

## **Online Data Supplement**

### **Obstructive sleep apnea during REM sleep and incident nondipping of nocturnal blood pressure: A longitudinal analysis of the Wisconsin Sleep Cohort**

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## **METHODS**

The University of Wisconsin Health Sciences Institutional Review Board approved the Wisconsin Sleep Cohort Study (WSCS) protocols and informed consent documents. Details of the WSCS are provided in the online supplement. The Wisconsin Sleep Cohort was established in 1988 as a prospective epidemiologic community-based study of the natural history, causes, and consequences of OSA in community-dwelling adults who responded to a mailed survey on sleep characteristics and other factors between 1989 and 1993. The response rate to the initial survey was 71%. In brief, 30- to 60-year-old men and women living in south-central Wisconsin were selected from payroll records of several Wisconsin state agencies with job titles ranging from unskilled to professional. Of the 2,940 individuals invited to undergo an overnight in-laboratory protocol, 1,546 (53%) agreed to participate and were successfully studied. Since its inception in 1989 the Cohort has provided the opportunity for adding ancillary studies. In this study, a protocol for 24-hour ambulatory BP was added to the overnight sleep study protocol in 1991 with sequential enrollment. A total of 817 participants had at least one baseline ambulatory BP study.

### ***Polysomnography***

All participants underwent a baseline overnight 18-channel polysomnography (Grass model 78; Quincy, MA) using a standard protocol.<sup>1</sup> The polysomnograms recorded sleep state using electroencephalography, electrooculography, and electromyography; breathing, using respiratory inductance plethysmography (Respirtrace; Ambulatory Monitoring, Ardsley, NY) and nasal and oral airflow (ProTec thermocouples; Hendersonville, TN) and nasal pressure transducers; and oxyhemoglobin

saturation, using pulse oximetry (Ohmeda Biox 3740; Englewood, CO). Each 30-second epoch of the sleep studies was scored for sleep stage and apnea and hypopnea events by trained technicians and reviewed using standard criteria.<sup>1,2</sup> Apnea was defined as cessation of nasal and oral airflow for 10 seconds or more and hypopnea as a discernible reduction in breathing (sum of chest and abdominal excursions) with a reduction in oxyhemoglobin saturation of 4% or greater. The total AHI was defined as the number of obstructive apneas and obstructive hypopneas per hour of sleep. REM AHI was calculated as the number of apneas and hypopneas during REM sleep divided by total time in REM sleep in hours. REM AHI categories were examined as the independent variable: REM AHI < 1 (Reference category), 1 to 4.9, 5 to 14.9,  $\geq 15$ . NREM AHI was calculated by dividing the number of apneas and hypopneas during NREM sleep by total time in NREM sleep in hours. Oxygen saturation metrics such as 4% or greater oxygen desaturation index (ODI) and percent sleep time below 90% SpO<sub>2</sub> (T90) as well as time spent in supine position are not available for the majority of polysomnograms prior to 2000, when fully digitalized data collection was initiated in the WSCS. Between 1998 and 2000, polysomnograms were scored using a paper-based system; since 2000, studies have been scored on a computer. All statistical modeling adjusts for the scoring changes; this removes the instrumentation-related influences on OSA assessments after the year 2000.

### *Covariates*

Standardized interviews were performed by trained personnel on the night of the in-laboratory sleep study to obtain information on medical history (physician diagnosed diabetes, hypertension and physician-diagnosed sleep apnea, and use of CPAP treatment),

medication use (prescription and over-the-counter), age, smoking (current and past cigarette smoking), alcohol consumption (usual weekly number of cans/bottles of beer, glasses of wine, mixed drinks or shots of liquor), and subjective sleepiness (by the Epworth Sleepiness Scale score or a “yes” response to the question “During a typical day do you experience excessive sleepiness when it is difficult to fight an uncontrollable urge to fall asleep?”). Measures of body habitus were obtained per protocol as previously described.<sup>3</sup> At each polysomnography study, hypertension was defined by: 1) clinically-assessed auscultatory blood pressure equal to or above 140/90 mm Hg as previously described,<sup>4</sup> or use of antihypertensive medications. Self-reported habitual sleep time in hours was calculated as the weighted average of weekday and weekend sleep time (i.e.  $[5*\text{weekday}+2*\text{weekend}]/7$ ).

## REFERENCES

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