Sleep Medicine
A New Prescription for Diabetes Management

Kristyna M. Hartse, Ph.D.

WHY STUDY SLEEP DISORDERS?

- They are common
- They are debilitating
- They are dangerous
- They are expensive

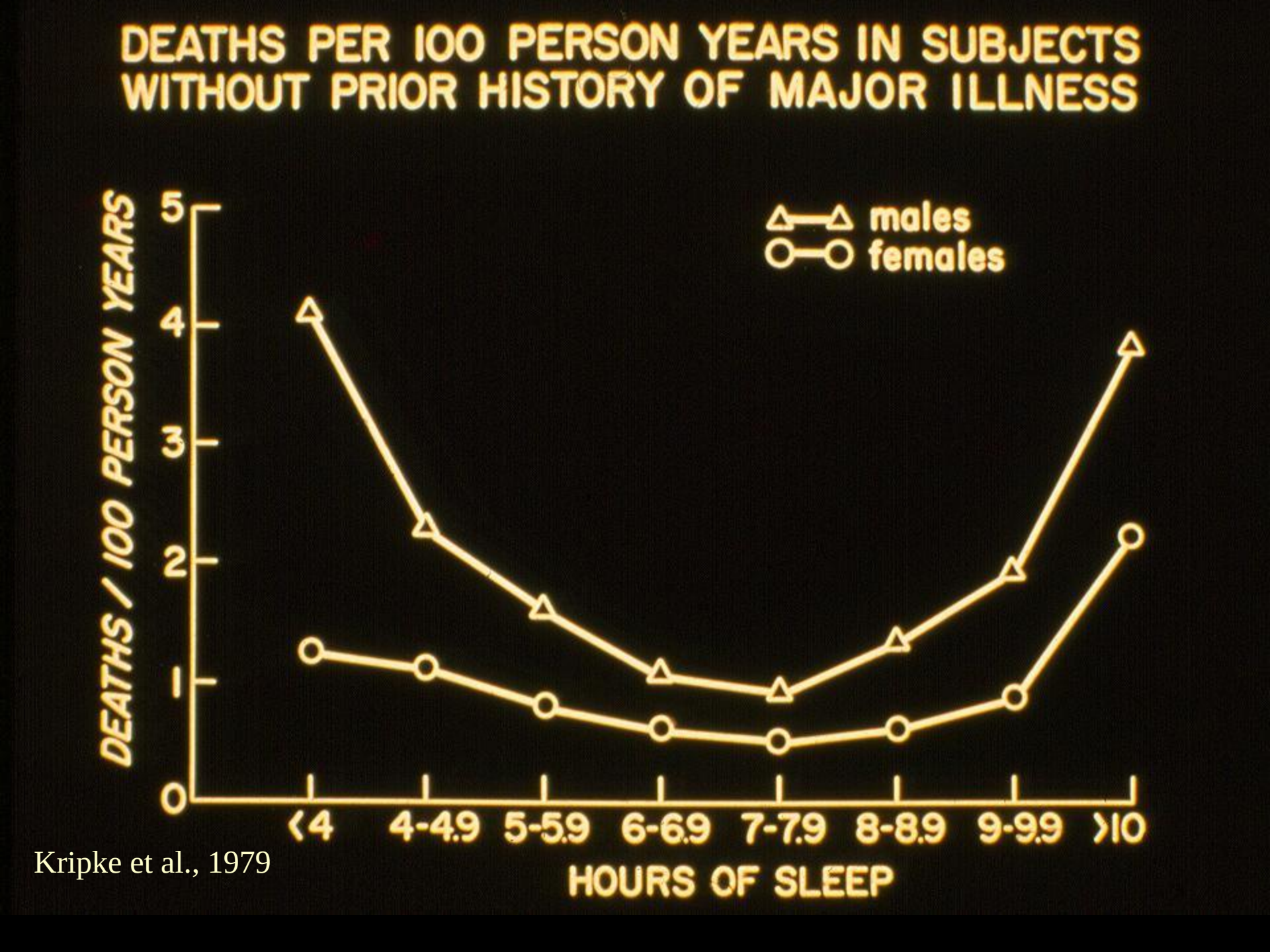
SLEEP IN AMERICA

The National Sleep Foundation Poll 2008

- 33% reported at least one symptom of insomnia every night
- 24% reported snoring every night
- 5% reported observed or experienced pauses in breathing every night
- 8% reported restless legs sensations every night
- N=1506 telephone interviews with persons at least 18 yrs of age

Impact of Disordered Sleep

- Poor Job and School Performance
- Attention and Memory Problems
- Depressed Mood
- Overuse of Hypnotic Drugs and OTC Medications
- Lowered Quality of Life
- SHORTENED LIFESPAN?



Kripke et al., 1979

Poor Sleep is Dangerous

- Increased risk for somatic illness including gastrointestinal disorders, headache, diabetes, heart disease, and cardiovascular events
- Increased risk for daytime drowsiness and accidents
- Increased risk for depression and anxiety

Poor Sleep is Expensive

- Lost work days and reduced productivity
- Disproportionate utilization of medical and psychiatric resources
- Motor vehicle and other accidents

Health Care Utilization

For the 10 years prior to OSA Diagnosis

OSA pt claims:	$3872 per patient
Control claims	$1969 per patient

Rise in health care costs each year prior to diagnosis. Initial data suggest that after diagnosis claims are halved.

We conclude that by the time patients are finally diagnosed for sleep apnea, they have already been heavy users of health services for several years.

Ronald et al, SLEEP, 1999.

Sleep-Disordered Breathing & School Performance in Children

- Identified 1st graders performing at the bottom 10% percent of grade level
- Found over 20% had OSA
- All were offered surgery (tonsillectomy and adenoidectomy), but only half accepted
- All children who had surgery improved their grades, the others stayed the same

Gozal, Pediatrics, 1998.

Common Causes for Poor Sleep

- Poor sleep hygiene
- Irregular sleep-wake schedule
- Excessive caffeine use
- Alcohol use
- Medication use
- Nocturia

Common Sleep Disorders

- Sleep apnea
- Restless legs/Periodic limb movements
- Circadian rhythm disorders/shift work
- Parasomnias (Tooth grinding, sleep walking, nightmares, etc.)
- Narcolepsy

All of these disorders can cause complaints of difficulty sleeping at night or feeling sleepy during the day.

