Letters

RESEARCH LETTER

Endorsements of Surgeon Punishment and Patient Compensation in Rested and Sleep-Restricted Individuals

The annual national cost of indemnity payments and legal expenses is $10 billion.[1] Every year, 15% to 20% of US surgeons face a malpractice claim, with each claim requiring nearly 2 years to resolve.[2] Patients are more likely to file a malpractice claim when the error is severe and undisclosed and when the surgeon displays little empathy.[3] Based on evidence from neurobiological research, we hypothesized that a crucial overlooked factor is sleep loss.[4] Sleep loss, which permeates hospital and home settings, not only impedes recovery but also amplifies emotional reactions and triggers impulsive behaviors.[5,6]

Methods | We randomly assigned healthy adults (aged 18-30 years), who were free of sleep disorders and regularly slept 7 hours or more per night, to sleep normally (>7 hours/night) or mildly restrict their sleep (to 6 hours/night) for 4 nights. The Baylor University institutional review board approved the study, and participants provided written consent. Data collection occurred from October 2017 to February 2018.

At baseline, participants completed questionnaires and cognitive tests. They were given wristband actigraphy devices to monitor sleep and then were randomly assigned to conditions using sealed envelopes (to mask experimenters). After 4 nights, participants repeated the questionnaires and cognitive tests and read 8 medical error vignettes (https://osf.io/v9arg) based on prior studies.[3] The vignettes involved retained surgical instruments, insufficient anesthesia, and other moderate-to-severe errors. Participants rated each error on 10 domains.

On analysis, varimax-rotation principal components analysis converged with a priori expectations of 2 general factors. Factor 1 included questions on the surgeon's competence, professionalism, medical expertise, quality of care, and thoroughness. Factor 2 included questions on error severity, error incompetence, recommended surgeon punishment, and recommended patient compensation. We compared vignette ratings, questionnaire responses, and cognitive performance across conditions using *t* tests and χ^2 tests. We further evaluated the variance in vignette ratings explained by total sleep time as a continuous variable, after controlling for questionnaire and cognitive measures using hierarchical linear regression. The significance level was set to .05 and effect sizes were estimated using Cohen d and R^2. Data were analyzed using SPSS version 24.0 (IBM).

Results | A total of 46 participants were randomized. Two withdrew after random assignment to sleep restriction. Forty-four were included in analysis. Participants ranged in age from 18 to 27 years (20.68 [1.84]) and 28 were female (63.6%).

At baseline, the participant groups were similar on sex distribution and questionnaire, cognitive, and sleep measures (**Table**). After random assignment, participants in the normal-sleep group slept 91 minutes per night longer than participants in the restricted-sleep group (mean [SD], 461 [41] vs 370 [51] minutes; $t_{42} = 6.48$; $P < .001$; *d*, 1.95 [95% CI, 1.22-2.67]). After sleep restriction, subjective sleepiness scores (normal-sleep group, 3.00 [1.54]; restricted-sleep group, 5.36 [1.79]; $P < .001$), mood disturbance scores (normal-sleep group, 93.77 [17.68]; restricted-sleep group, 111.18 [24.63]; $P = .01$), and scores on tasks measuring lapses of attention (normal-sleep group, 1.50 [1.95]; restricted-sleep group, 4.05 [4.35]; $P = .02$) were increased in the restricted-sleep group, but fluid intelligence remained stable (Table).

Factor 2 ratings (on error, punishment, and compensation) were altered after sleep restriction ($t_{41} = 2.82$; $P = .007$; *d*, 0.85 [95% CI, 0.23-1.46]), with factor 1 surgeon quality ratings remaining stable ($t_{41} = 1.10$; $P = .28$; *d*, 0.33 [95% CI, −0.27 to 0.92]). Total sleep time explained significant variance in factor 2 ratings ($\Delta R^2 = 11.7$; $P = .005$), even when controlling for factor 1 ratings, fluid intelligence, attention, mood, and subjective sleepiness (total $R^2 = 40.0$; $P = .001$).

Of the 4 items in factor 2, perceived error severity and incompetence were not associated with sleep restriction (Table). However, sleep restriction was associated with greater endorsements of punishing the surgeon ($t_{41} = 3.22$; $P = .003$; *d*, 0.97 [95% CI, 0.34-1.59]) and financially compensating the patient ($t_{41} = 2.31$; $P = .03$; *d*, 0.70 [95% CI, 0.08-1.30]). The **Figure** illustrates an increased likelihood of endorsing maximum punishment ($\chi^2_1 = 12.78$; $P < .001$) and maximum financial compensation ($\chi^2_1 = 18.21$; $P < .001$) after sleep restriction.

