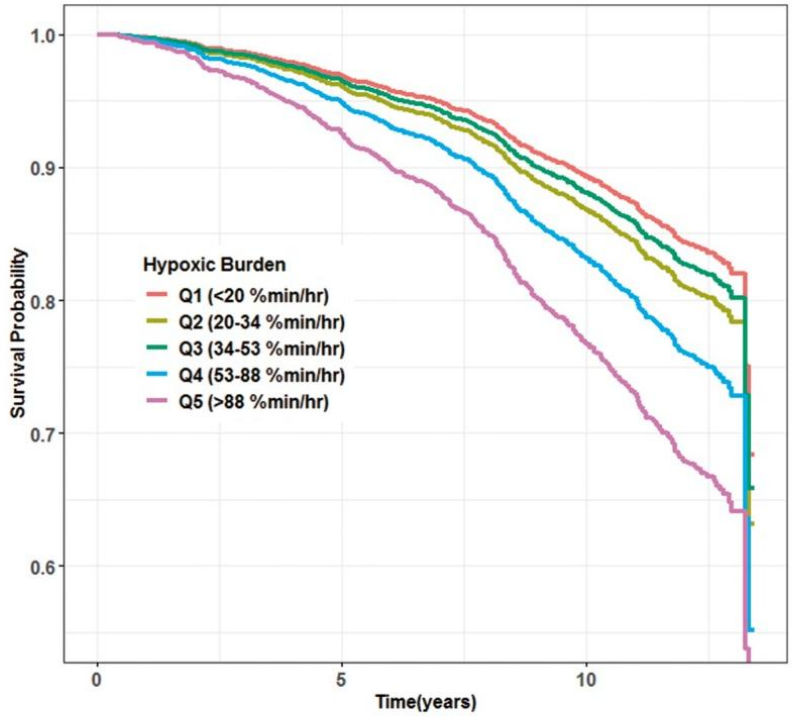
# Markery možného KV rizika u pacientů s OSAS

„hypoxické břemeno“ - procentominuty v hyposaturaci oproti baseline za hodinu spánku




For example a hypoxic burden of 40 (%min)/h

= 20 minutes of 2% desaturation
= 10 minutes of 4% desaturation
= 5 minutes of 8% desaturation




Adjusted survival curves for cardiovascular mortality across categories of the hypoxic burden in MrOS. These curves were obtained from Model 4. The adjusted survival curves were obtained by averaging the predicted survival curves for every observation in MrOS study.

The Outcomes of Sleep Disorders in Older Men (2743 pts.)
Sleep Heart Health Study (5111 pts.)