Quantity and Quality of Sleep and Incidence of Type 2 Diabetes

- Meta analysis of 10 prospective studies
- 107, 756 male and female subjects
- Sleep assessed by questionnaires
- Short sleep defined as <7 hours/night
- Long sleep defined as 8 or ≥ 9 hours/night
- Follow-up of at least 3 years

Cappuccio et al., Diabetes Care, 2010

Risks of Developing Type II Diabetes

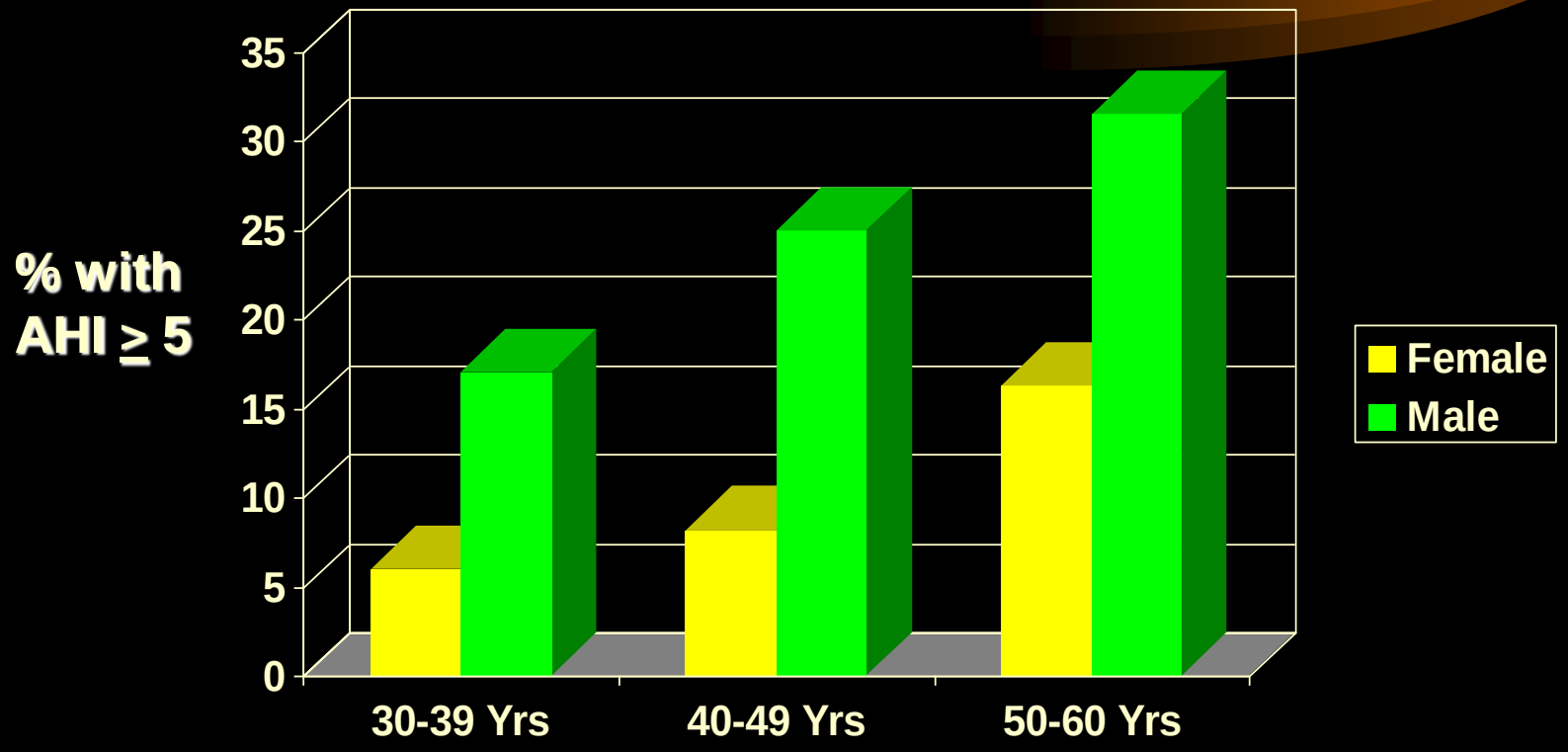
- Short sleep +28%
- Long sleep +48%
- Difficulty initiating sleep +57%
- Difficulty maintaining sleep +84%

MODEST SLEEP RESTRICTION DISRUPTS THE GLUCOREGULATORY RESPONSE

8 Hours Sleep		*4 Hours Sleep*	
Glucose (mmol/L)		Glucose (mmol/L)	
Prebreakfast	4.5	Prebreakfast	4.5
Peak	6.1	Peak	6.8*
Insulin (pmol/L)		Insulin (pmol/L)	
Prebreakfast	27.9	Prebreakfast	31.2
Peak	284.3	Peak	398.5*

Schmid, et al, *Sleep*, 2011

Respiratory Events and Age



Adapted from Young T et al. N Engl J Med 1993;328.

Symptoms of Sleep Apnea

- Loud, interrupted snoring
- Bedpartner reports of breathing pauses
- Excessive daytime drowsiness
- Patient complaints of disturbed nighttime sleep

Who is likely to have sleep apnea?

- Male gender
- Overweight (Body Mass Index >30)
- Large neck size greater than 17 inches
- Tonsils present
- Increasing age

BUT……

SLEEP APNEA CAN AFFECT ANYONE

- Females
- Children
- Babies
- Thin body types

MOST PEOPLE DO NOT KNOW THEY HAVE SLEEP APNEA

- The patient is not reliable. He/she is asleep at the time the problem occurs.
- Loud snoring is not a “natural” feature of men’s sleep.
- Daytime sleepiness is often attributed to not getting enough sleep, even though the patient may sleep excessively.

Daytime Drowsiness

One of the biggest impediments to evaluating any sleep disorder causing daytime drowsiness is DENIAL of the problem.

- “Only lazy people sleep a lot.”
- “Only depressed people sleep all the time.”
- “I just don’t get enough sleep.”
- “Missing a little sleep won’t cause me any problems.”
- “Sleep really isn’t that important.”

