Saturday 17 afternoon - Cenacolo Room

← GO BACK TO SATURDAY, OCTOBER 17, 2015

14.30-16.30

Sorin Group Satellite Symposium

Advances in cardiac pacing and arrhythmia management

Chairmen: **M.G. Bongiorni** / Pisa, Italy – **H. Burri**/ Geneva, Switzerland

Long-lasting ECG monitoring for syncope and palpitations, what else?g
E. Locati/ Milan, Italy

Multidisciplinary approach for sleep apnea syndrome in paced patients
A. Capucci/ Ancona, Italy

20 years in CRT therapy: what's more?
R. Mantovan/ Cesena, Italy

Relevance of ICD longevity in clinical practice
L. Calò/ Rome, Italy

Strategies to reduce inappropriate shocks: which options?
S. Reif/ Munich, Germany

Venice, Italy October 16-18 2015 14th Edition
VENICE 2015 ARRHYTHMIAS

Multidisciplinary approach for Sleep Apnea Syndrome in paced patients

Alessandro Capucci,FESC,FACC,FHRS
Clinica di Cardiologia e Aritmologia
Università Politecnica delle Marche
Ancona-Italy

October 16 - 18
14th EDITION 2015

NO CONFLICT OF INTEREST TO DECLARE

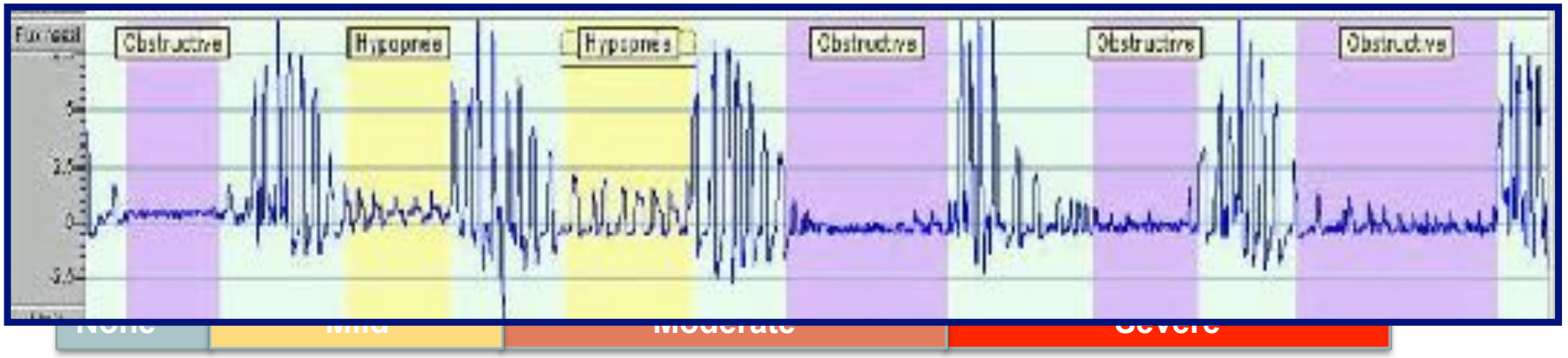
Apnea and Hypopnea

** American Academy of Sleep Medicine Task Force (Sleep 1999; 22: 667-689)*

- **Apneic episodes** are defined by complete cessation of airflow for ≥ 10 s

- **Hypopnea episodes** are characterized by either ≥ 30% reduction in airflow and ≥ 4% reduction in blood oxygen saturation from baseline for at least 10 s or 50% reduction in air flow and ≥ 3% reduction in oxygen saturation from baseline for at least 10 s or arousal from sleep

- **AHI:** n°of apneas and hypopnea per hour of total sleep



- **Sleep Apnea Syndrome (SAS): AHI > 5 with symptoms**

Symptoms of OSA

DAY TIME:

Early morning headaches, Fatigue, Daytime sleepiness, Poor memory, concentration or motivation, Unproductive at work, Falling asleep driving, Depression

NIGHT TIME:

Frequent nocturnal awakenings, Waking up choking or gasping for air, Restless sleep, nocturia, Unrefreshed sleep, decreased libido, Loud snoring, Witnessed apnoea reported by bed partner

Table 1—Symptoms and Signs of OSA

Daytime symptoms
Daytime sleepiness or fatigue
Difficulties with concentration and short-term memory
Depression
Nocturnal symptoms
Awakenings
Insomnia
Nocturia
Obstructive breathing
Loud snoring
Choking/gasping
Witnessed apneas
Conditions with increased risk
Menopausal status in women
Family history of OSA
Hypertension
Stroke
Diabetes mellitus
Alcohol use
Pulmonary hypertension
Signs
Upper body obesity
Crowded pharyngeal airspace
Retrognathia
Reduced cricomental space
Macroglossia
Lateral peritonsillar narrowing
Lower extremity edema
Tonsillar hyperplasia
Elevated Mallampati score

Patil SP, Schneider H & al. CHEST 2007;132:325-37

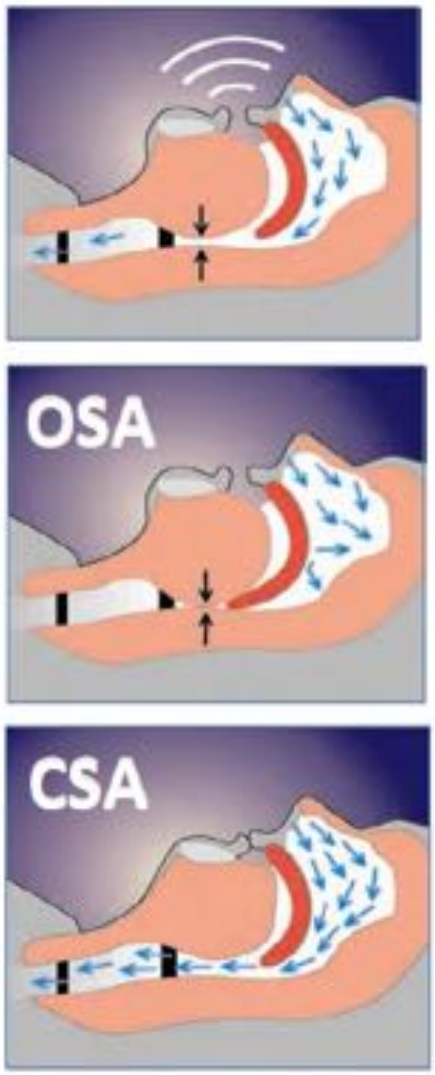
Two main categories of SAS

1. Obstructive Sleep Apnea (OSA)

- Most common form of SAS
- More than 90% of SAS patients
- Obstruction of upper airway despite increased ventilatory effort

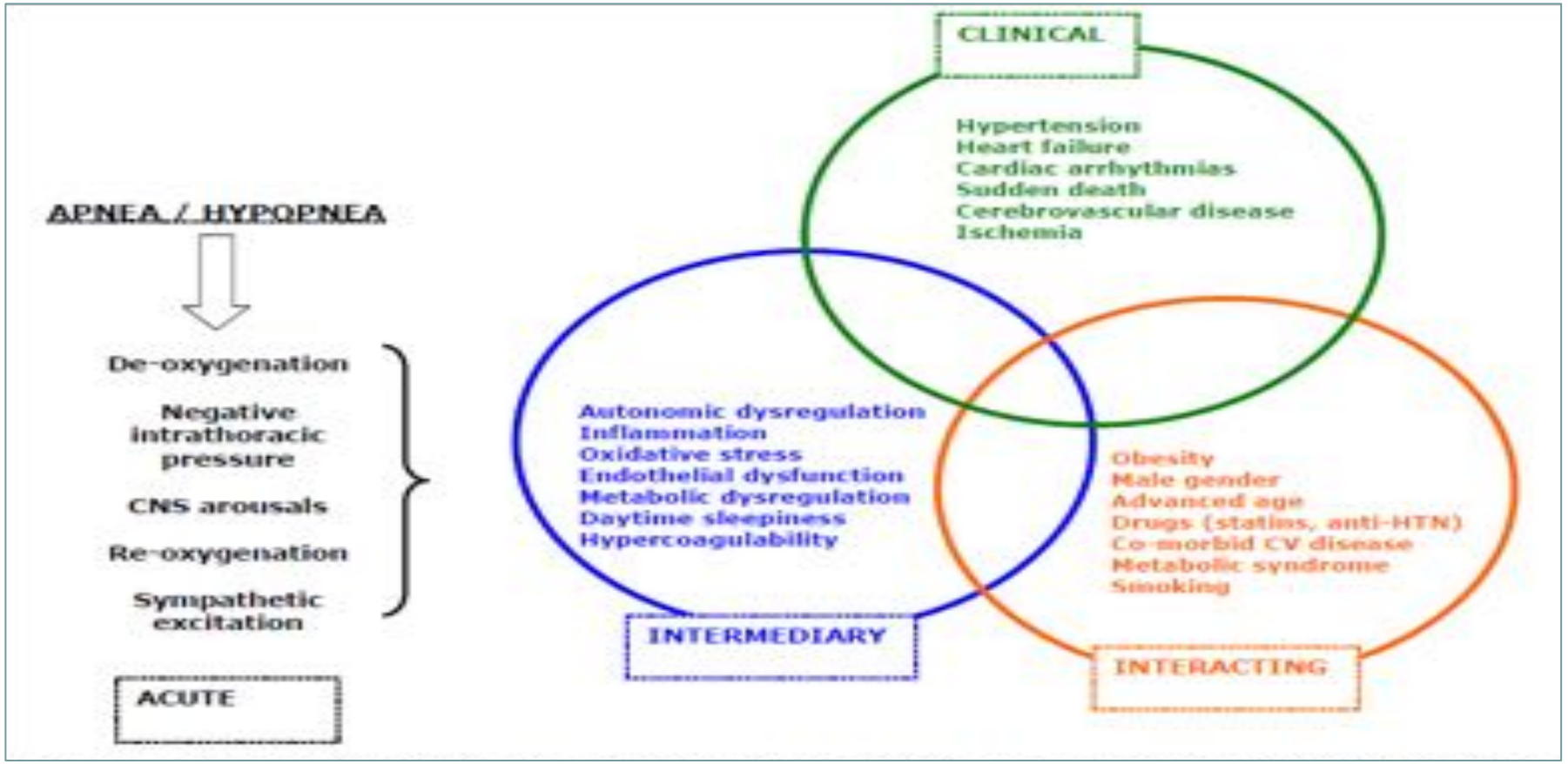
2. Cheyne-Stokes Respiration (CSR) and Central Sleep Apnea (CSA)

- More prevalent in some patient groups
- Less than 10% of SAS patients
- Absence of brain signal to the muscle to breathe