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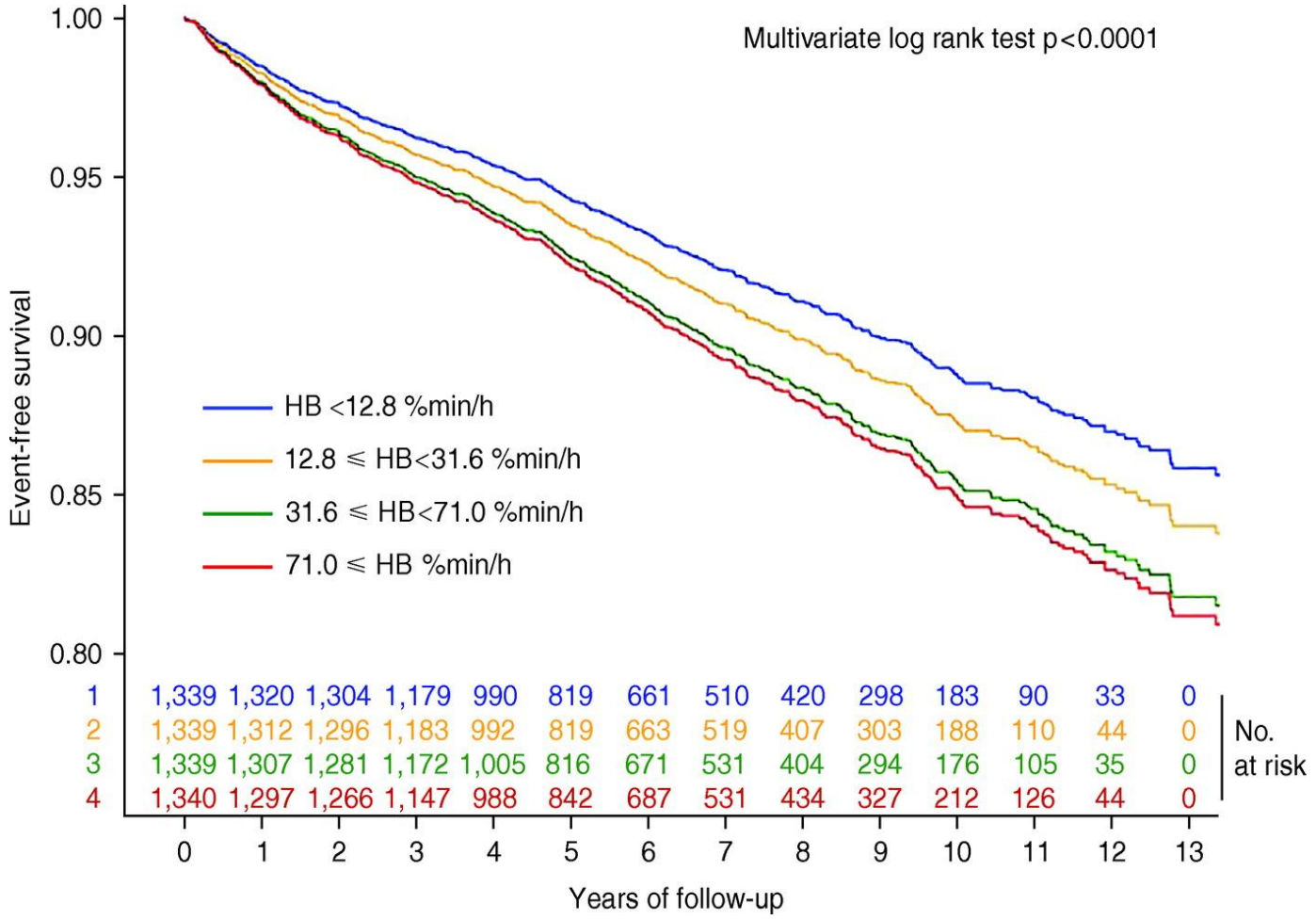
Azarbarzin A te al., Eur Heart J. 2019

# Markery možného KV rizika u pacientů s OSAS

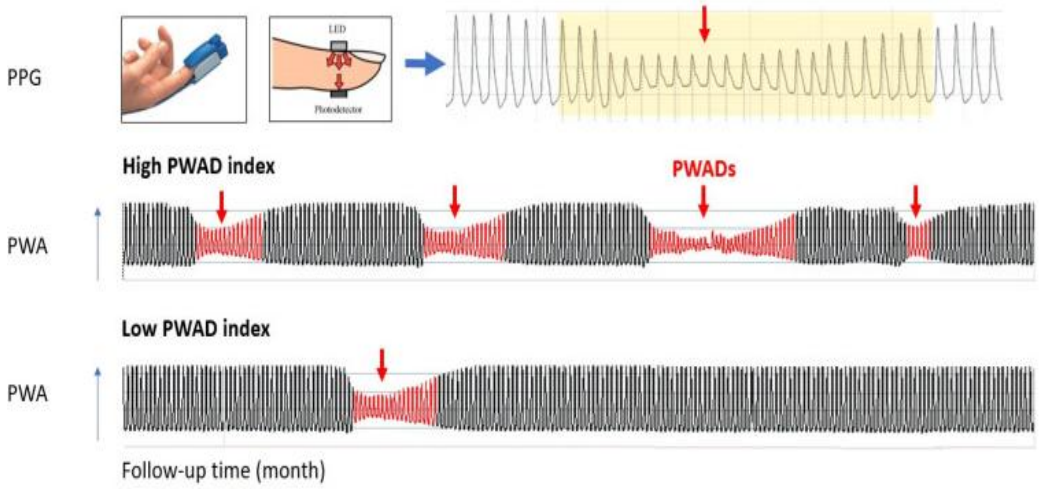
Pacienti s vyšším hypoxic burden mají vyšší výskyt MACE