Types of Sleep Apnea

Obstructive sleep apnea

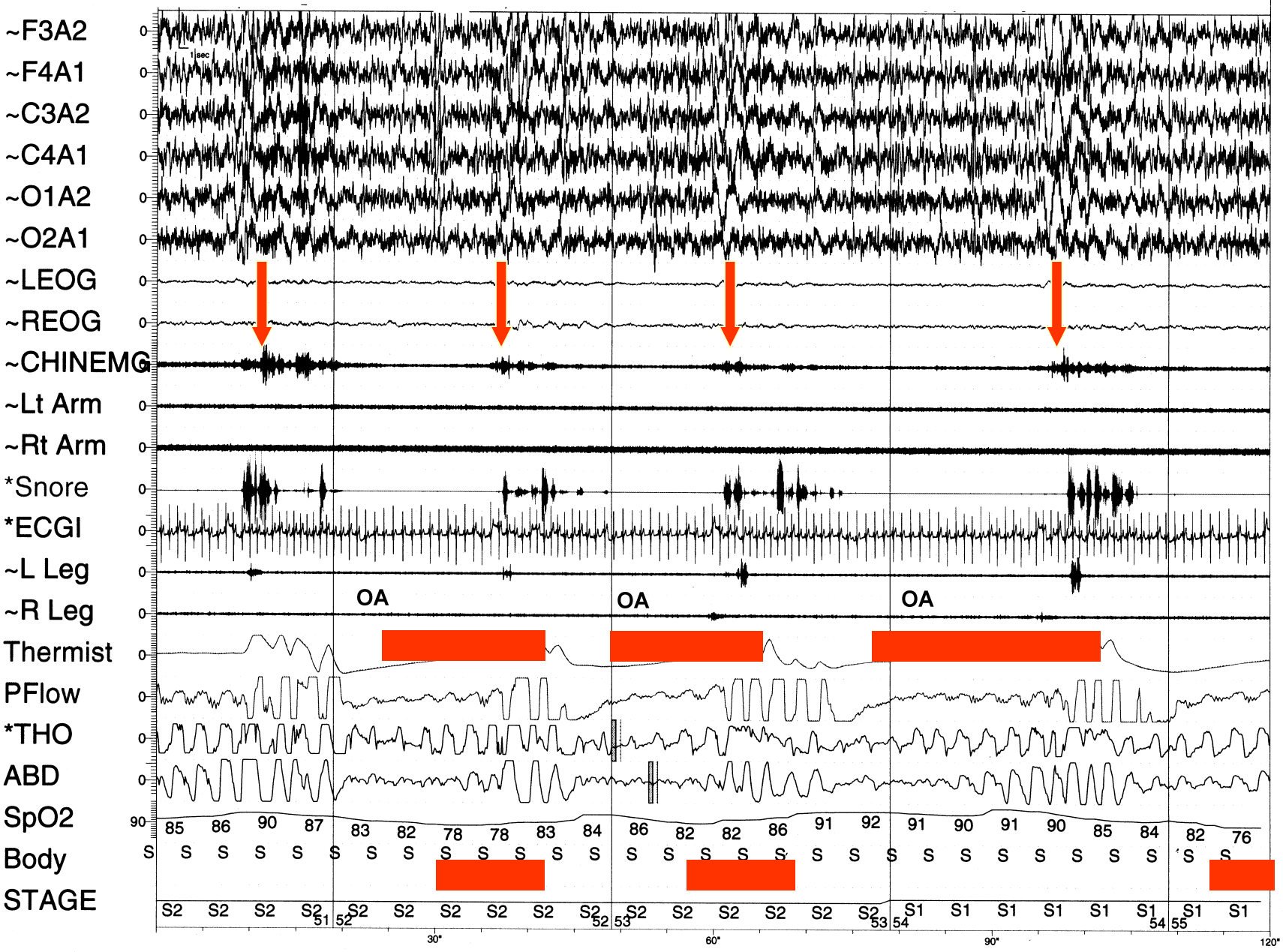
Central sleep apnea

Mixed sleep apnea

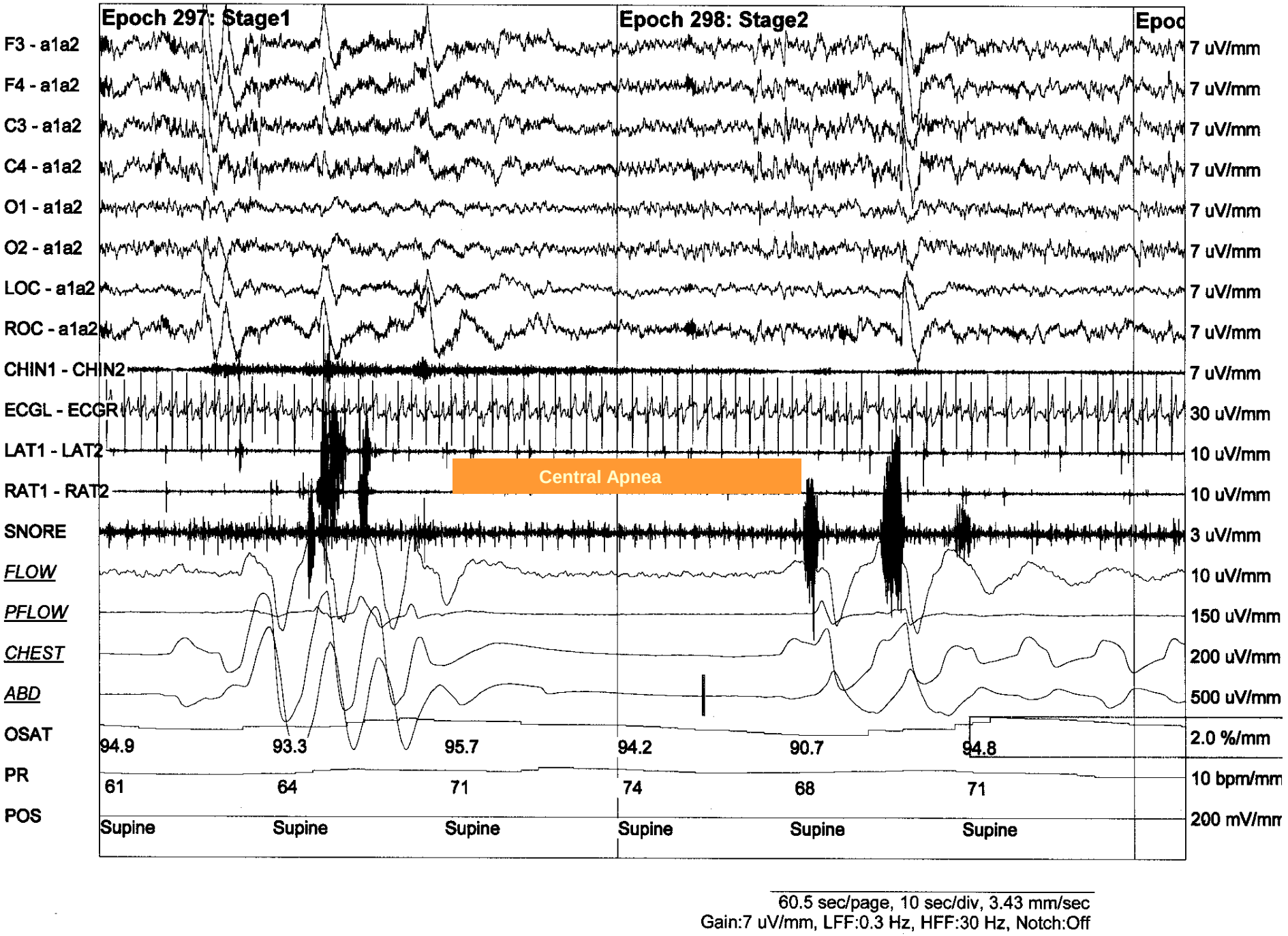
Non Sequitur

EMAIL: RSTROMOSKI@AOL.COM
6-16

Guest cartoonist is Rick Stromoski. Wiley will return June 22nd.