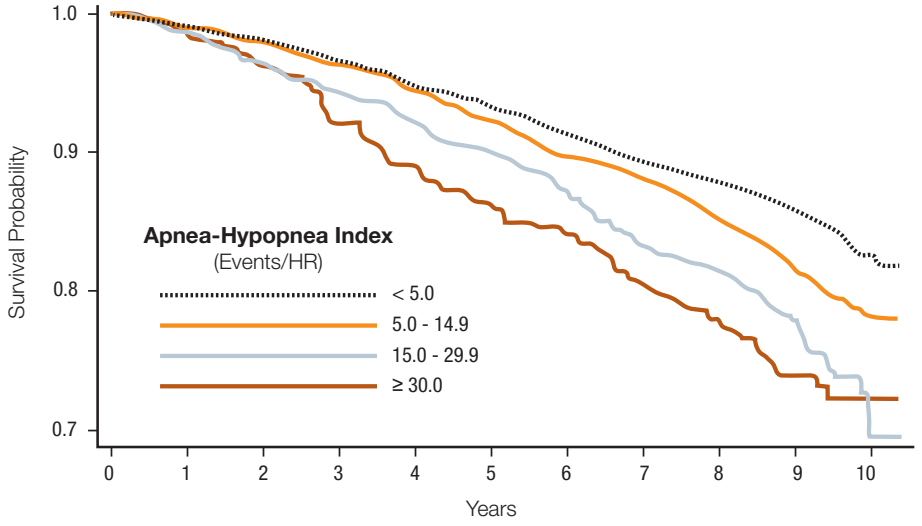
Sleep apnea and comorbidities correlations

Sleep apnea is a systemic disease. It is not a local disease



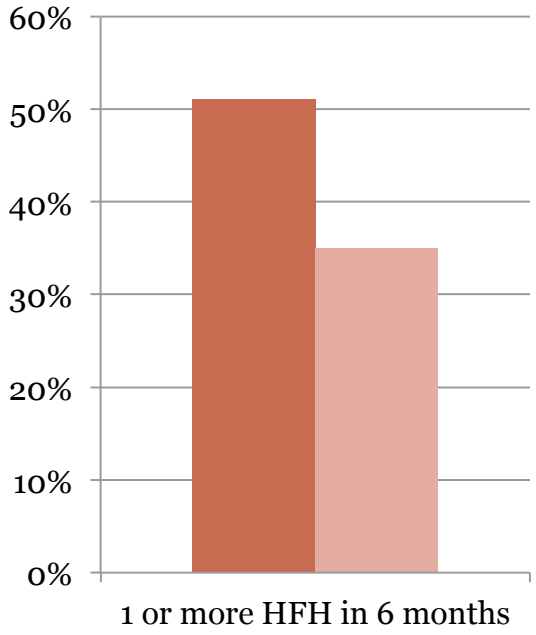
Managing SAS is important for cardiovascular co-morbidities

- The risk of HF is 58% higher in severe Sleep Apnea patients[1]
- The risk of AF is 4 times higher in Sleep Apnea patients[2]
- Sleep Apnea patients show resistance to pharmacological treatement[3,4]
- More recurrence of AF after AF ablation[5,6] and cardioversion[2]
- The severity of Sleep Apnea is an independent predictor of mortality[7]

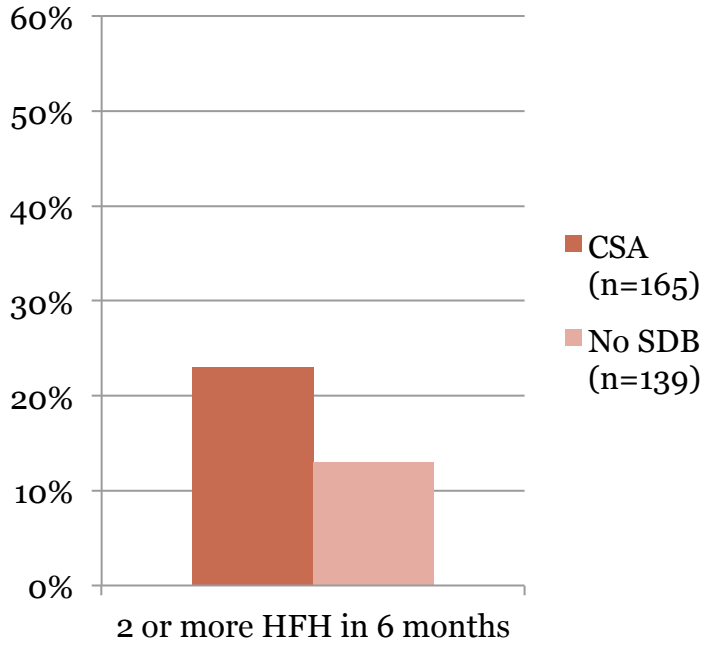


1. Gottlieb DJ et al. Circulation 2010
2. Mehra R et al. Am J Respir Crit Care Med 2006
3. Monahan K et al. Am J Cardiol. 2012
4.Linz D et al. Heart Rhythm 2011
5. Kanagala R et al. Circulation 2003
6. Ng CY et al. Am J Cardiol. 2011
7. Punjabi NM et al. PLoS Med. 2009

CSA increases risk of HF patient readmissions



More than 50% of HF patients with CSA were **readmitted at 6 months**



Almost 25% of HF patients with CSA had **2 or more readmissions within 6 months**

As a consequence CSA monitoring can be very useful for HF monitoring

Khayat et al. J Card Fail. 2012

Screening and Diagnosing Sleep Apnea

Polysomnography (PSG): gold standard for the diagnosis of SDB

✓ Using multiple channels to record sleep quality, disturbancesof breathing and oxygen desaturation during sleep

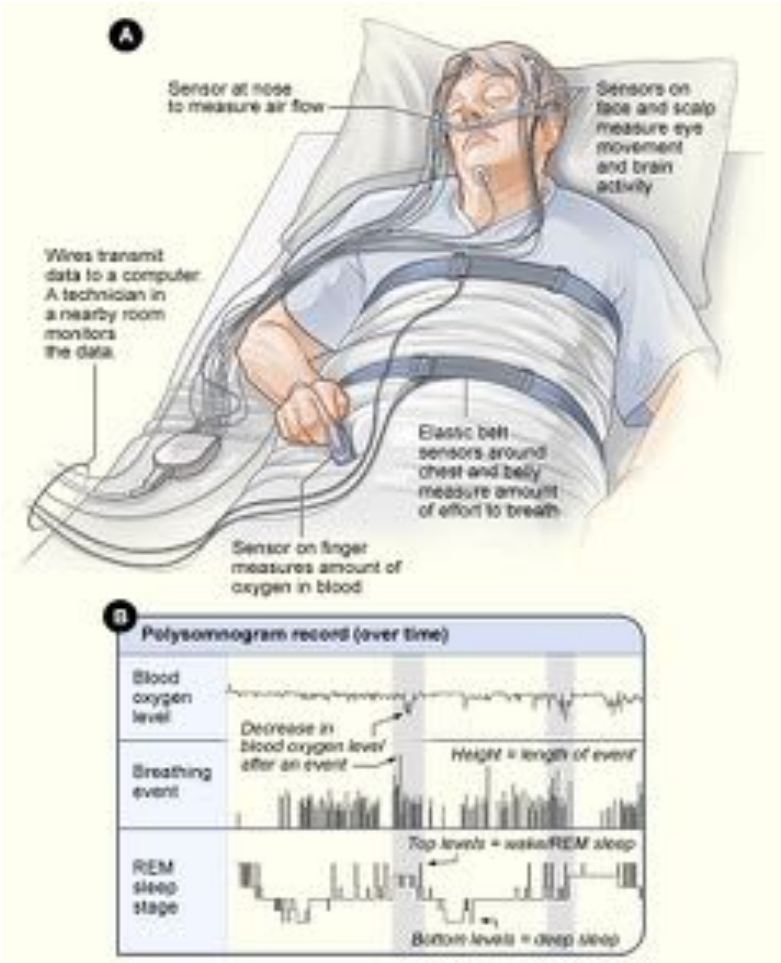
✓Assessment of the severity of sleep apnea measuring AHI (apnea/hypopnea index)

BUT....

✓ Limited number of sleep laboratories available/waiting list

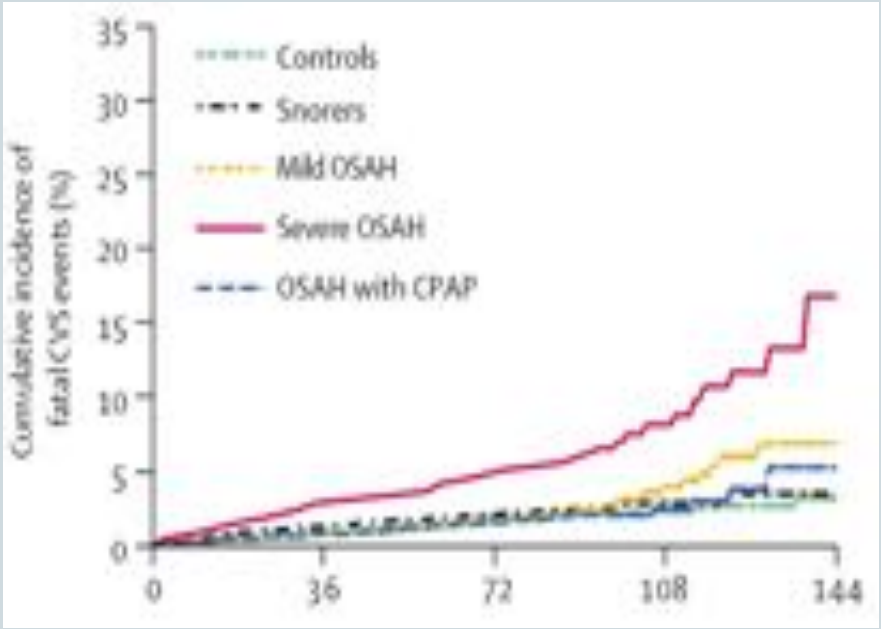
✓ Need specific training, laborious task, high costs

✓ Expensive & time-consuming



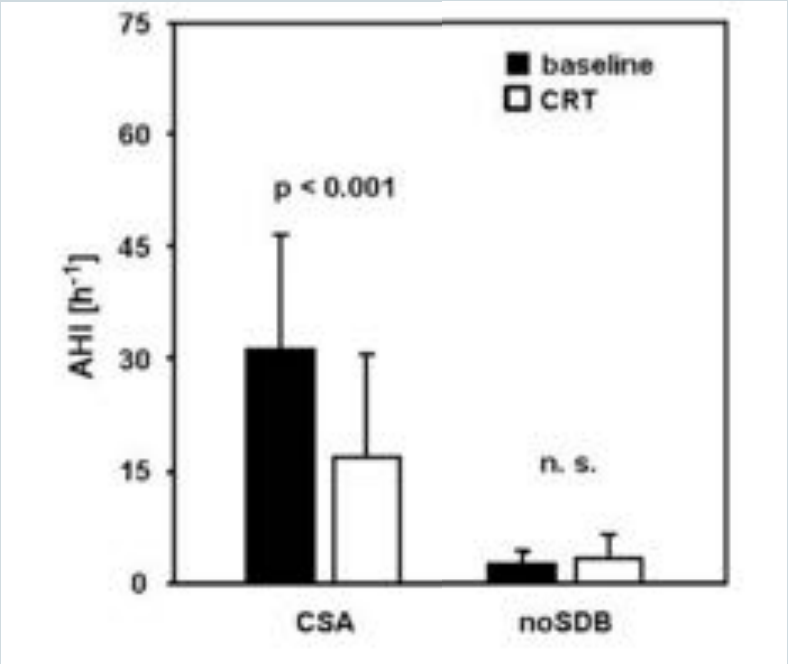
SAS Treatment

Treatment of OSA by CPAP virtually eliminates the increased risk for Cardiovascular Events



Marin M , Lancet 2005;365:1046-53

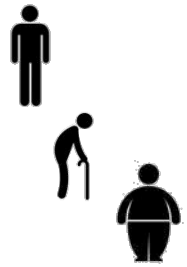
CRT improves cardiac function and CSA



Oldenburg O et al. Euro J Heart Fail. 9 (2007) 820–826

Sleep Apnea is highly prevalent…
in general poulation

OSA prevalence = 2 – 4 % of US adult population

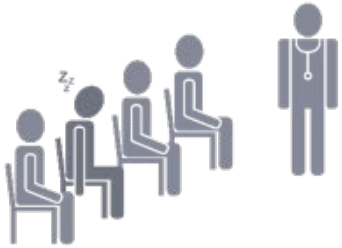


- Risk factors double for men
- increases with age and is at least 20% in patients over 65 years old
- Increased with BMI and is 3-fold higher in high BMI than in low BMI

CSA prevalence: less than 1% in adult population.