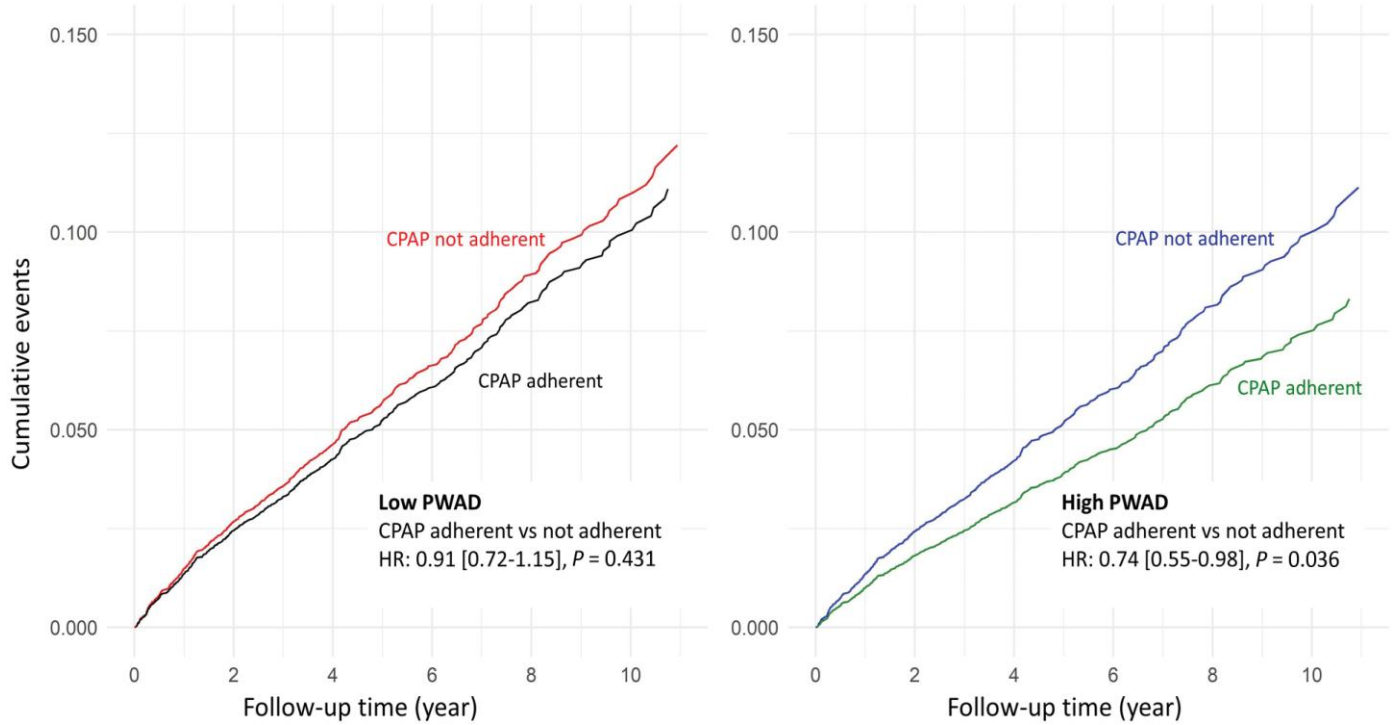



Trzepizur W et al., Am J Respir Crit Care Med, 2022

# Markery možného KV rizika u pacientů s OSAS

Pokles amplitudy pulsního oxymetru = přehodné snížení srdečního výdeje

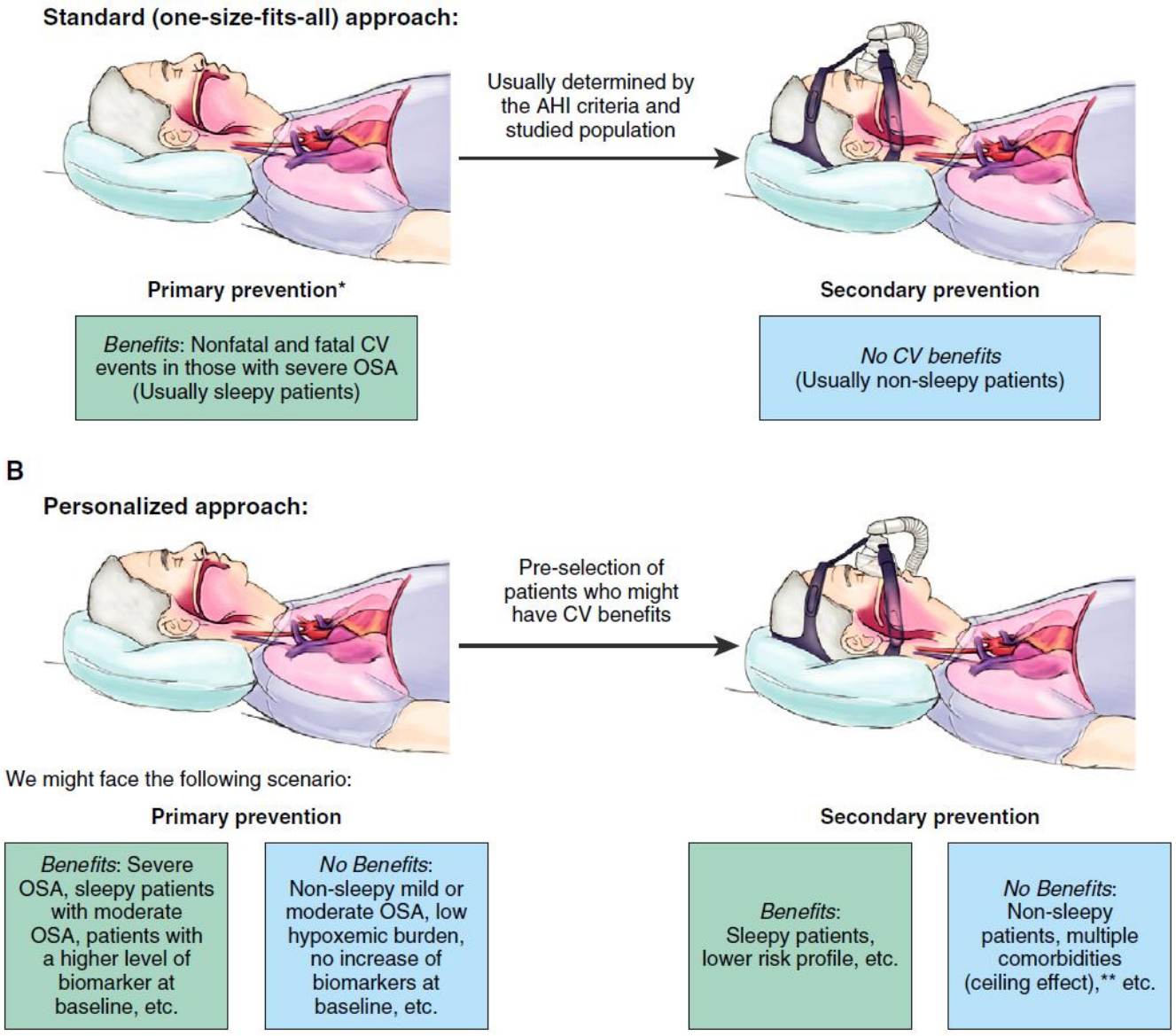



Pacient s vysokými PWAD bude při léčbě CPAPem výrazně profitovat z léčby – snížení MACE

Solelhac G et al., Am J Respir Crit Care Med 2023

# Standardní versus personalizovaný přístup




OSA nemusí představovat nezávislý rizikový faktor a terapie CPAP by proto nepřinesla další KV přínosy