OBSTRUCTIVE APNEA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C4 - a1a2
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O2 - a1a2
LOC - a1a2
ROC - a1a2
CHIN1 - CHIN2
ECGL - ECGR
LAT1 - LAT2
RAT1 - RAT2
SNORE
FLOW
PFLOW
CHEST
ABD
OSAT
PR
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2.0 %/mm
10 bpm/mm
200 mV/mm
Central Apnea
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93.3
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94.2
90.7
94.8
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71
74
68
71
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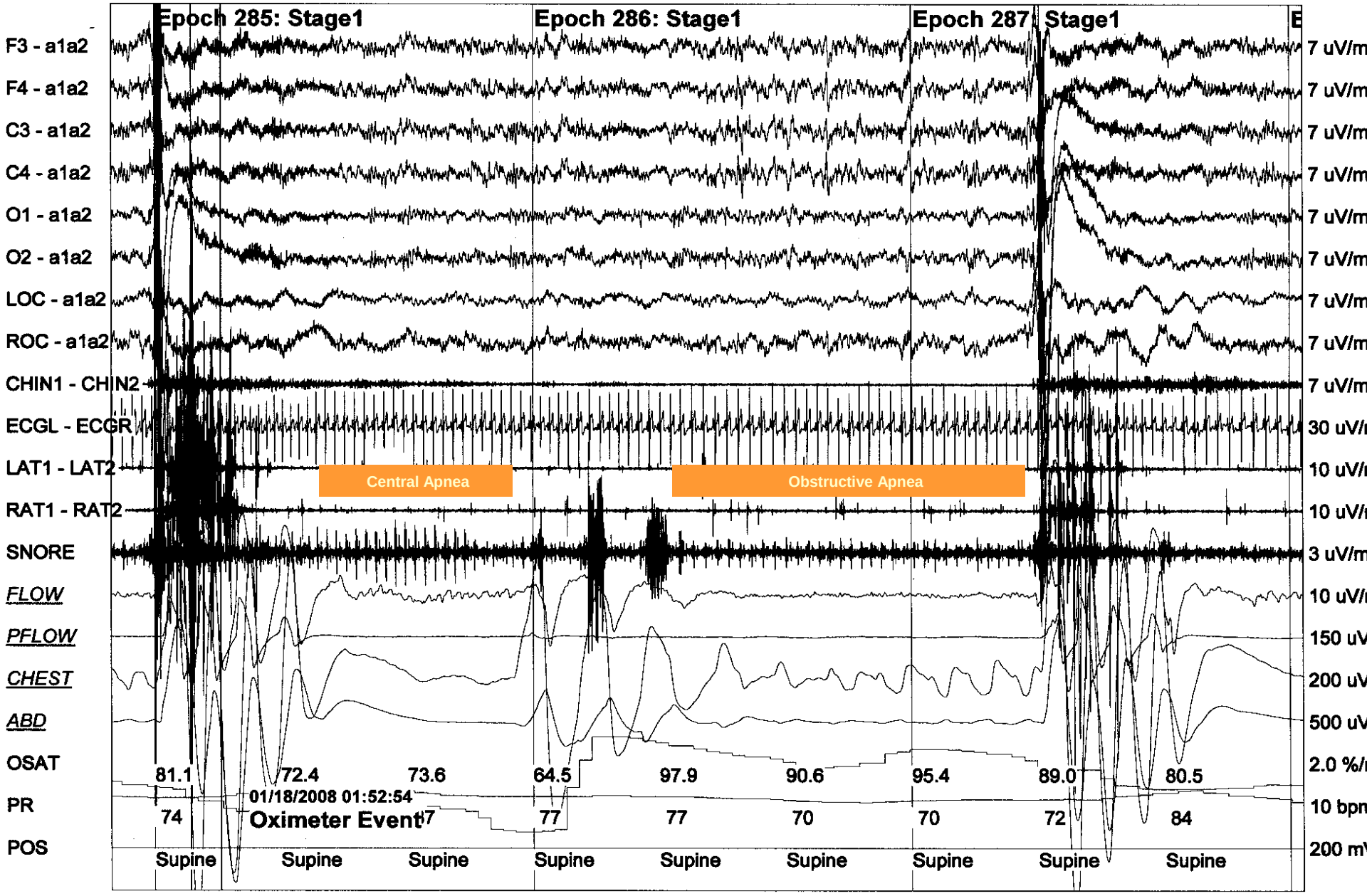

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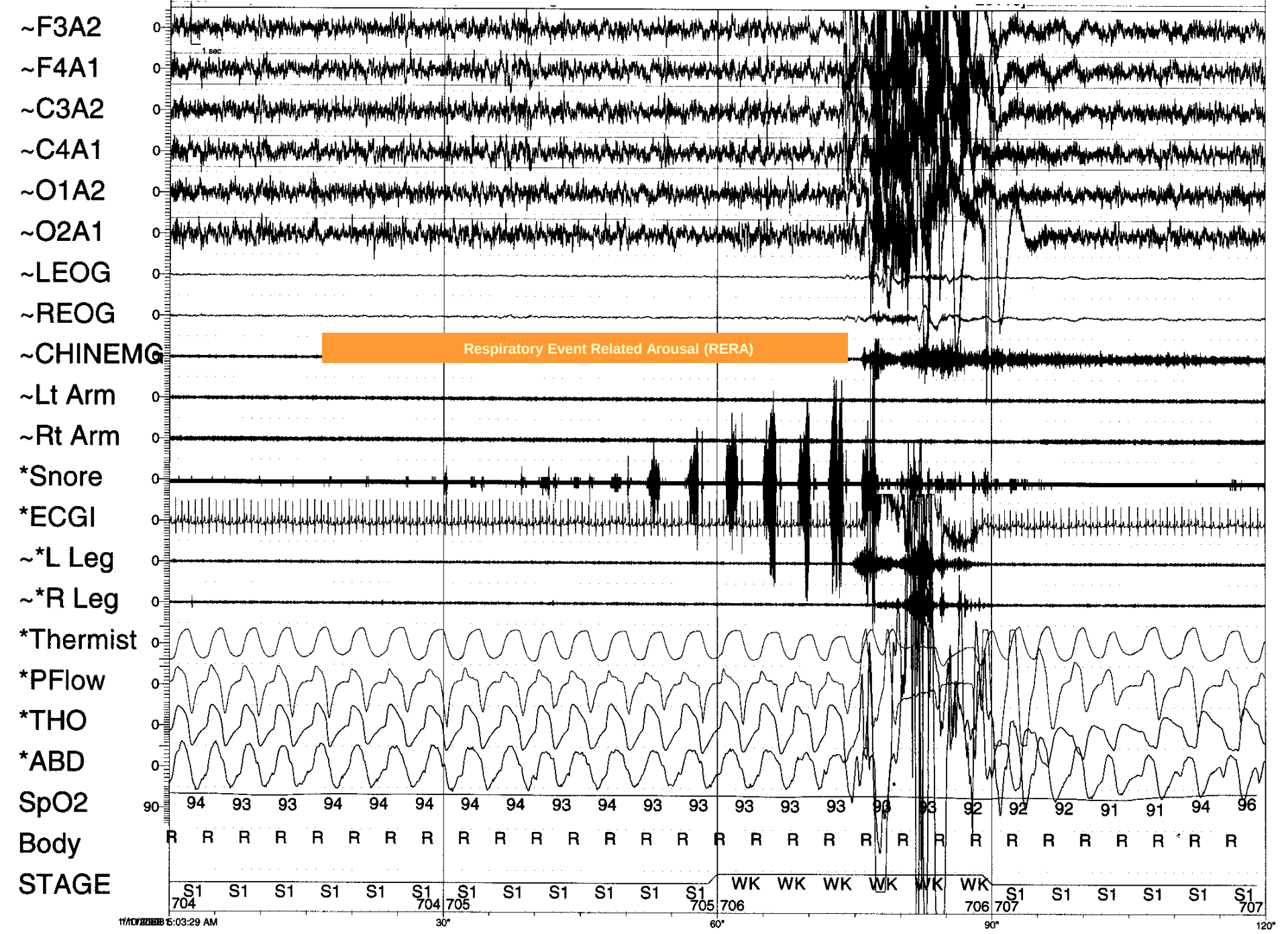
Snoring