- Higher in population subsets: CSB-CSA has been reported in 25-50% of patients with heart failure and in 10% of patients who have had a stroke

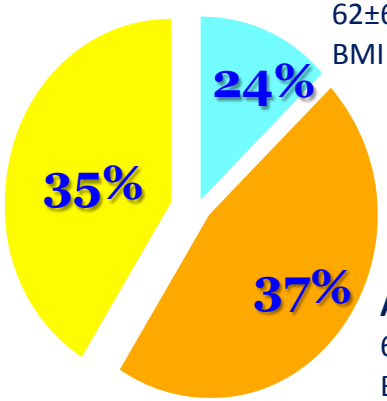
1. Young T, Palta M (Wisconsin, US), NEJM 1993 Apr, Vol 328 Nr 17
2. Bradley TD, Floras JS. Lancet 2009



Sleep Apnea is highly prevalent…

in paced patients

11 european centers
n = 98 patients



Heart failure
62±6 years
BMI 26±6

Bradycardia
67±6 years
BMI 27±4

AV Block
68±10 years
BMI 26±4

1 out of 4 SND or AVB patients suffers from severe SAS

Variables	AV Block *n=36*	Brady *n=31*	HF *n=21*
10 ≥ AHI < 30	41%	31%	45%
AHI ≥ 30	27%	27%	05%
Total	**63%**	**58%**	**50%**
Obstructive apnea	15±19%	13±17 %	19±23 %
Central apnea	07±09 %	08±07 %	08±12 %
Hypopnea	78±19 %	79±17 %	73±25 %

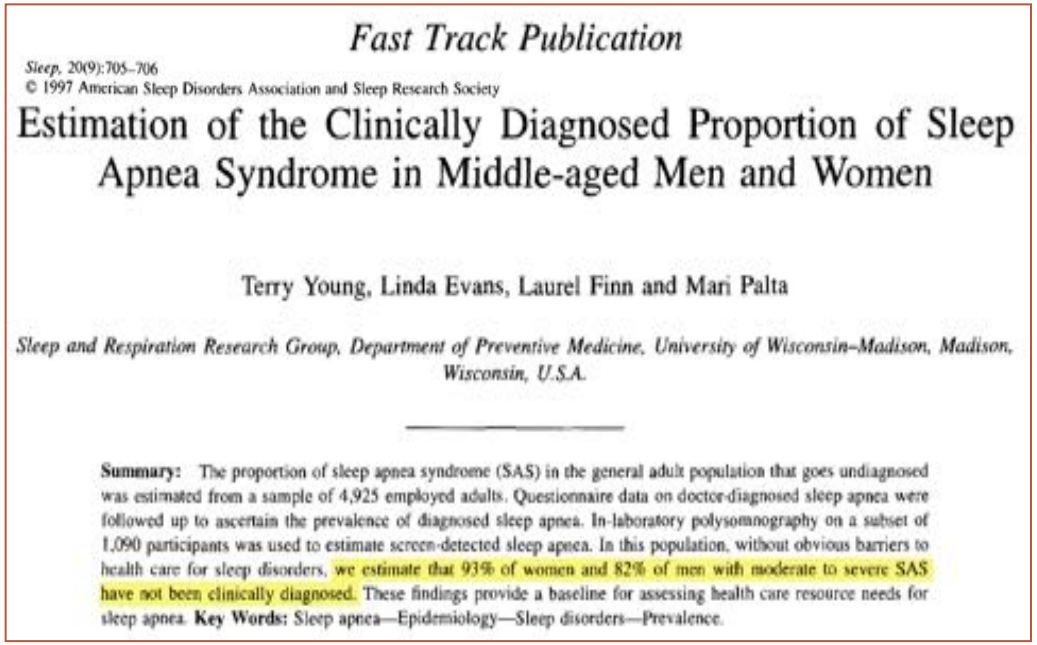
Garrigue S, et al. Circulation 2007;115:1703-9

…yet underdiagnosed

80% of patients with moderate to severe
Obstructive sleep Apnea (OSA) are undiagnosed[1]

CSA is “silent” for patients with multiple comorbidities (in particular diabetes & HF patients)[2]

50% to 90% of patients are undiagnosed
and therefore untreated[1]



Fast Track Publication

Sleep, 20(9):705–706
© 1997 American Sleep Disorders Association and Sleep Research Society

Estimation of the Clinically Diagnosed Proportion of Sleep Apnea Syndrome in Middle-aged Men and Women

Terry Young, Linda Evans, Laurel Finn and Mari Palta

Sleep and Respiration Research Group, Department of Preventive Medicine, University of Wisconsin–Madison, Madison, Wisconsin, U.S.A.

Summary: The proportion of sleep apnea syndrome (SAS) in the general adult population that goes undiagnosed was estimated from a sample of 4,925 employed adults. Questionnaire data on doctor-diagnosed sleep apnea were followed up to ascertain the prevalence of diagnosed sleep apnea. In-laboratory polysomnography on a subset of 1,090 participants was used to estimate screen-detected sleep apnea. In this population, without obvious barriers to health care for sleep disorders, we estimate that 93% of women and 82% of men with moderate to severe SAS have not been clinically diagnosed. These findings provide a baseline for assessing health care resource needs for sleep apnea. **Key Words:** Sleep apnea—Epidemiology—Sleep disorders—Prevalence.

1. Lee W et al. Expert Rev Respir Med 2008

SAS is a common clinical problem in patients with implantable cardiac devices

- High prevalence pathology among pacemaker patient, under-diagnosed, with heavy cardiovascular (CV) consequences
- Costly therapies are less efficient on untreated Sleep Apnea patients
- Diagnostic methods expensive and time-consuming
- SAS therapy effective on symptoms, and on reduction of CV morbi-mortality

- **Problem: how to diagnose SAS at CV-care level ?**
- **Which effective and "easy to use" screening tools are today available for cardiologists ?**

Reliability of SA screening tool: the "DREAM" study

A pacemaker transthoracic impedance sensor with an advanced algorithm to identify severe sleep apnea: The DREAM European study

Pascal Defaye, MD,[*] Ines de la Cruz, MD,[†] Julio Martí-Almor, MD, PhD,[‡] Roger Villuendas, MD,[§] Paul Bru, MD,[‖] Jérémie Sénéchal, MSc,[¶] Renaud Tamisier, MD, PhD,[#**] Jean-Louis Pépin, MD, PhD[#**]

From the [*]Arrhythmia Unit, Cardiology Department, University Hospital, Grenoble, France, [†]Sleep Unit, Pneumology Service, Virgen de Valme University Hospital, Sevilla, Spain, [‡]Arrhythmia Unit, Cardiology Department, Hospital del Mar, Barcelona, Spain, [§]Electrophysiology and Arrhythmia Unit, Department of Cardiology, Germans Trias I Pujol Hospital, Badalona, Spain, [‖]La Rochelle Hospital, La Rochelle, France, [¶]SORIN CRM SAS, Clamart, France, [#]Central Core Lab, Sleep Laboratory, University Hospital, Grenoble, France, and [**]University of Grenoble Alpes, HP2, Inserm, Grenoble, France.

BACKGROUND Sleep apnea (SA) is associated with cardiovascular diseases and is highly prevalent in patients with pacemakers (PMs).

OBJECTIVE To validate a transthoracic impedance sensor with an advanced algorithm (sleep apnea monitoring) for identifying severe SA.

METHODS Patients with indications for PM (VVI/DDD) were enrolled regardless of symptoms suggesting SA. Severe SA diagnosis was acknowledged when the full polysomnography gave an apnea-hypopnea index (PSG-AHI) of ≥30 events/h. The PSG-AHI was compared with the respiratory disturbance index evaluated by the SAM algorithm (SAM-RDI) compiled from the device during the same diagnosis night, and the performance of the device and the SAM algorithm was calculated to identify patients with severe SA. The agreement between methods was assessed by using Bland and Altman statistics.

RESULTS Forty patients (mean age 73.8 ± 19.1 years; 67.5% men; body mass index 27.7 ± 4.4 kg/m^2) were included. Severe SA was diagnosed by PSG in 56% of the patients. We did not retrieve SAM-RDI data in 14% of the patients. An optimal cutoff value for the SAM-RDI at 20 events/h was obtained by a receiver operator characteristic curve analysis, which yielded a sensitivity of 88.9% (95% confidence interval [CI] 65.3%–98.6%), a positive predictive value of 88.9% (95% CI 65.3%–98.6%), and a specificity of 84.6% (95% CI 54.6%–98.1%) (n = 31). The Bland-Altman limits of agreement for PSG-AHI (in events per hour) were [−14.1 to 32.4].

CONCLUSION The results suggest that an advanced algorithm using PM transthoracic impedance could be used to identify SA in patients with PMs outside the clinic or at home.