Discussion | During and after hospitalization, sleep loss is pervasive in patients.[5] The current data implicate mild sleep restriction in altering mood and cognitive functioning, as well as perceptions of how much surgeons should be punished and patients should be compensated for medical errors.[2,3] Incorporating self-reported sleep measures for all hospitalized patients may allow for a quick and simple indicator of sleep disturbances, which has implications for patient mood, cognition, and other health-relevant factors. More broadly, while health care professionals acknowledge that sleep is important to patient health, most hospital environments are poorly designed for sleep (eg, with noise, light, staff interruptions). Potential solutions include earplugs, eye masks, and educating staff on sleep hygiene.[6] Improving sleep quality during and after hospitalization also by educating patients and family members on sleep health (eg, brochures, free online resources) may directly promote patient health and indirectly reduce the $10 billion annual burden of settlement and legal expenses that predominantly affect surgical specialists.[1,2]

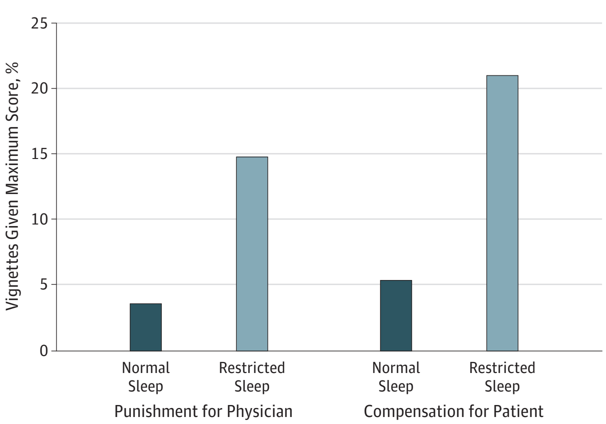
Table. Mood, Sleepiness, Cognitive, and Medical Error Rating Outcome Measures Across Sessions

Variable	Mean (SD)		Main Effect	
	Participants in Normal Sleep Groups (n = 22)	Participants in Restricted Sleep Group (n = 22)	Value of Statistic	P Value
Session 1				
Female, No. (%)	15 (68)	13 (59)	$\chi^2_1 = 0.39$	.53
Profile of Mood States score	91.23 (11.77)	91.64 (16.44)	$t_{42} = 0.10$	.93
Total sleep before baseline session, min	426.9 (60.5)	419.9 (67.01)	$t_{42} = 0.361$	.72
Karolinska Sleepiness Scale score	5.24 (1.48)	4.36 (1.76)	$t_{41} = 1.76$	.09
Psychomotor Vigilance Task attention lapse score	2.14 (3.96)	1.91 (2.29)	$t_{42} = 0.23$	.82
Reading span score	22.45 (5.18)	20.00 (5.82)	$t_{39} = 1.42$	.16
Raven's matrices total score	11.57 (2.96)	11.55 (3.26)	$t_{41} = 0.03$	.98
Session 2[a]				
Profile of Mood States score	93.77 (17.68)	111.18 (24.63)	$t_{42} = 2.69$	.01
Karolinska Sleepiness Scale score	3.00 (1.54)	5.36 (1.79)	$t_{42} = 4.70$	< .001
Psychomotor Vigilance Task attention lapse score	1.50 (1.95)	4.05 (4.35)	$t_{42} = 2.51$	.02
Reading span score	24.14 (5.24)	21.81 (5.55)	$t_{42} = 1.42$	.16
Raven's matrices total score	11.14 (2.44)	10.68 (3.33)	$t_{42} = 0.52$	.61
Factor 1 ratings	2.93 (0.91)	2.63 (0.86)	$t_{41} = 1.10$	.28
Factor 2 ratings[b]	4.33 (0.65)	3.63 (0.94)	$t_{41} = 2.82$	.007
Error severity	6.87 (0.90)	7.32 (1.00)	$t_{41} = 1.57$	.13
Error incompetence	2.90 (0.97)	2.55 (0.95)	$t_{41} = 1.21$	.23
Physician punishment	4.85 (1.19)	6.07 (1.28)	$t_{41} = 3.22$	.003
Patient compensation	5.13 (1.11)	6.07 (1.52)	$t_{41} = 2.31$	.03

[a] The Profile of Mood States assesses mood; the Karolinska Sleepiness Scale, sleepiness; the Psychomotor Vigilance Task, sustained attention; reading span, working memory; and Raven matrices, fluid intelligence. Technical difficulties caused some data loss for the Karolinska Sleepiness Scale (n = 1), reading span (n = 3), and medical error rating (n = 1) tasks.

[b] Factor 2 included ratings on perceived error severity, error incompetence, degree of physician punishment, and degree of patient compensation.

Figure. Endorsements of Maximum Surgeon Punishment and Maximum Patient Compensation After Normal and Mildly Restricted Sleep



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