Snoring alone can result in disruption of sleep and excessive daytime sleepiness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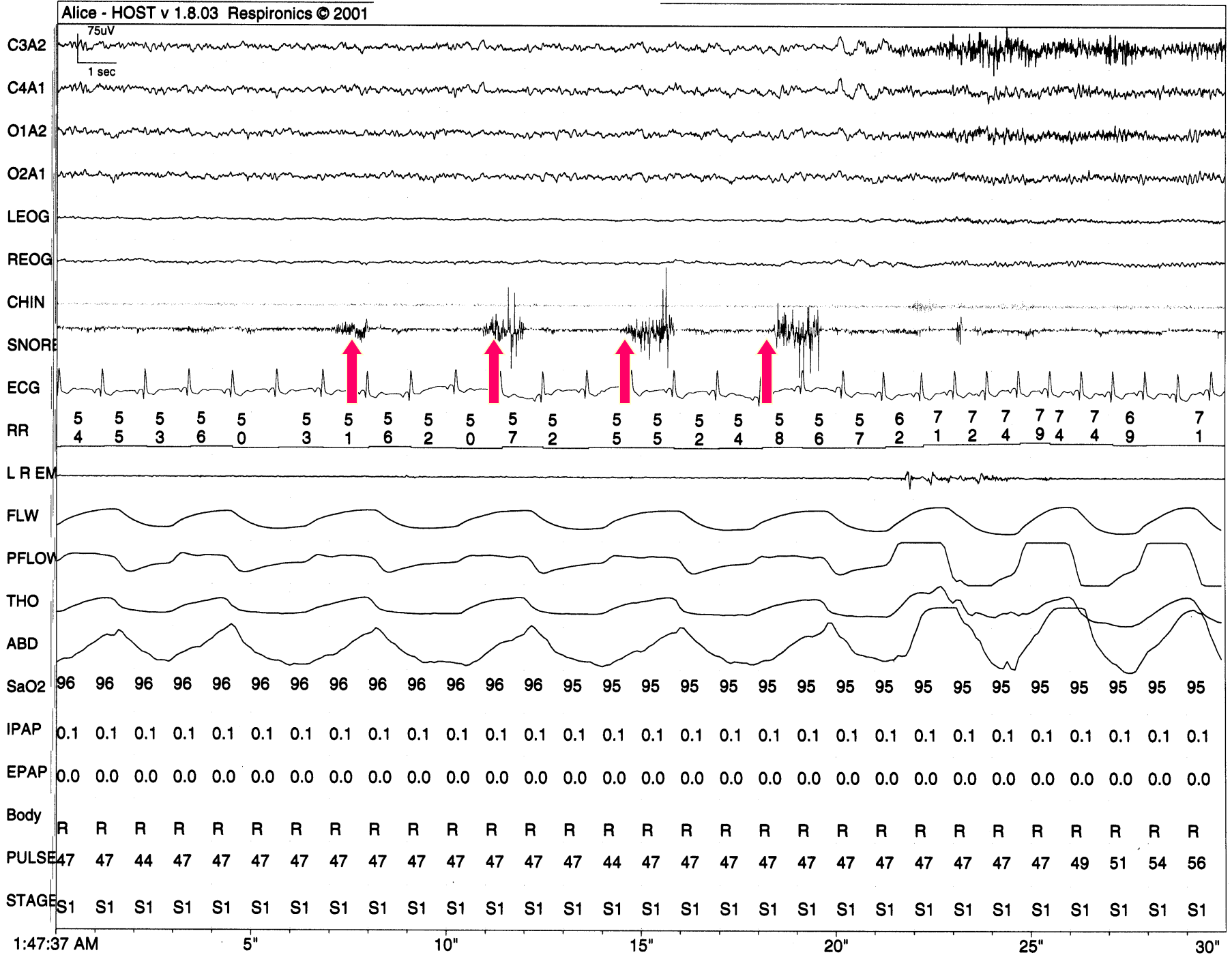
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EPAP 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
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STAGE S1 S1 S1 S1 S1 S1 S1 S1 S1 S1 S1 S1 S1 S1 S1 S1 S1 S1 S1 S1 S1 S1 S1 S1 S1 S1 S1 S1 S1 S1
1:47:37 AM
5"
10"
15"
20"
25"
30"

Cardiovascular Consequences of Sleep Apnea

Cardiac arrhythmias
Left ventricular systolic dysfunction
Left ventricular diastolic dysfunction
Congestive heart failure
Stroke
Coronary heart disease
Pulmonary hypertension