KEYWORDS Bradycardia; Pacemaker; Minute ventilation; Sleep apnea; Sleep apnea diagnosis

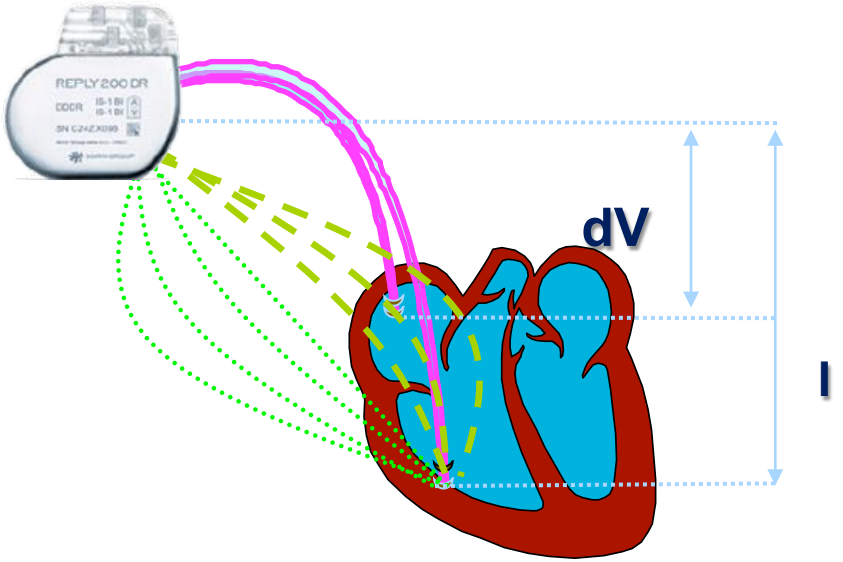
ABBREVIATIONS **CI** = confidence interval; **NPV** = negative predictive value; **PM** = pacemaker; **PPV** = positive predictive value; **PSG** = polysomnography; **PSG-AHI** = apnea-hypopnea index evaluated by polysomnography; **SA** = sleep apnea; **SAM** = sleep apnea monitoring; **SAM-RDI** = respiratory disturbance index evaluated by the sleep apnea monitoring algorithm

(Heart Rhythm 2014;11:842–848)

Main objective: to validate a transthoracic impedance signal with advanced algorithm (Sleep Apnea Monitoring) for identifying severe SA in an unselected patient population with indication for permanent cardiac pacing

Heart Rhythm 2014; 11: 842-848

… SAS screening by the Pacemaker
Transthoracic impedance measurement

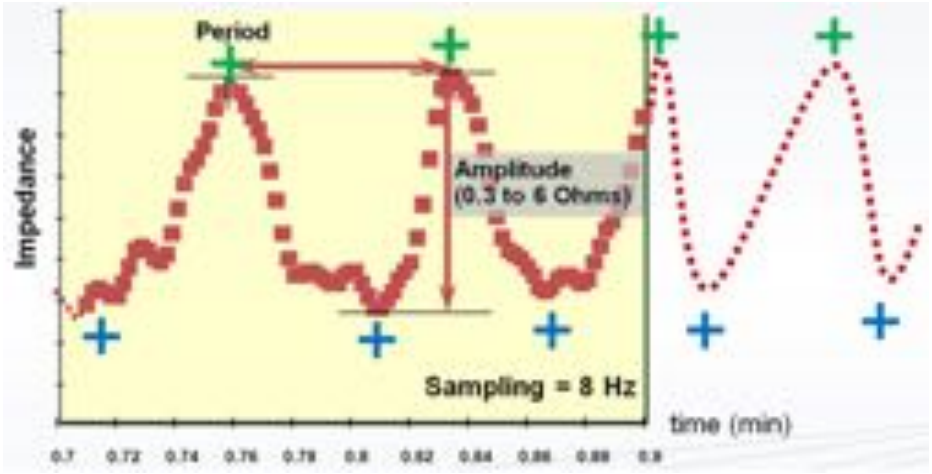


Zth is the transthoracic impedance

$$\text{Zth } (\Omega) = \frac{dV\ (V)}{I\ (A)}$$

I is the value of a fixed current injected between the can and the distal atrial electrode

dV is the voltage measured between the can and the proximal atrial electrode

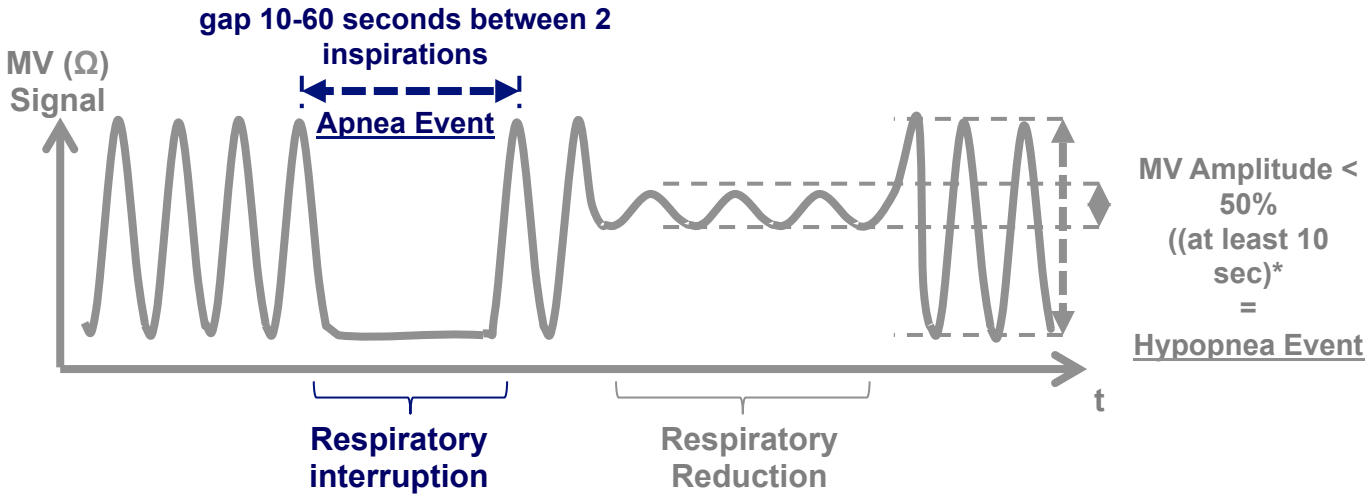


Calculation of **MV signal**

$$\text{VM } (\Omega.s\text{-}1) = \frac{\text{Zth } (\Omega)}{\text{Time period (s)}}$$

SAM (Sleep Apnea Monitoring)

A specific software dedicated to automatically identify apneas and hypopneas, to make an automatic screening of pacemaker patients (SR, DR or CRT) for the risk of severe Sleep Apnea

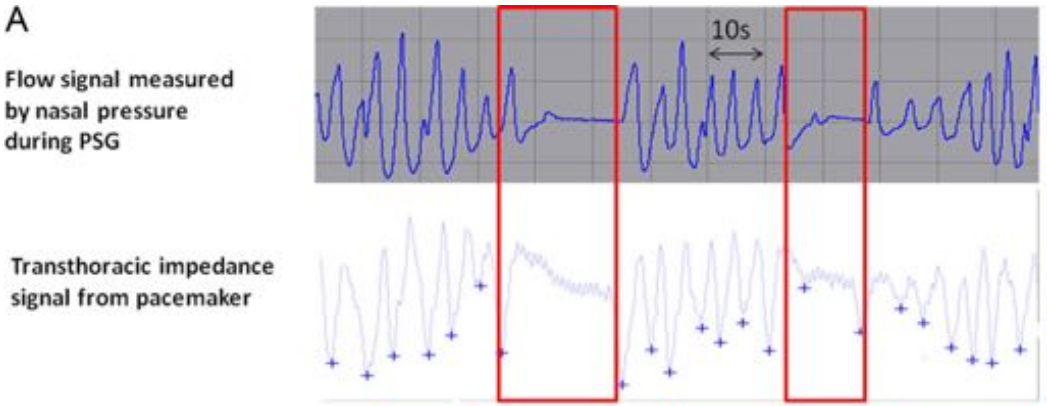


- Definition of ***RDI (Respiratory Disturbance index)***:

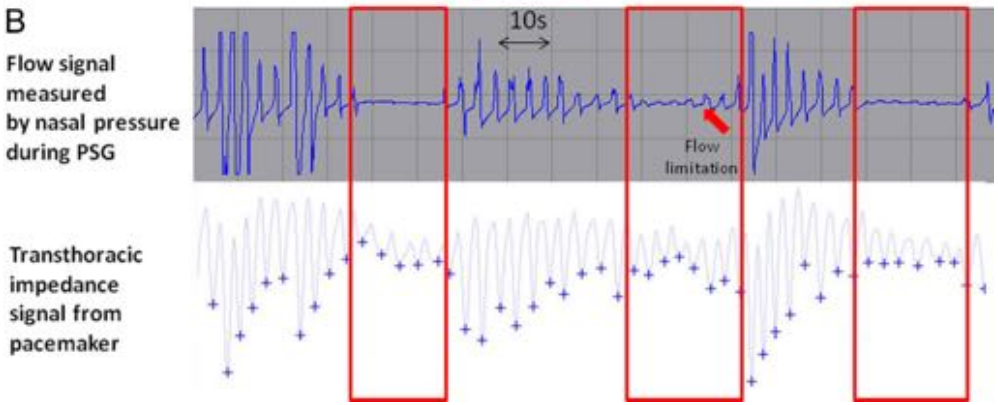
$$\frac{\text{Number of Ventilation Pauses \& Reductions}}{\text{Number of Hours of Monitoring}}$$

RDI defines the severity of Sleep Apnea

Apnea / Hypopnea detection
PSG recording and PMK transthoracic impedance signal



A: 2 apnea events
concurrent reduction of the amplitude of the thoracic impedance signal from the PMK

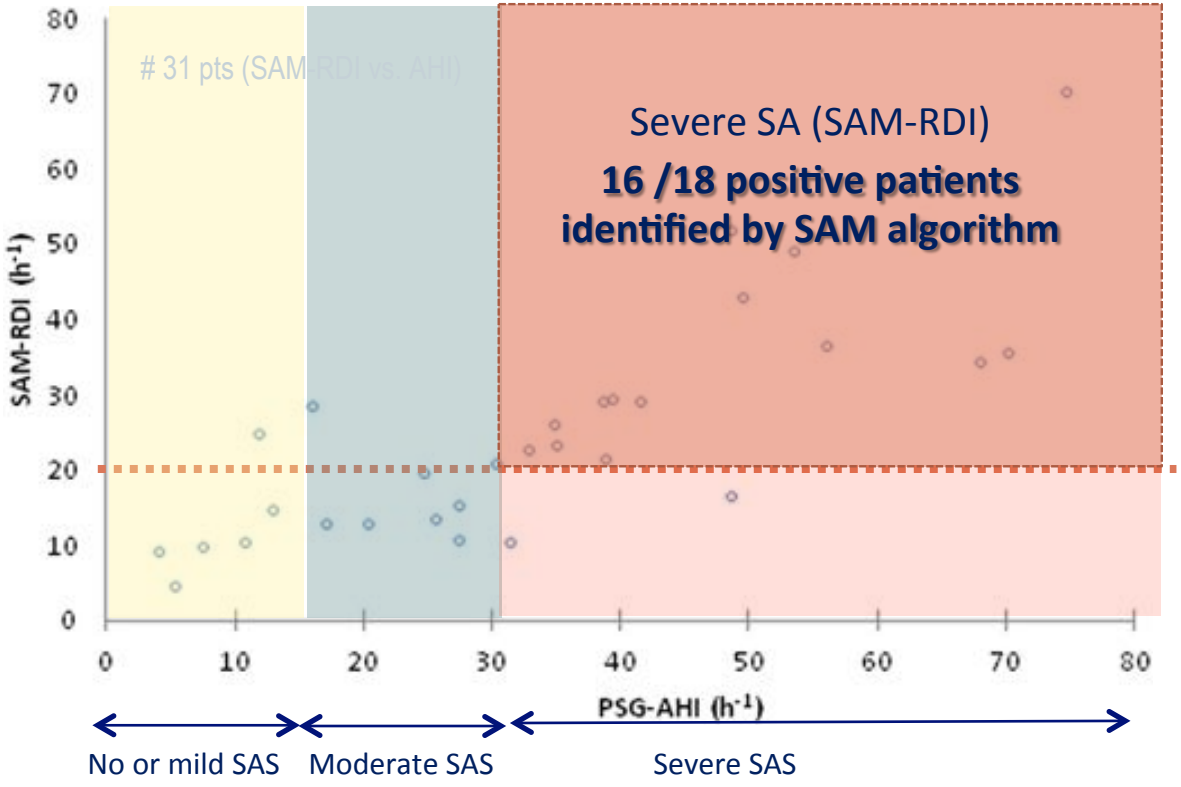


B: 3 hypopnea events
simultaneous reduction of the amplitude of the thoracic impedance signal from the PMK

