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Objective Sleep Duration and Quality in Hospitalized Older Adults: Associations with Blood Pressure and Mood

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Keywords

Older Hospitalized Patients; Sleep Quality; Blood Pressure

To the Editor:

Background

Obtaining adequate sleep duration and quality may be especially challenging for older adults who are hospitalized due to a variety of environmental and medical factors.¹ Despite the proven relationship in laboratory and epidemiologic studies^{2–4} between recurrent partial sleep restriction and negative cognitive and cardio-metabolic consequences,^{2–4} no study has examined these associations in hospitalized older patients. This study aims to objectively characterize sleep duration and quality in hospitalized older adults and to analyze their associations with blood pressure and mood.

Methods

Wrist activity monitors (Basic Motionlogger: Ambulatory Monitoring, Inc., Ardsley, New York) were used to estimate sleep duration and efficiency in hospitalized seniors age 60 years and older who were enrolled in an ongoing study⁵ of inpatient medical care at the University of Chicago between June and August 2009.⁶ Patients who were institutionalized, transferred from an ICU, cognitively impaired (abbreviated Mini Mental Status Exam < 17)⁷, not able to ambulate or had a known sleep disorder (e.g. obstructive sleep apnea, narcolepsy) were excluded from this actigraphy study.

On admission, patients reported sleep quality and daytime sleepiness during the previous month using the Pittsburgh Sleep Quality Index (PSQI)⁸ and Epworth Sleepiness Scale.⁹ Mood was assessed daily using the validated Global Vigor and Affect Scale,¹⁰ which yields distinct Global Vigor and Affect scores ranging between 0 and 100. Morning blood pressure was abstracted via chart review. To determine associations between sleep characteristics (sleep duration and sleep efficiency) and outcomes (systolic and diastolic blood pressure, vigor and affect), multivariate linear regression analyses clustered by subject and controlling

Conflict of Interest Checklist:

for study day, race, age, gender, BMI, and baseline PSQI and Epworth scores were

Elements of Financial/Personal Conflicts	*Author 1 VA		Author 2 KC		Author 3 AF		Author 4 PS	
	Yes	No	Yes	No	Yes	No	Yes	No
Employment or Affiliation		X		X		X		X
Grants/Funds		X		X		X		X
Honoraria		X		X		X		X
Speaker Forum		X		X		X		X
Consultant		X		X		X		X
Stocks		X		X		X		X
Royalties		X		X		X		X
Expert Testimony		X		X		X		X
Board Member		X		X		X		X
Patents		X		X		X		X
Personal Relationship		X		X		X		X
Elements of Financial/Personal Conflicts	*Author 5 PZ		Author 6 KK		Author 7 DM		Author 8 EVC	
	Yes	No	Yes	No	Yes	No	Yes	No
Employment or Affiliation		X		X		X		X
Grants/Funds		X		X		X		X
Honoraria		X		X		X		X
Speaker Forum		X		X		X		X
Consultant		X		X		X		X
Stocks		X		X		X		X
Royalties		X		X		X		X
Expert Testimony		X		X		X		X
Board Member		X		X		X		X
Patents		X		X		X		X
Personal Relationship		X		X		X		X

Author Contributions:

Vineet Arora: study concept and design, acquisition of data, analysis and interpretation of data, drafting the article and final approval of the version to be published.

Kevin Chang: acquisition of data, analysis and interpretation of data, drafting the article and final approval of the version to be published.

Arshiya Fazal: acquisition of data, critical revisions for important intellectual content and final approval of the version to be published.

Paul Staisiunas: acquisition of data, drafting the article and final approval of the version to be published.

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Eve Van Cauter: study concept and design, acquisition of data, analysis and interpretation of data, critical revisions for important intellectual content and final approval of the version to be published.

performed. We also obtained actigraphy readings on a cohort of community-dwelling adults matched for age, sex, race, and BMI. The University of Chicago Institutional Review Board approved this study.

Results

Forty nights of sleep were sampled from 20 inpatients, who had a mean age of 72.4 years (SD 7.5), mean BMI 25.4 m/kg² (SD 6.7), and a median length of stay of 7 days (IQR = 3.0–9.3). Twelve were male, and 9 were African American. Patients had few comorbidities: 5 chronic obstructive pulmonary disease, 3 congestive heart failure, 1 end stage renal disease, and 5 diabetes.

On average, in-hospital sleep duration was 2.5 hours shorter (277 min, SD = 107) than self-reported habitual sleep (427 min, SD = 113 min; $p < 0.001$). In-hospital sleep efficiency was very low [66.0% (95% CI 59.0–73.0)], with 67.5% of nights below the clinical threshold for insomnia (80% efficiency). Compared to matched community controls, mean in-hospital sleep duration was 2 hours shorter (–120 minutes, 95% CI –179.2, –61.8; $p = 0.005$) and sleep efficiency was 14% lower (95% CI –25.3, –2.7; $p = 0.020$) in hospitalized seniors.

Mean systolic blood pressure was 142.1 mmHg (95% CI 136.2–147.9) and mean diastolic blood pressure was 70.0 mmHg (95% CI 66.5–73.4). In-hospital sleep and systolic blood pressure were inversely correlated ($r = -0.46$, $p = 0.003$). Patients in the highest tertile of sleep duration (mean 398 min 95% CI 367, 423) had an average blood pressure of 130 mmHg (95% CI 118, 141) while those in the lowest tertile of sleep duration (mean 166 minutes 95% CI 131, 200) had a blood pressure that was over 20 points higher (152 mmHg 95% CI 138, 165) ($p = 0.015$ by trend test). This relationship remained significant in multivariate analyses. For each hour of inpatient sleep loss, systolic blood pressure increased by 6.2 mmHg (95% CI 3.2 to 9.2, $p < 0.001$) (Figure 1). Likewise, each 10% decrease in sleep efficiency was associated with an increase in systolic blood pressure of 4.2 mmHg (95% CI 1.6 to 6.9, $p = 0.002$). Multivariate, but not univariate, regression models demonstrated that each hour of sleep loss was associated with an increase of 3.1 mmHg (95% CI 1.6 to 4.6, $p < 0.001$) in diastolic blood pressure. No association between sleep efficiency and diastolic blood pressure was observed.

Mean global vigor in this cohort (65.8) was slightly higher than in previous studies of normal middle aged controls (59.0), while mean global affect scores (70.4) were equivalent to the prior studies (68.3).¹⁰ We did not find an association between hours of inpatient sleep loss and global vigor score [Δ GV –0.9 (95% CI –4.4, –2.5) $p = 0.60$]. Each hour of sleep loss was associated with a statistically significant but minimal elevation in global affect score [Δ GA +2.2 (95% CI 0.1, 4.3) $p = 0.04$].

Conclusion

Hospitalization represents a period of clinically significant sleep loss for older adults that may be associated with higher morning blood pressure. Interventions to improve sleep for hospitalized seniors are needed.

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Figure 1. Association between Systolic Blood Pressure and Sleep Duration for Hospitalized Seniors

Graph depicting the association between systolic blood pressure and sleep duration derived from multivariate within-subject random effects regression model controlling for study day, PSQI score, BMI, gender, race, and age on a sample of 40 nights obtained from 20 patients. For every 1 hour of sleep loss, systolic blood pressure increases by 6.2 mmHg ($p < 0.001$).