Mayo Clin Proc; 2004

Incidence of OSA In Type II Diabetes

Aronsohn et al 2010

Total Type II Patients with OSA

77%

- Mild OSA 38.3%
- Moderate OSA 25.0%
- Severe OSA 8.8%

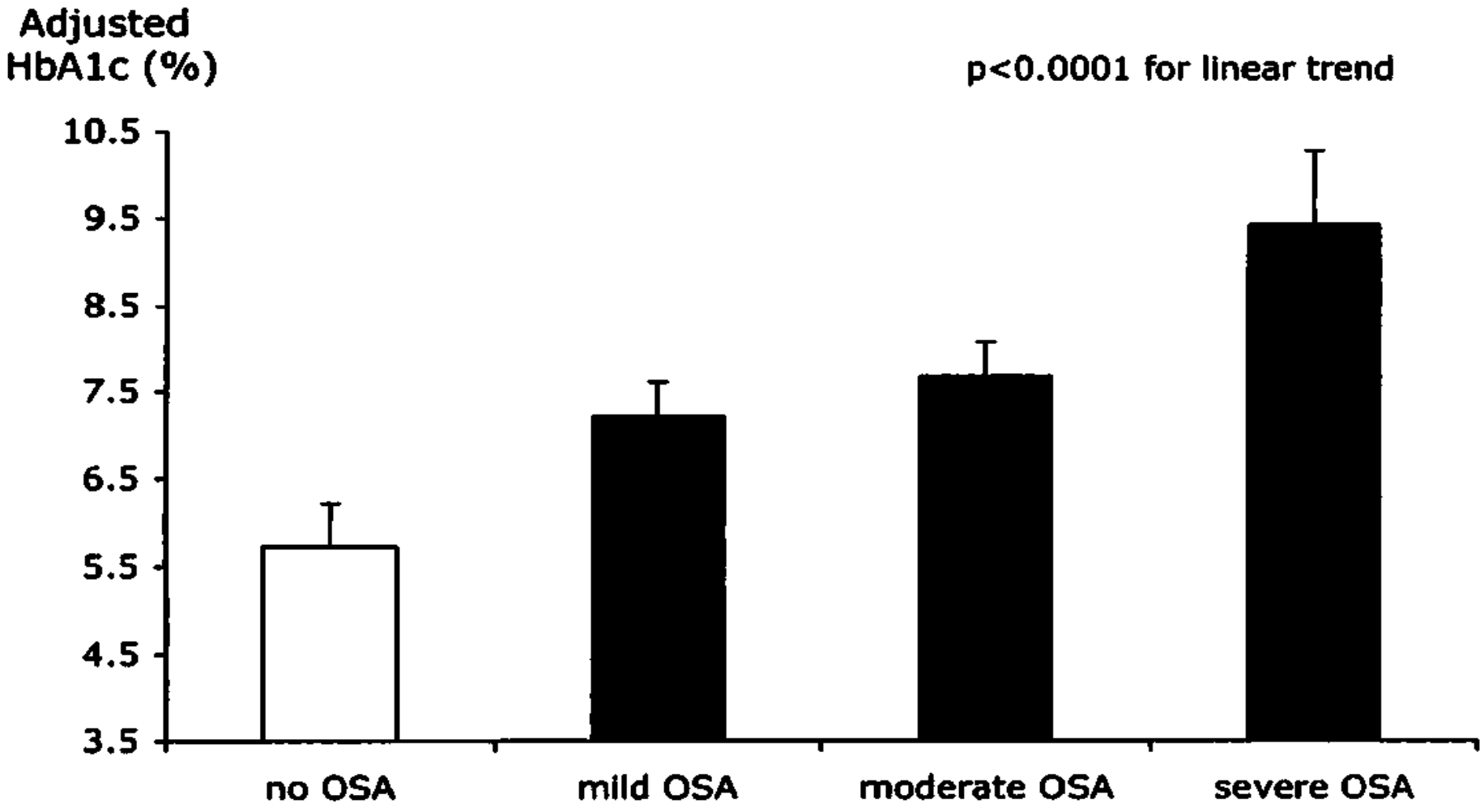
Foster et al. 2009

Total Type II Patients with OSA

86.6%

- Mild OSA 33.4%
- Moderate OSA 30.5%
- Severe OSA 22.6%

Severity of OSA and HbA1C



Aronsohn , et al., 2010

BEHAVIORAL INTERVENTIONS FOR SLEEP APNEA

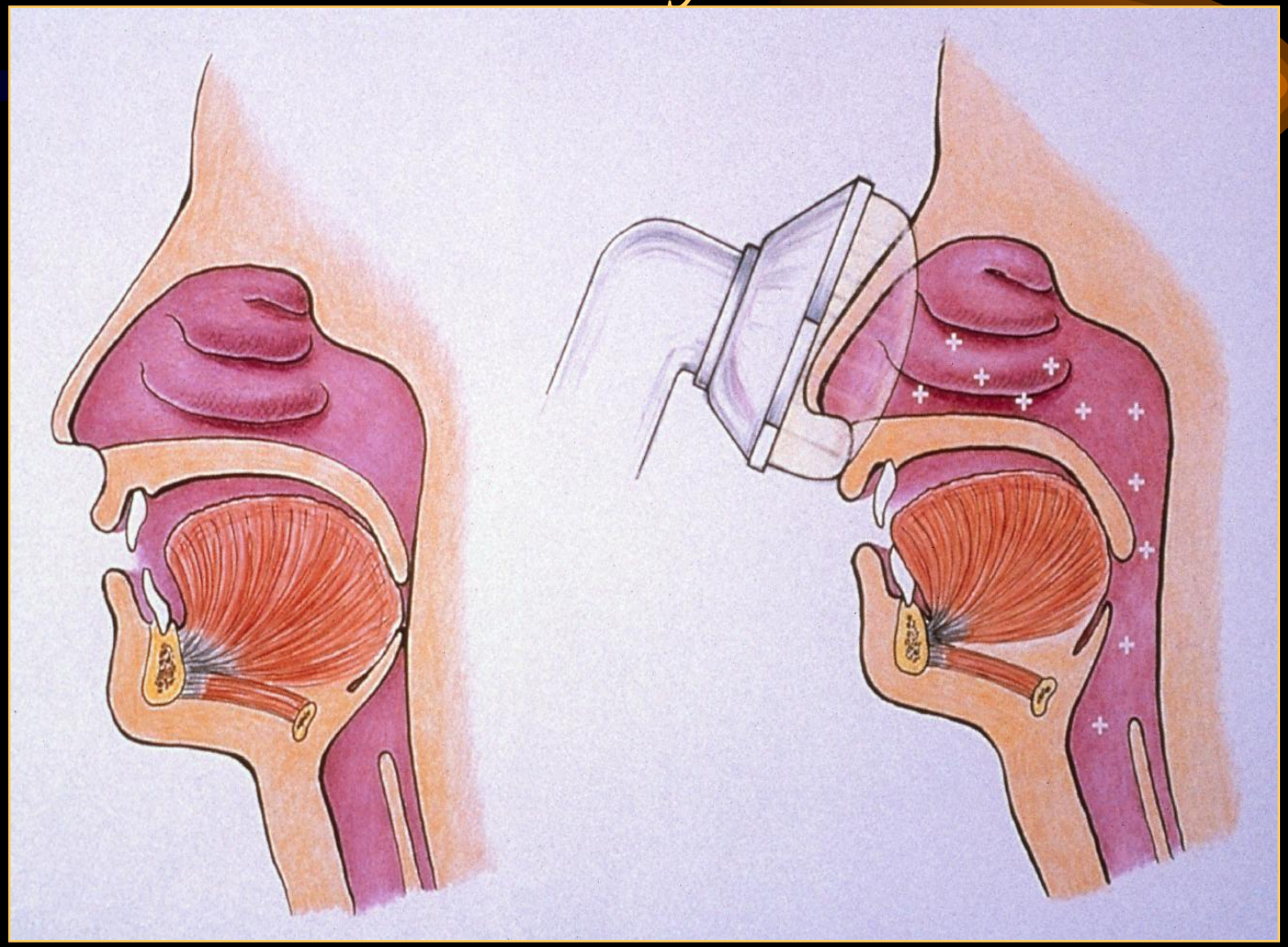
- Lose weight
- Avoid alcohol and sedatives
- Avoid a supine sleeping posture
- Stop smoking

Medical Interventions for Sleep Apnea

- Continuous positive airway pressure (CPAP), bilevel positive airway pressure (BiPAP), auto servo ventilation (ASV)
- Oral appliances
- Upper airway surgery
- Maxillofacial surgery

The Single Most Effective Intervention for Obstructive Sleep Apnea is CPAP or other Positive Airway Pressure Devices