Heart Rhythm 2014; 11: 842-848

DREAM study[1]: SAM-RDI vs PSG-AHI

- SAM-RDI is correlated with gold standard Apnea-Hypopnea Index (AHI-PSG)
- An optimal cutoff of 20 events/h for the SAM-RDI value was validated to identify severe SA (AHI-PSG > 30) with a **sensitivity of 88.9%,** a **PPV of 88.9%,** and a **specificity of 84.6%**

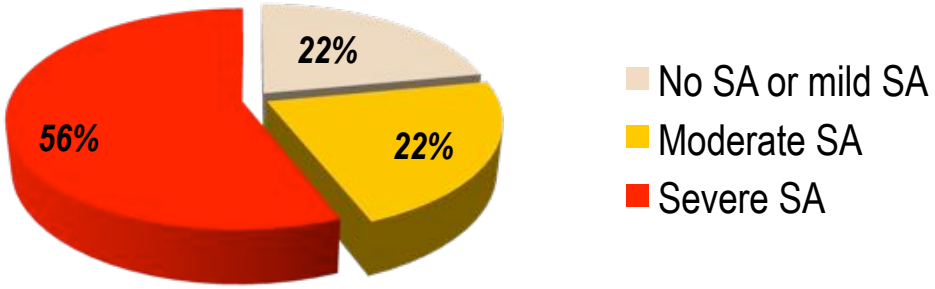


Sensitivity	Specificity
88.9%	84.6%
PPV	**NPV**
88.9%	84.6%

1. Defaye P, J & al. Heart Rhythm 2014

Reliability of SA screening tool: the "DREAM" Study Main findings and conclusions

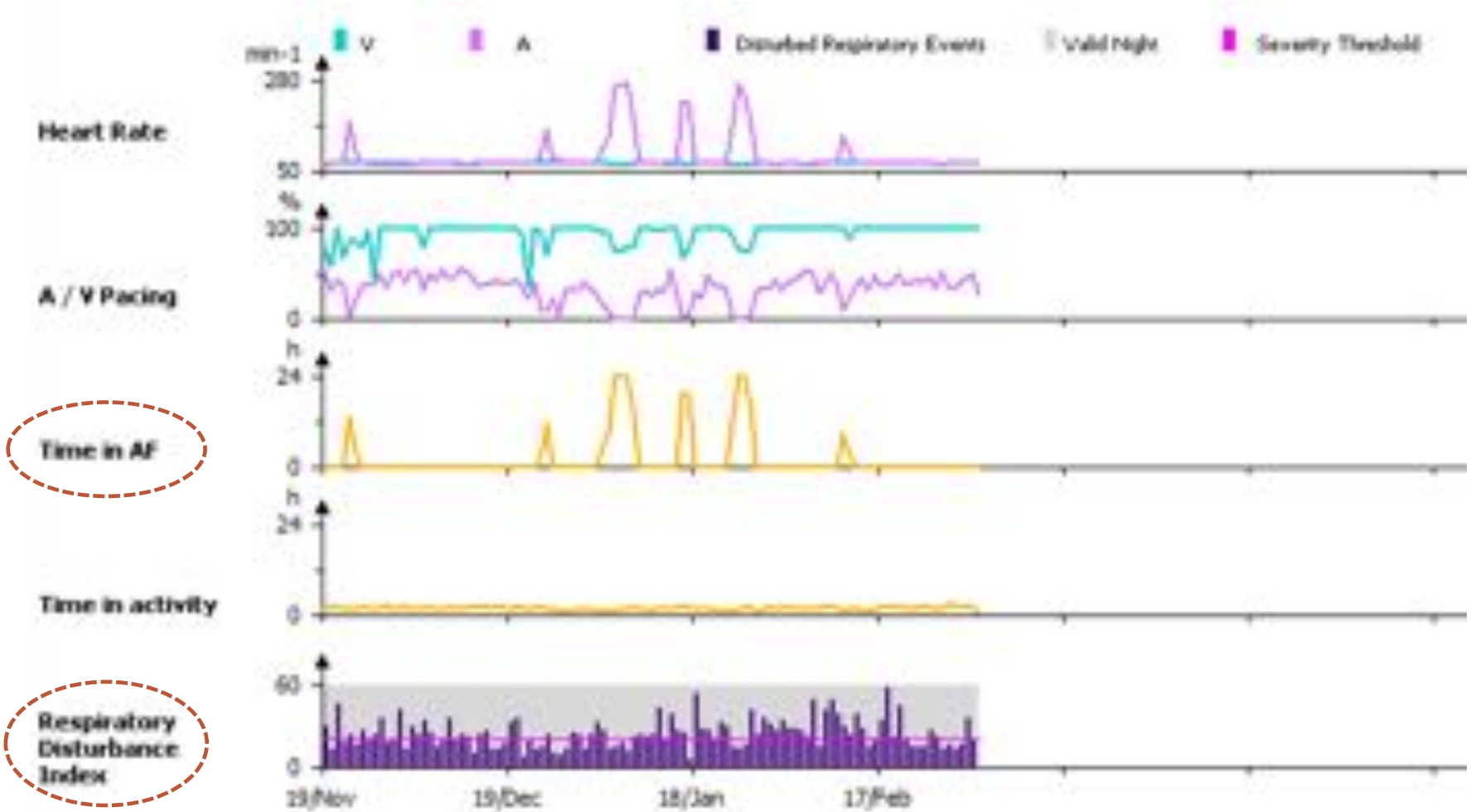
- Prevalence of SA in the DREAM study unselected pacemaker population (evaluated by PSG-AHI)
  - 78% moderate to severe SA
  - 56% severe SA



- An optimal cut-off of 20 events/hour for SAM-RDI value was validated to identify severe SA with
  - 88.9% Sensitivity – 88.9% PPV
  - 84.6% Specificity

The DREAM study showed that a transthoracic impedance sensor with an advanced algorithm (SAM) could be used to identify severe SA in PMK patients

SAM : Not only screening but also monitoring



Clinical case showing the practical use of the screening detection of the cardiac device

Clinical Case

Introduction

- Male, 57 yr old
- Ischemic Cardiomyopathy
- Indication : High degree AVB
- No known SAS
- No AF
- Hypertension/Dyslipidemia

➢ Dual-chamber PM *(REPLY 200 DR)* implanted Sep 12th, 2013

FU at 1 month : October 23rd 2013

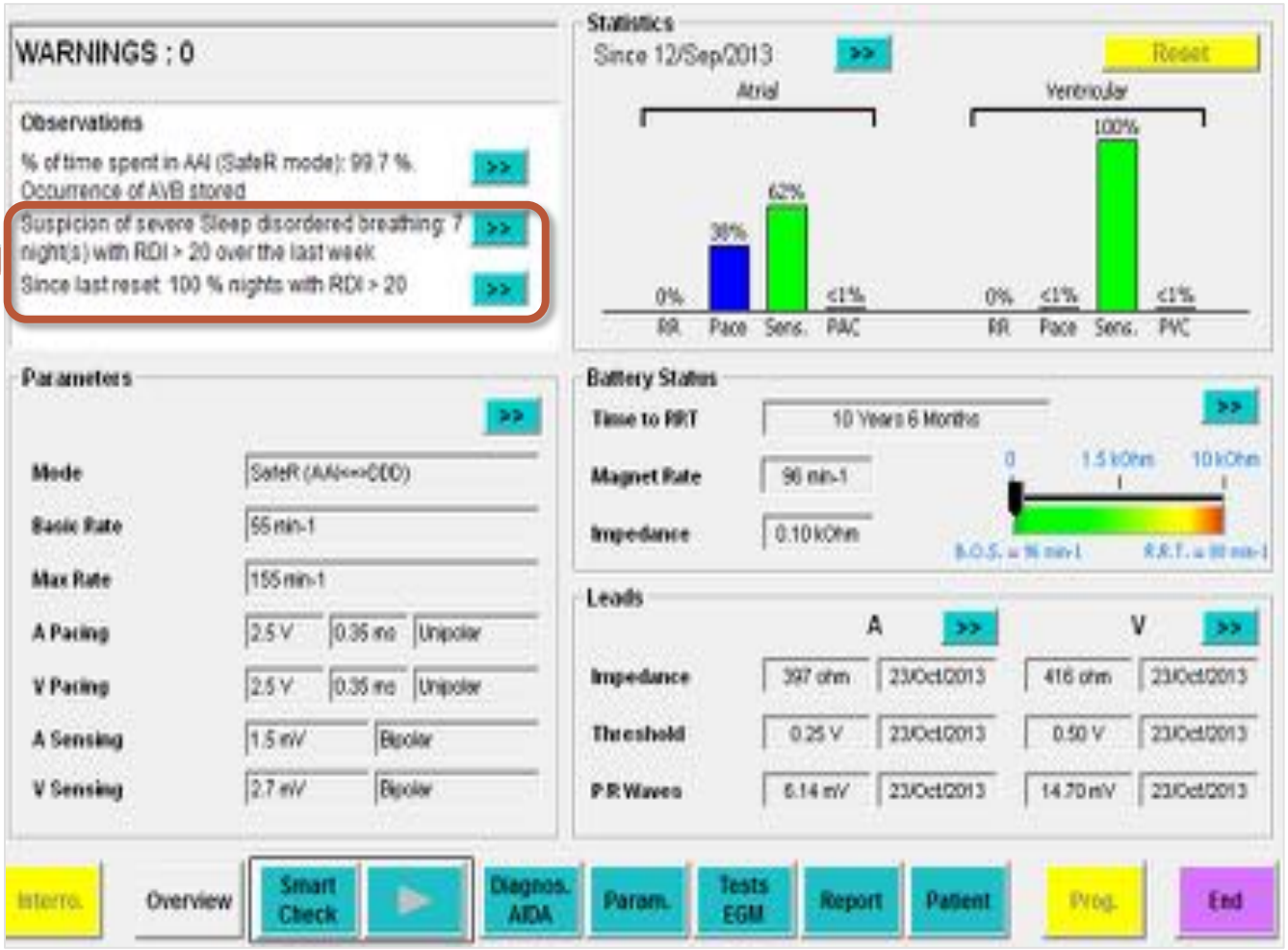
FU at 4 month : January 11th 2014

By courtesy of Dr. J. Marti Almor – Hospital del Mar. Barcelona (Sp)