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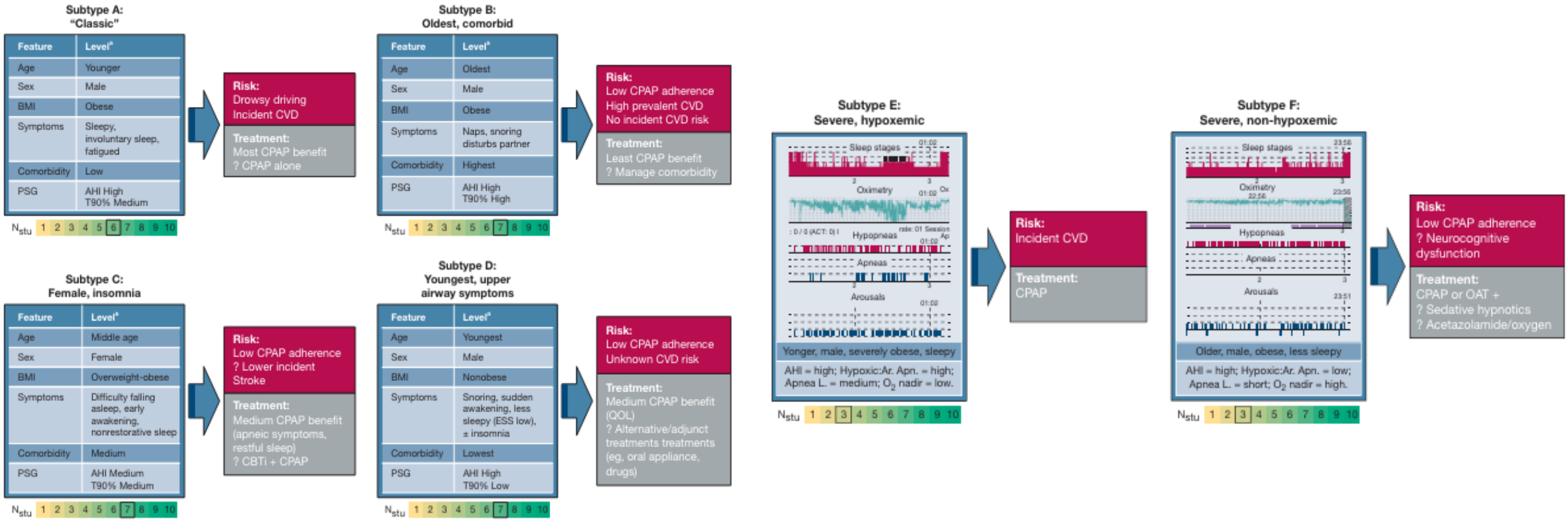
Mazzotti DR et al, Am J Respir Crit Care Med 2020

# Strategie léčby různých fenotypů OSAS




Phenotypic Subtypes of OSA A: Challenge and Opportunity for Precision Medicine

MUNI MED

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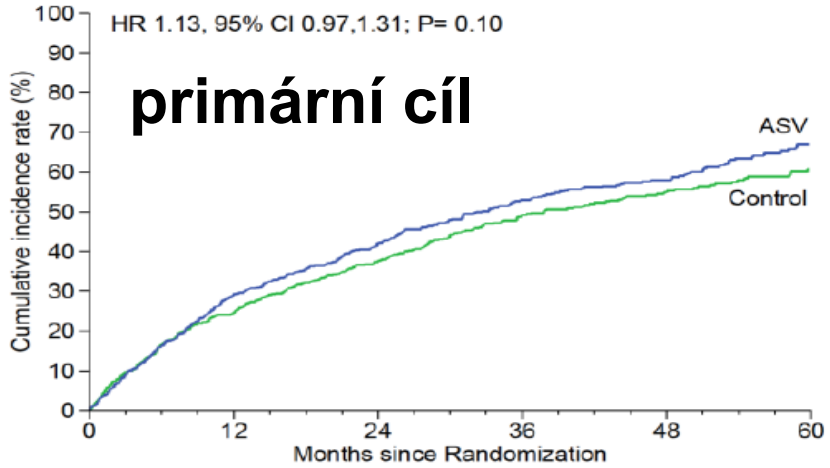
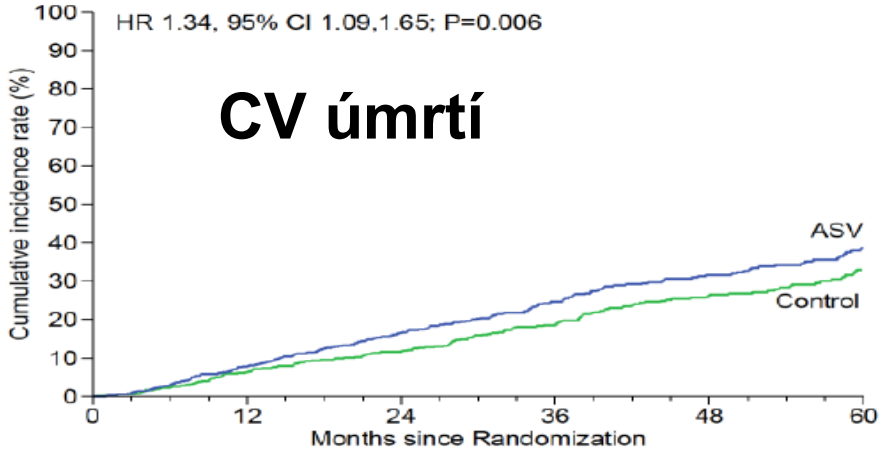
Zinchuk A et al., CHEST 2020