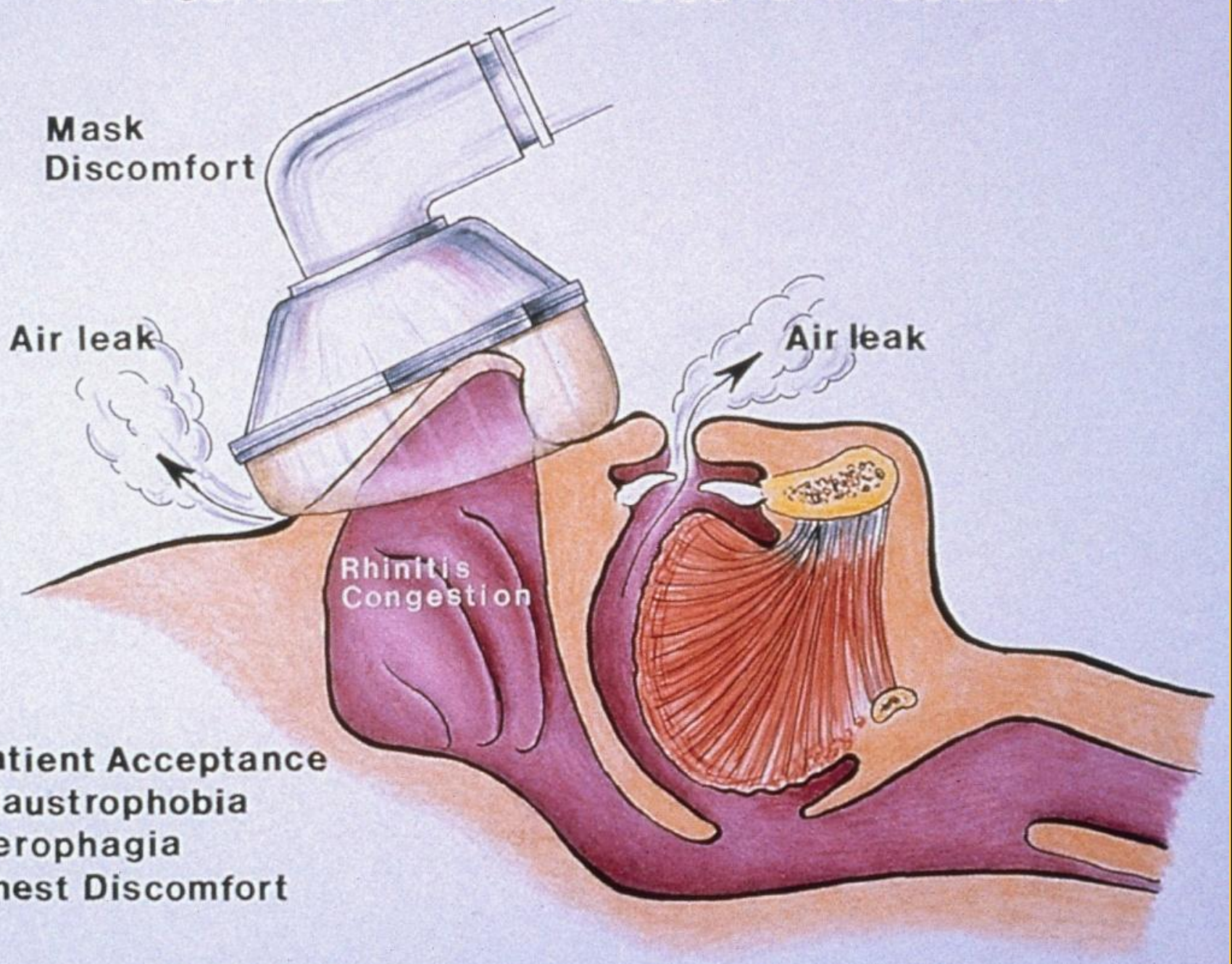
Positive Airway Pressure



POSITIVE AIRWAY PRESSURE

- Continuous Positive Airway Pressure (CPAP)
- Bi-level Positive Airway Pressure (BiPAP)
- Auto Servo Ventilation (ASV)

POSITIVE AIRWAY PRESSURE: PROBLEMS



Patient Acceptance
Claustrophobia
Aerophagia
Chest Discomfort

Major side effects of CPAP Use

- Mask/headgear marks on face
- Nasal bridge discomfort
- Nasal congestion
- Skin breakdown under mask
- Dry nose and eyes
- Machine noise
- Ear pain
- Runny nose
- Bloating
- Difficulty exhaling

COMPLIANCE MACHINES

CPAP COMPLIANCE

- Patient report: 75%
- Objectively measured use

  ≥ 4 hrs for ≥ 5 nights / week: 46%

CPAP Follow-Up

- Use of compliance machines
- Two to three week follow-up after beginning CPAP
- Three month follow-up as necessary
- Six month follow-up thereafter for download of machines and assessment of usage, mask replacement, and replenishment of supplies (filters and tubing) as necessary

Sonno Sleep Center
2311 N. Mesa Blgd. E
El Paso, Texas 79902 USA

Patient Name: John Smith

Device: REMstar Auto M Series with A-Flex (510M)

Compliance Details - Full Report

Interaction Date: 6/18/2008 2:48 PM

Patient: John Smith

USA

Patient ID 1476
Home Phone
Age 84

Referring Physician:

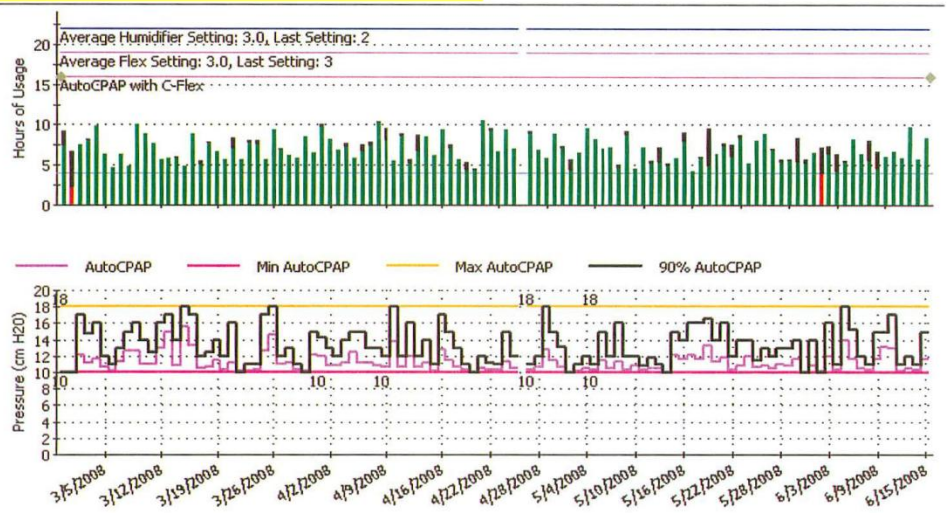
Group/Practice
Phone
Fax
E-Mail Address

PCP:

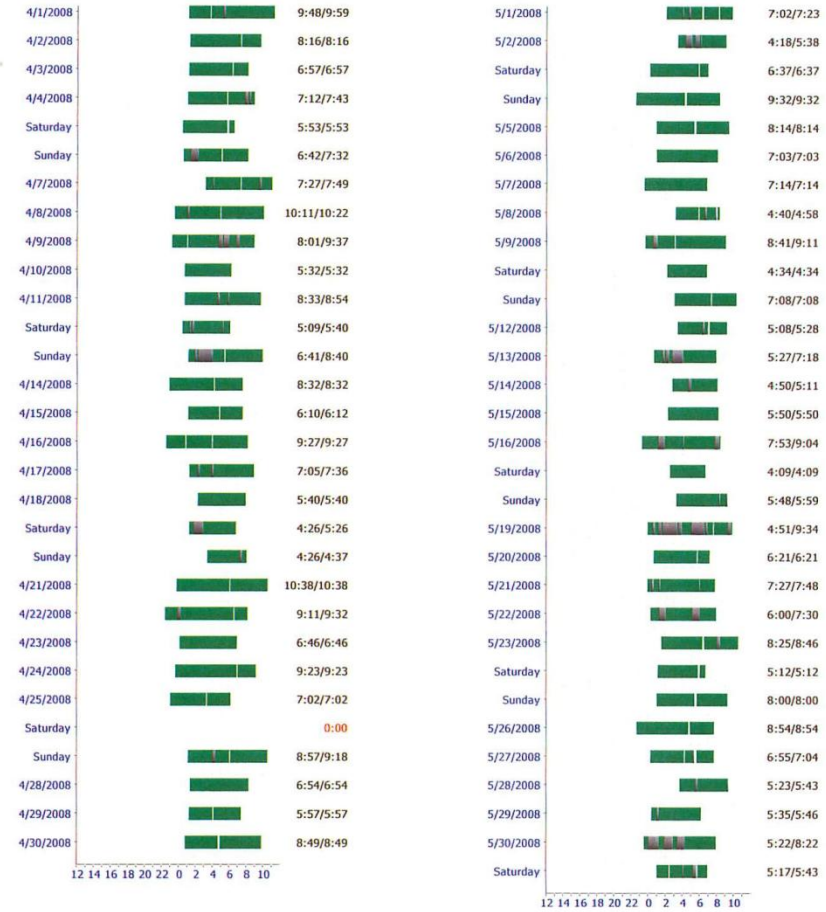
Phone

Clinician:

Compliance Information 2/29/2008 - 6/15/2008



Patterns of use



Postprandial Glucose Before and after CPAP Therapy

	Pre CPAP	Post CPAP
Breakfast	191	130
Lunch	196	138
Dinner	199	137

Babu, et al, Arch Intern Med, 2005

mg/dL

Effect of Hours of CPAP Use on Postprandial Glucose

>4 Hours Use per night			**≤ 4 Hours Use per Night**		
	Pretherapy	Posttherapy		Pretherapy	Posttherapy
BF	200	123	BF	188	138
Lunch	203	136	Lunch	195	144
Dinner	206	130	Dinner	197	150

Babu, et al, Arch Intern Med, 2005

mg/dL

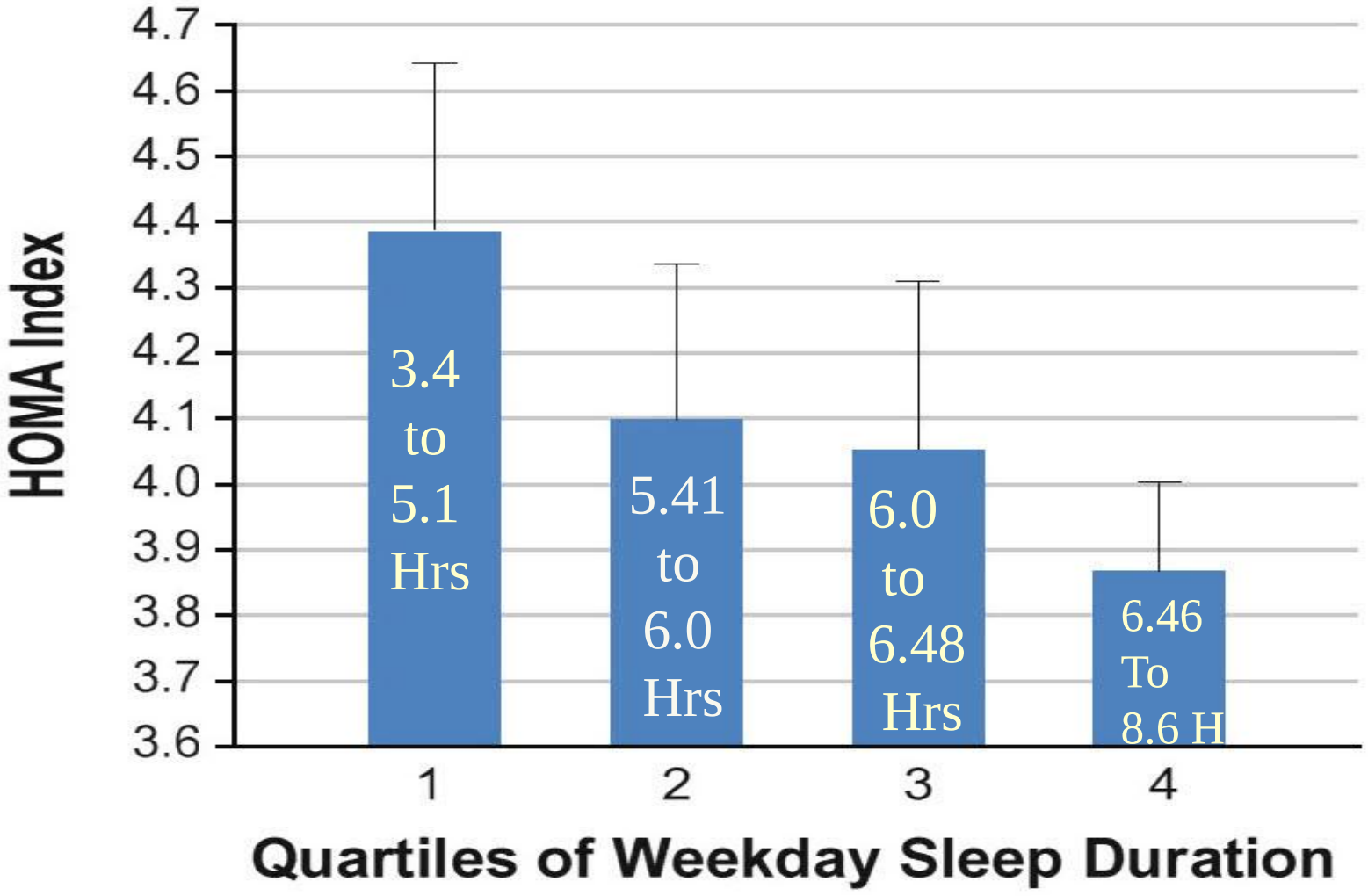
Sleep in Adolescents

N = 245

Sleep Duration (h)	Full Week	WeekN	WeekE
Actigraphy	6.4	5.9	7.4
Diary	7.4	6.8	8.7

Recommended 9 Hours/Night

HOMA Index and Sleep Duration in Adolescents



Matthews et al., ***Sleep***, 2012

Who should have a sleep study?

- Persistent complaints of difficulty falling or staying sleep
- Impaired daytime functioning and daytime drowsiness resulting from poor sleep at night
- Unusual behaviors during sleep
- Observations of snoring and breath holding by a bedpartner
- Physical findings suggesting pathology
- Unremitting complaints about sleep

Five Key Sleep Screening Questions

- How much sleep do you obtain at night?
- Is your sleep interrupted by awakenings?
- Do you snore?
- Do you stop breathing during sleep?
- Do you feel drowsy or drift off to sleep during quiet daytime activities?

How we make our marriage work

Now Marie and Allen Woodward know why they were both so grumpy all the time. They hadn't fallen out of love; a sleep disorder was souring their marriage . . . and these masks made their life together sweet again

'It's the only way we can get any sleep'

(From Women's World, June 15, 1993)

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