FU – 4 weeks - October 23rd 2013

Severe SAS suspected by PM diagnostics

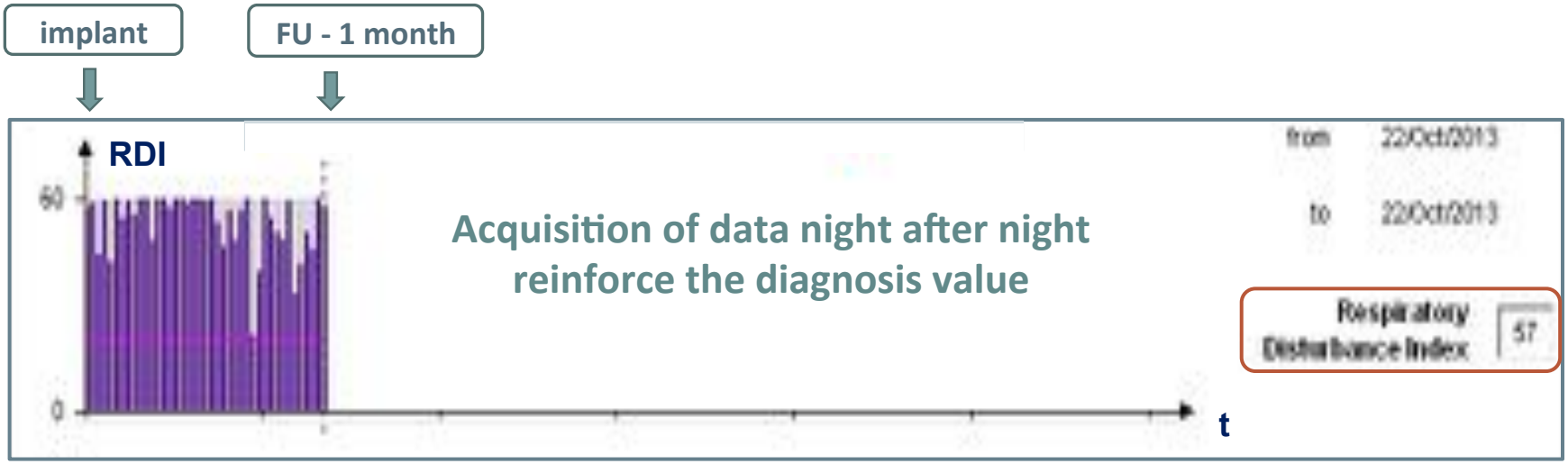
Automatic alerts on Programmer screen when patients are at risk of severe SAS



By courtesy of Dr. J. Marti Almor Hospital del Mar. Barcelona (Sp)

FU – 4 weeks - October 23rd 2013

Early screening for severe sleep apnea



Overnight respiratory polygraphy results

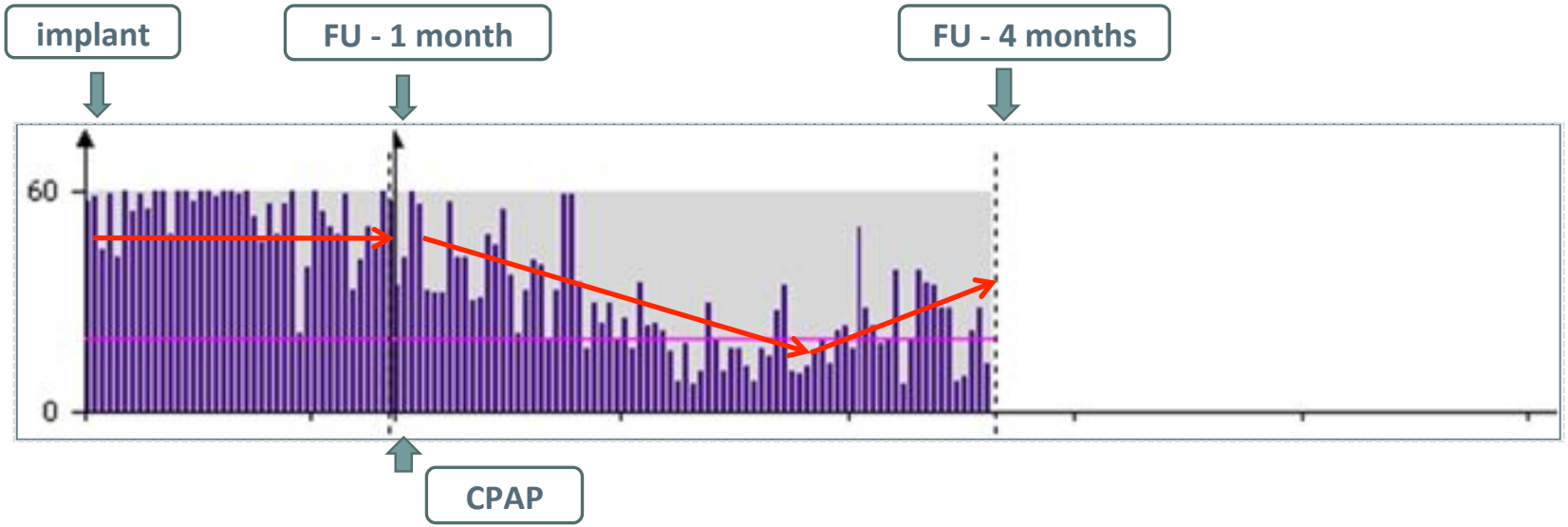
- Severe OSAS
- *AH Index = 55.6/hour*
- 254 Apnea events and 137 Hypopnea events
- Apnea events: average = 17.2s, longest = 29s

→ **REPLY 200 diagnostics confirmed**

By courtesy of Dr. J. Marti Almor
Hospital del Mar. Barcelona (Sp)

RDI since implant

The night after night measurements after implantation help to monitor and understand the evolution of severe SA, together with different therapeutic interventions



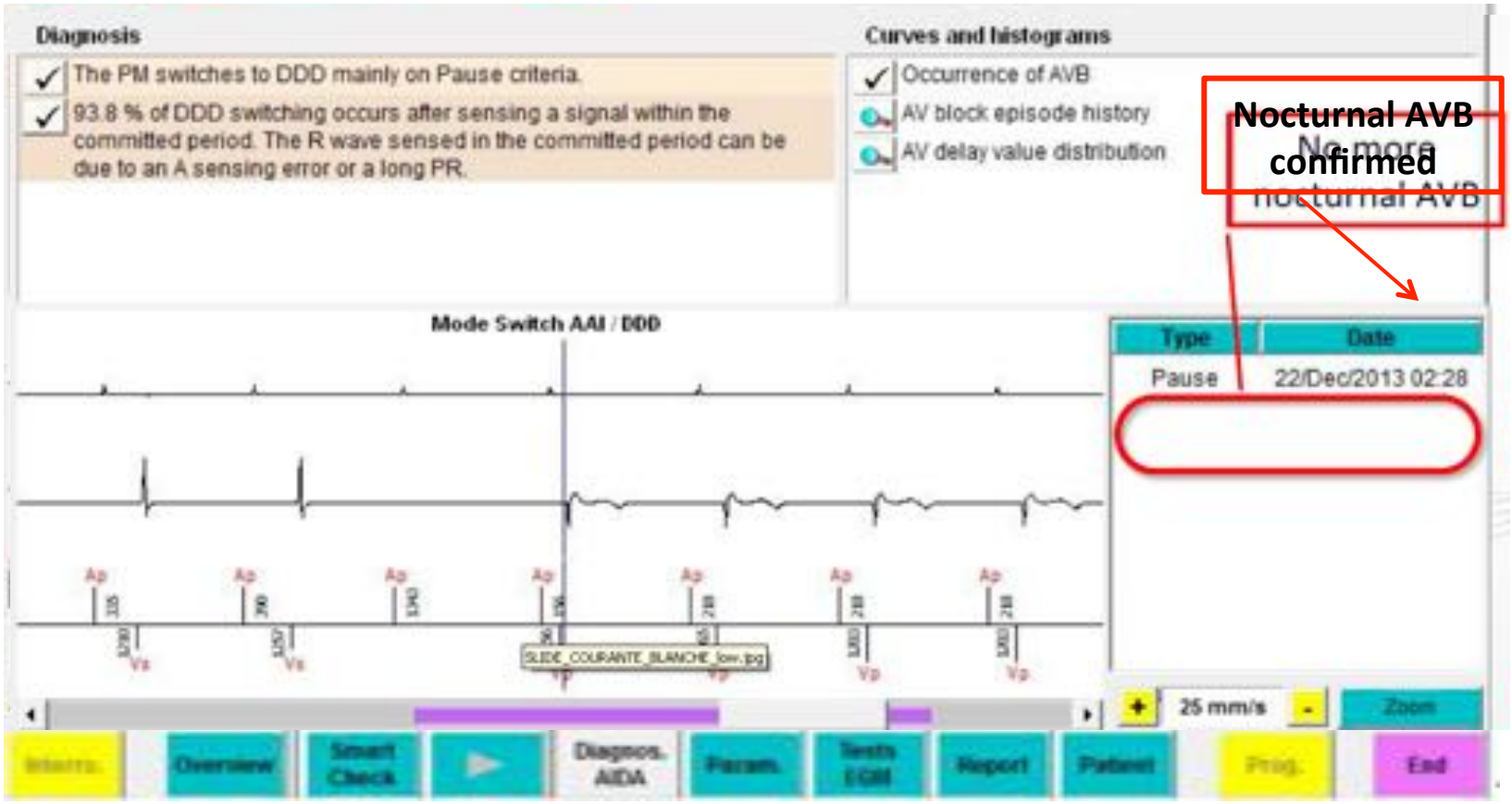
- CPAP treatment started just after previous FU
- Over the first month, the RDI decreases with CPAP treatment
- Over the next 3 weeks, the RDI increases again: there was a leak on the mask?!!
- To be continued....