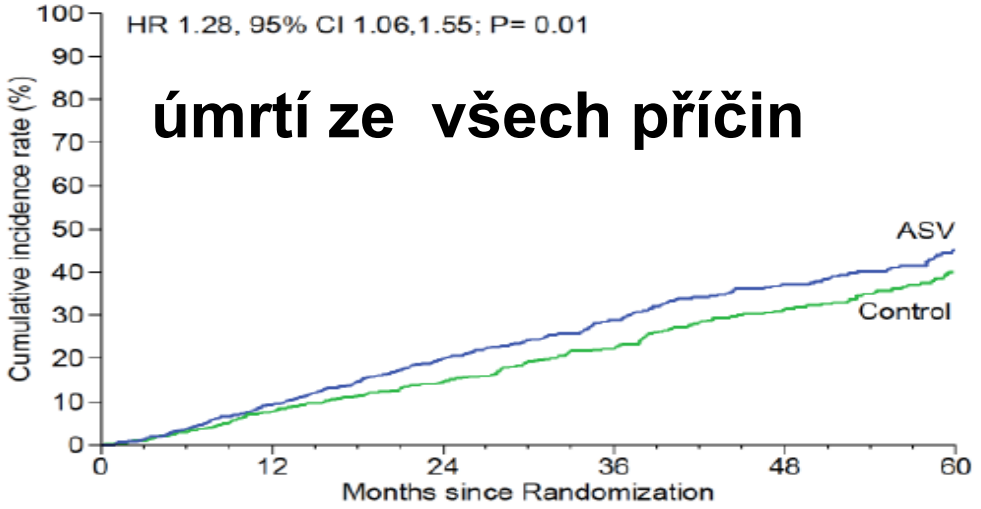
# SERVE-HF




| No. at Risk | | | | | | |
|---|---|---|---|---|---|---|
| Control | 659 | 463 | 365 | 222 | 136 | 77 |
| ASV | 666 | 435 | 341 | 197 | 122 | 52 |




| No. at Risk | | | | | | |
|---|---|---|---|---|---|---|
| Control | 659 | 563 | 493 | 334 | 213 | 117 |
| ASV | 666 | 555 | 466 | 304 | 189 | 97 |




| No. at Risk | | | | | | |
|---|---|---|---|---|---|---|
| Control | 659 | 563 | 493 | 334 | 213 | 117 |
| ASV | 666 | 555 | 466 | 304 | 189 | 97 |

Cowie et al., NEJM 2015

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# ASV se nemusíme bát – nejspíše ani u pacientů s HFrEF

- 2010-2021 (COVID-19-related restrictions + recall of the ASV device).
- 1127 pts. screened, 731 pts. (65%) randomized - SC (n=375; AHI 42,8) or SC + ASV (n=356; AHI 43,3).
- 41 (6%) of participants withdrew consent and 34 (5%) were lost to follow-up.
- In ASV group AHI decreased to 2,8-3,7 with associated improvements in sleep quality.
- Over a mean follow-up period of 3,6 years, ASV had no effect on the primary composite outcome (180 vs 166 events in the ASV group (HR 0,95, p=0,67) or the secondary endpoint of all-cause mortality (88 vs. 76 detahs in the ASV group (HR 0,89, p=0,47).
- For patients with OSA, the HR for all-cause mortality was 1,00 (p=0,98) and for CSA was 0,74 (p=0,25). No safety issue related to ASV use was identified.

**In pts. with HFrEF and SDB, ASV had no effect on the primary composite outcome or mortality but eliminated sleep-disordered breathing safely.**

ADVENT-HF

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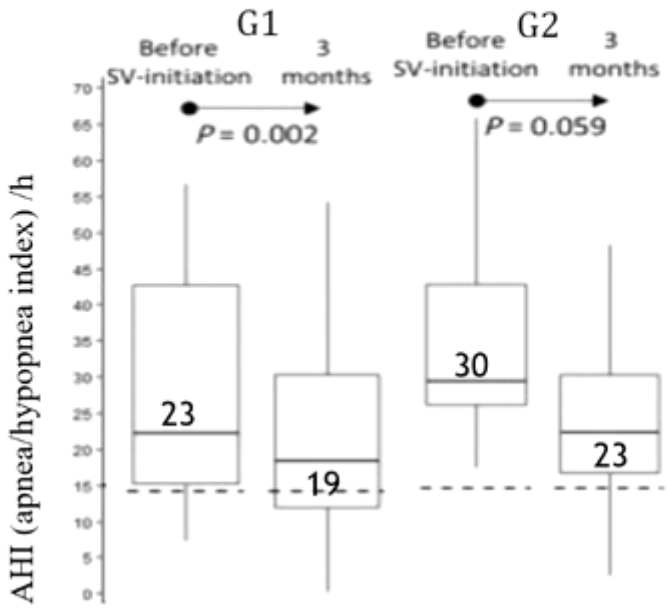
Bradley TD et al., Lancet Respir Med 2024

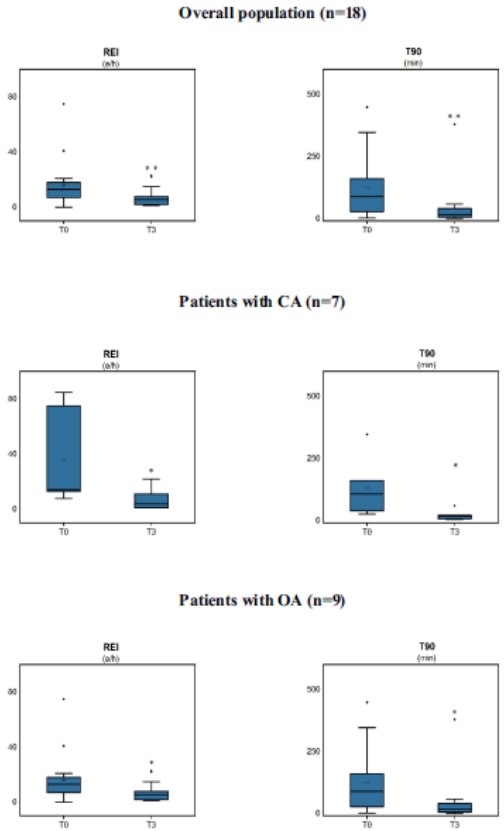
# A ještě Entresto – zde je ovšem efekt i na OSA

Sacubitril-valsartan initiation in chronic heart failure patients impacts sleep apnea: the ENTRESTO-SAS study

G1: $AHI_{central} \geq 5/h$ and $AHI_{obstructive} < 15/h$;
G2: $AHI_{obstructive} \geq 15/h$ regardless of the $AHI_{central}$




Effects of sacubitril-valsartan on central and obstructive apneas in heart failure patients with reduced ejection fraction




*$p < 0.05$
**$p < 0.01$
***$p < 0.001$

Jaffuel D et al., ESC Heart Failure 2021; Wang Y et al., Sleep and Breathing 2023