By courtesy of Dr. J. Marti Almor – Hospital del Mar. Barcelona (Sp)

Correlation between the patient's disturbed respiratory events and nocturnal AVB

SAM is a valuable diagnostic tool for monitoring patient clinical status

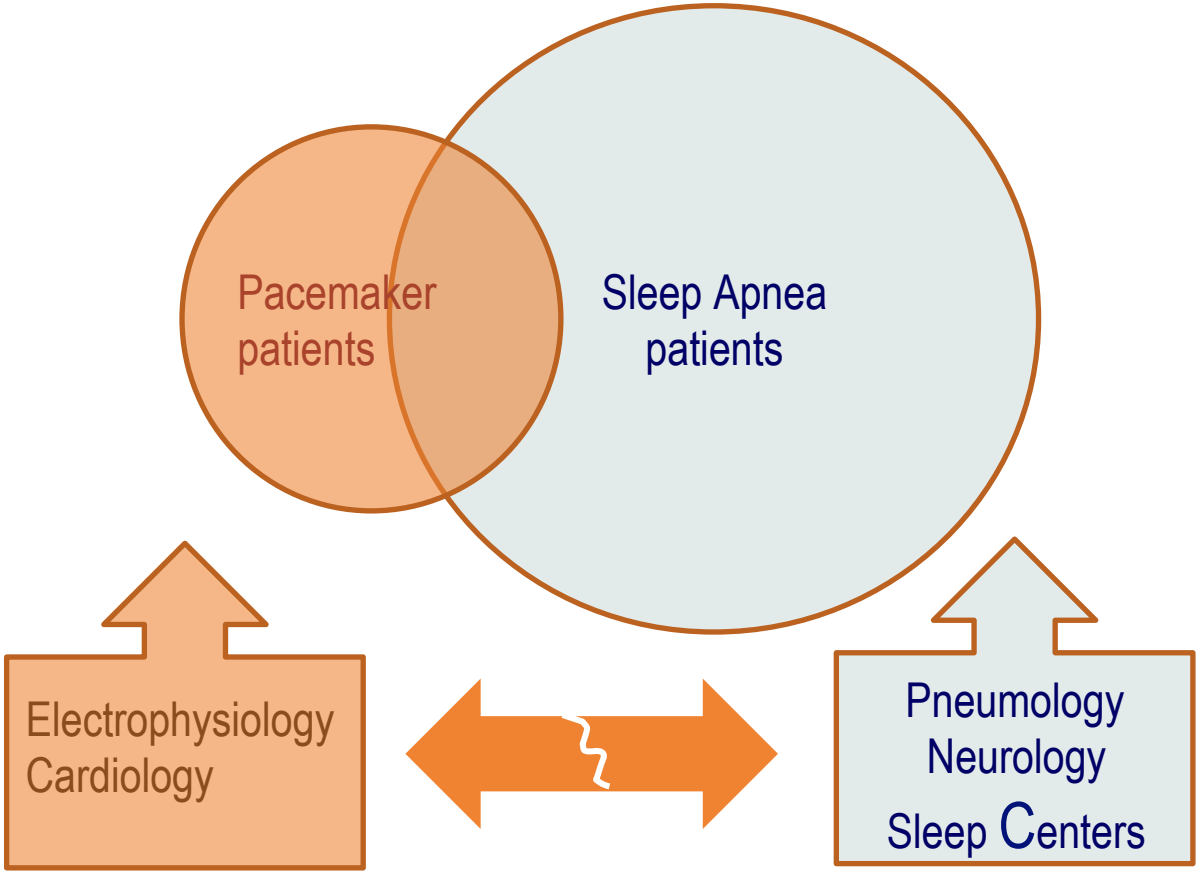
Before *After CPAP treatment*



Apneic patients treated by pneumologists…

… many of them are similar to patients treated by cardiologists !

Paced Patient Management
Multidisciplinary approach

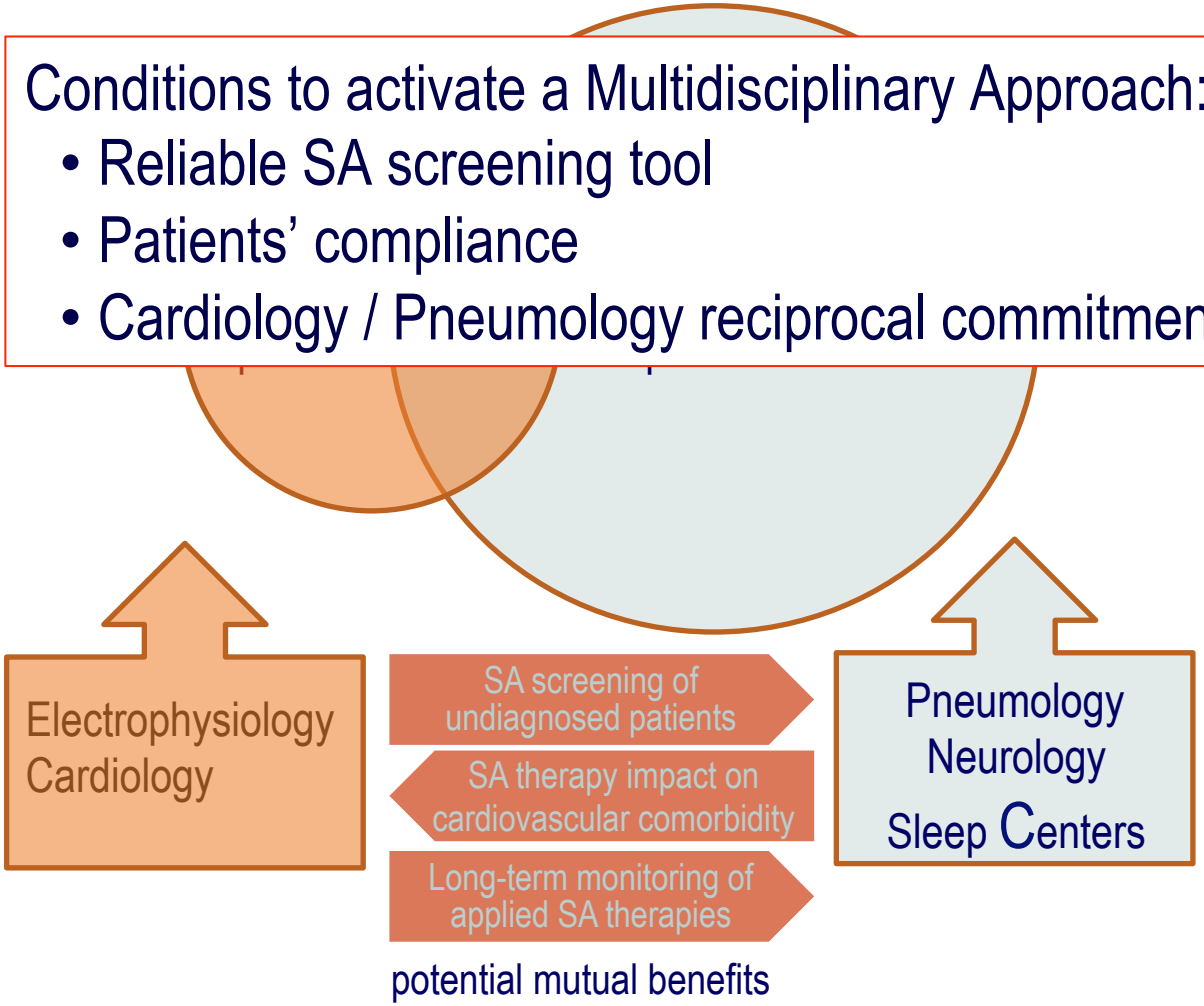


Poor collaboration in managing
SA / Heart diseases & co-morbidities

Paced Patient Management
Multidisciplinary approach

Conditions to activate a Multidisciplinary Approach:

- Reliable SA screening tool
- Patients' compliance
- Cardiology / Pneumology reciprocal commitment



potential mutual benefits

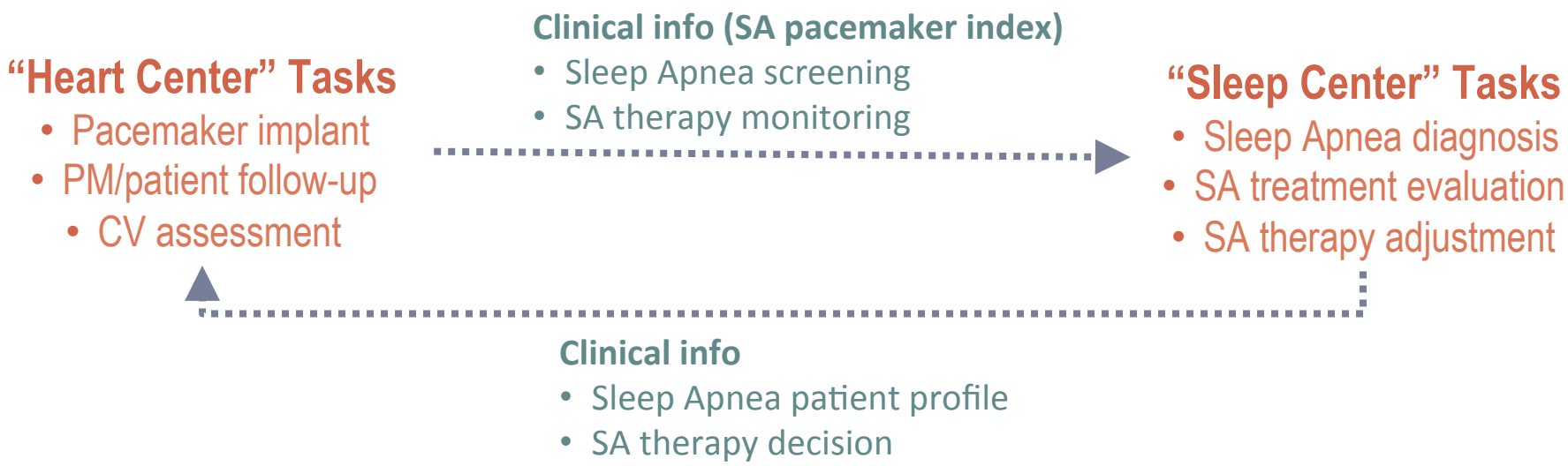
Towards a new clinical management model …

Moving from these premises and keeping in mind the strict interactions between heart and sleep a group of clinical researchers, began to work about an idea:

a) To develop a **"Clinical Management Model"** dedicated to diagnose / treat paced patients virtually affected by Sleep Apnea
b) To improve multidisciplinary collaboration [Cardiologist ↔ Lung Specialist / Neurologist]

In order to realize these aims, a Multicenter Prospective Observational Registry ("UPSTREAM") was conceived, to follow-up PMK patients (devices featuring Sleep Apnea screening tools) with a Systematic Multidisciplinary Approach involving Cardiologist/Lung Specialists (and/or Neurologist)

The basic idea of the "Multidisciplinary Approach"