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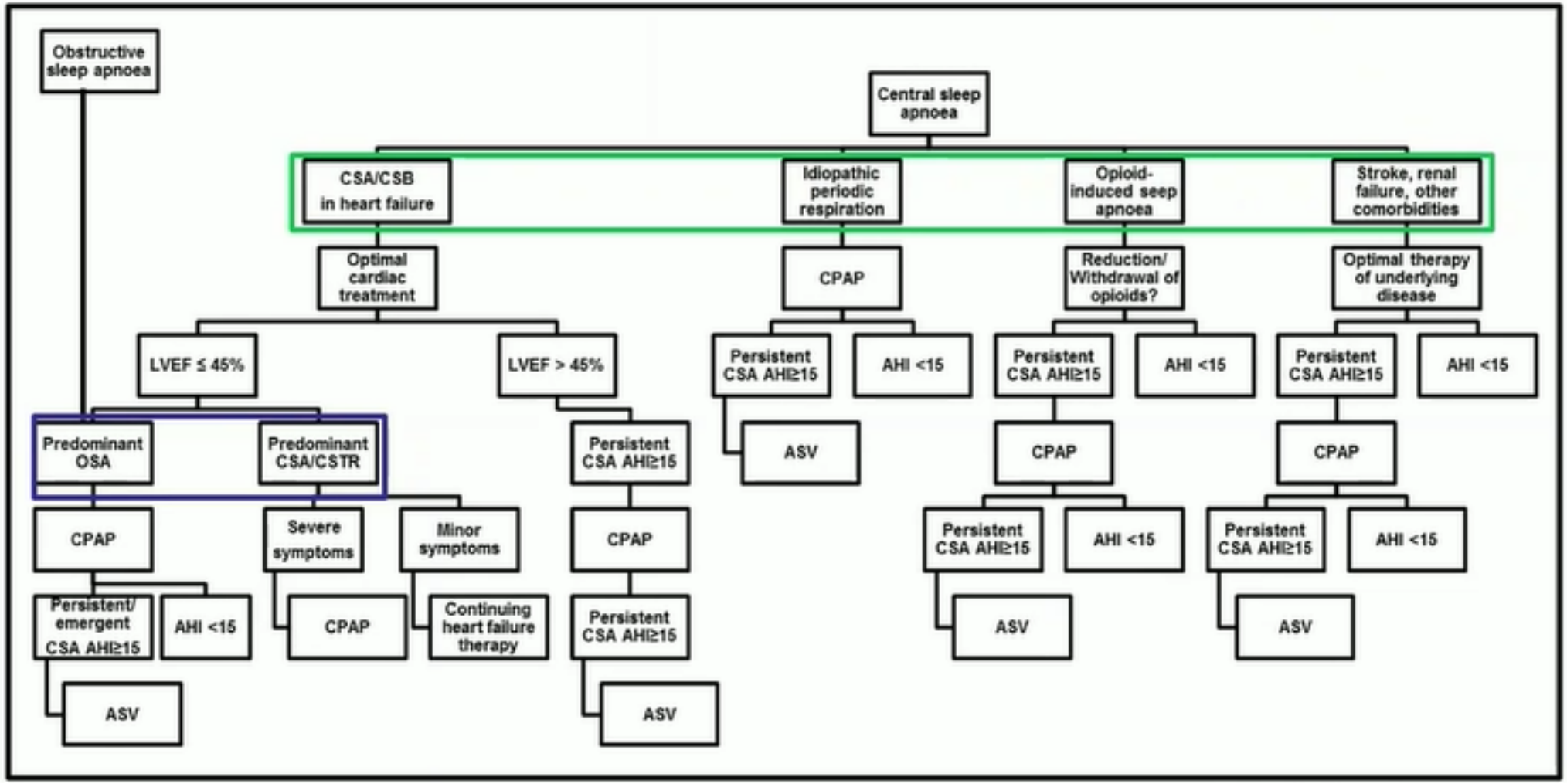
# Návrh algoritmu léčby centrální apnoe




Randerath W, Eur Resp J 2017

# Závěr

**Novinky v dg. a skórovacích kritériích AASM (OSA, CSA, hypopnoe, min/max TF…)**

**Léčba OSAS pomocí CPAP a hypertenze (TK, dip, CPAP/APAP)**

**Markery KV rizika u pac. s OSAS (pulse-rate response , hypoxic burden, pokles amplitudy pulsního oxymetru)**

**Standardní versus personalizovaný přístup + fenotypy**

**Terapie SDB u pacientů s HFrEF (ASV bezpečná) + vliv sacubitril valsartanu na SA**

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# Děkuji za pozornost

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