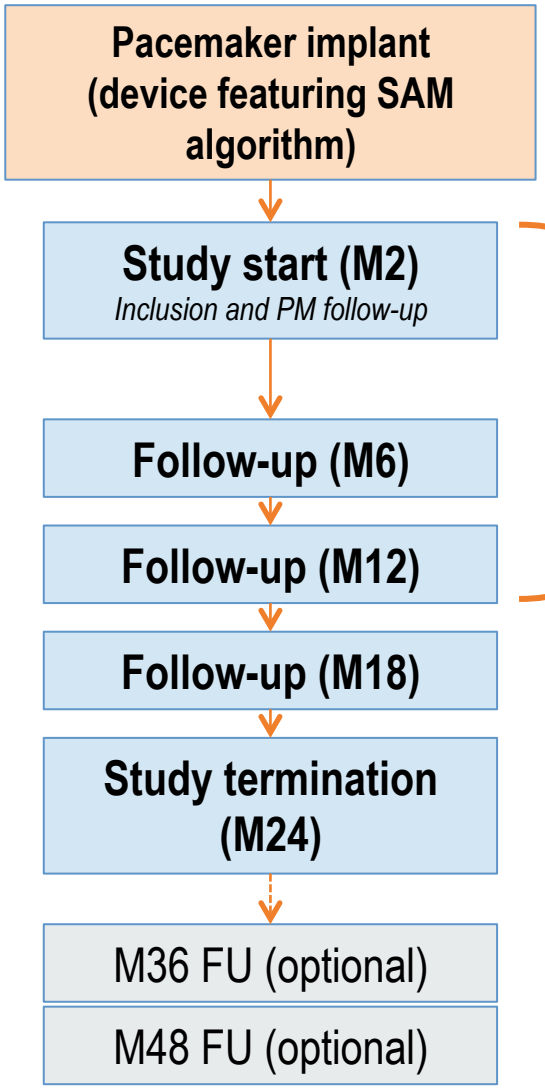


To assess the CLINICAL IMPACT of this Multidisciplinary Approach, a protocol was developed for a Multicenter Prospective Observational Registry (UPSTREAM), to follow-up PMK patients clinical outcomes

UPSTREAM Registry: Flowchart

Pacemaker implant SR/DR/CRTP (Guidelines), including device replacements
(AV node ablated pts excluded)

Patient inclusion period:
within 2 months following the implant procedure

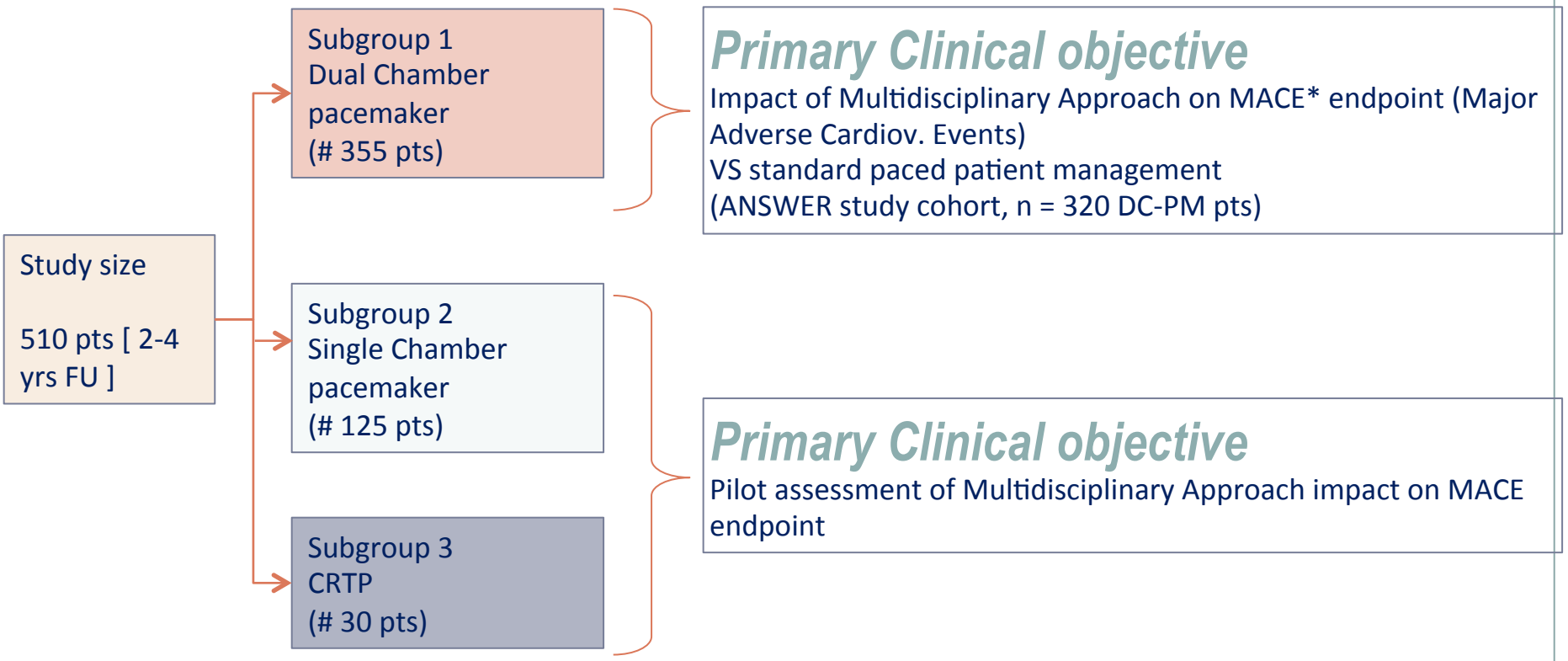


During 1st year of FU,
the protocol suggests a PGF performed by the reference Sleep-Center
(Pneumology/Neurology)

The Sleep-Center will evaluate the need for SA therapy (i.e. CPAP)

Analysis of PGF outcomes (Core Lab) to assess Sensitivity, Specificity, NPV / PPV of Pacemaker index vs PGF (secondary objective)

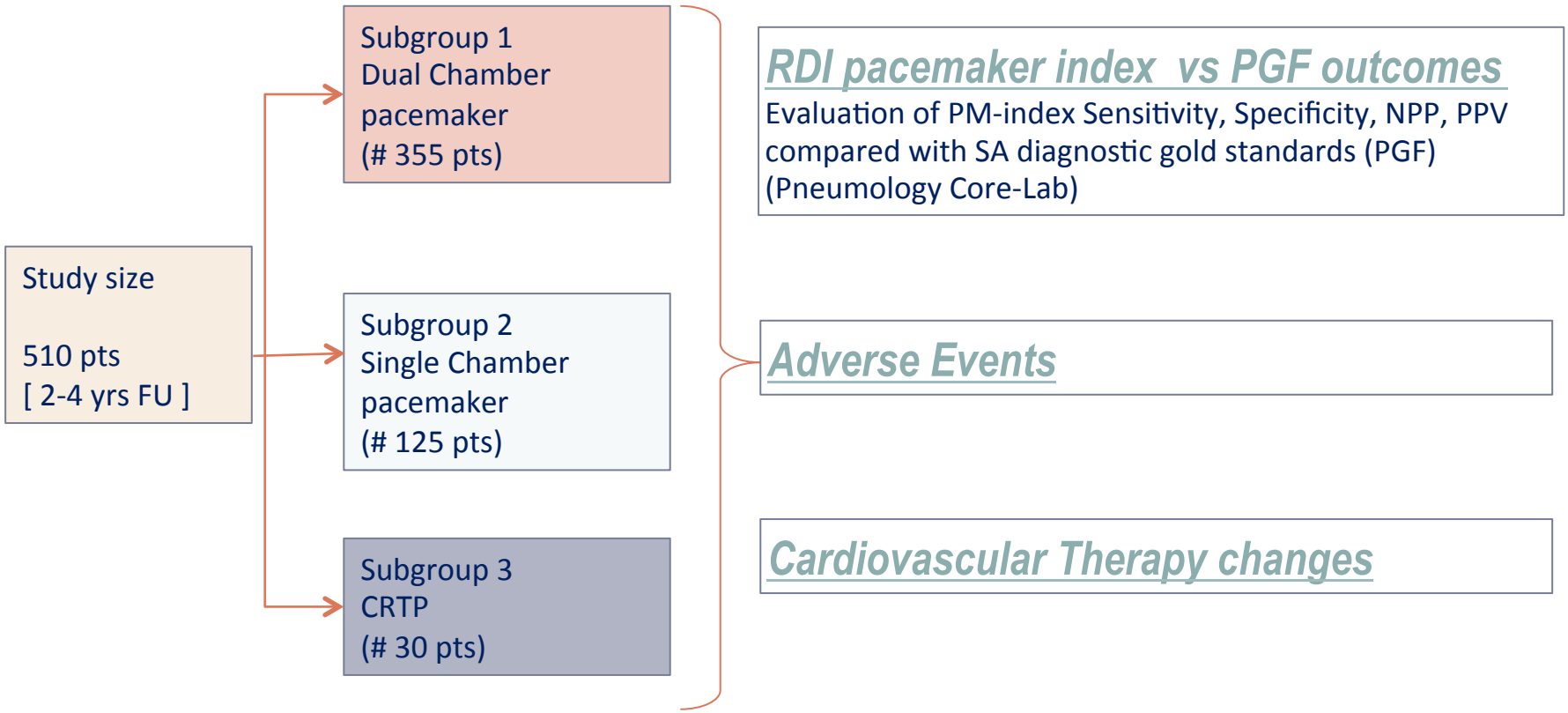
UPSTREAM Registry: Primary Objectives



*** MACE (Major Adverse Cardiovascular Events)**

- all-cause mortality
- CV mortality
- HF events
- urgent visits for Arrhythmia Cardioversions (A/V), coronary ischemia, or stroke;
- recurrence of Atrial Arrhythmias after electrical / pharmacological cardioversion

UPSTREAM Registry: Secondary Objectives



(for DC pacemaker pts): ***Resource consumption & Multidisciplinary Approach cost/effectiveness***
(vs standar approach; ANSWER study cohort)

for DC pacemaker & CRTP pts): ***AF burden***
Tot time in AF (pacemaker diagnostics) and SA therapy impact on AF burden

UPSTREAM Registry: Steering Committee

Center	Prof / Dr	
Università delle Marche – Ancona	Prof. Capucci	Steering Committee Coordinator
Osp. Sant'Anna – Como	Dr. Botto	Steering Committee Coordinator
Fond. Maugeri - Veruno (NO)	Dr. Braghiroli	Pulmonologist - Steering Committee Coordinator (SA Core Lab)
IRCCS - S. Donato Milanese (MI)	Dr. Aimè	Steering Committee
Osp. Univ. Ruggi D'Aragona - Salerno	Dr. Campana	Steering Committee
Policlinico - Bari	Dr. Carretta	Steering Committee
Osp. S. Cuore – Negrar (VR)	Dr. Molon	Steering Committee
Università Federico II - Napoli	Dr. Rapacciuolo	Steering Committee

Each investigator created a link with a referential lung specialist/ neurologist, and a reciprocal commitment has been established to manage paced patient virtually affected by Sleep Apnea

Conclusions

- There is an extremely high prevalence of undiagnosed SAS in paced patients .
- SAS should be sistematically searched to avoid additional detrimental effectcs on cardiovascular condition of these patients.
- A specific and advanced algorithm (SAM) included in a new generation of pacemakers has been found able to identify paced patients with SAS, with an excellent correlation with classical PSG.
- The feasibility of a new model of managing paced patients with SAS has also been demonstrated.
- On the strenght of these considerations, the observational registry «UPSTREAM» was conceived, with the aim of developing a multidisciplinary approach for the diagnosis and treatment of paced patients potentially affected by SAS.


Thank you for your attention