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Association of Sleep Quality with Depression in Police Officers

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Abstract: Poor sleep quality has been shown to adversely affect neurobehavior, including an increase in depression symptoms. Police officers are at increased risk of poor sleep quality due to occupational factors. This study analyzed self-reported sleep and depression data from police officers; 391 police officers from Buffalo, New York reported on sleep and depression by completing the Pittsburgh Sleep Quality Index (PSQI) and the Center for Epidemiological Studies Depression (CES-D) questionnaires. Mean CES-D scores were assessed across quintiles of PSQI. As PSQI scores increased, reflecting poorer sleep quality, CES-D scores also increased significantly, indicating an increase in depression symptoms as sleep quality worsens. This trend held for both male and female officers. Mean CES-D scores across quintiles ranged from 4.72 to 12.65 in men and from 5.53 to 12.63 in women. Multivariate adjustment only very slightly attenuated the association in female officers. After adjustment, five of the seven PSQI components showed statistically significant associations with CES-D scores in male officers and two in female officers. Sleep quality was significantly and independently associated with depressive symptoms as evidenced by a trend of increasing depressive symptom scores with decreasing sleep quality in both male and female officers. [International Journal of Emergency Mental Health, 2011, 13(4), pp. 267-277].

Key words*: law enforcement, cardiovascular disease, risk factors, health disparity, epidemiology*

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Studies have shown that poor sleep and depression are positively associated to a high degree. Sleep disturbances in older individuals and in women have strongly correlated with depression (Leineweber, Kecklund, Janszky, Akerstedt, & Orth-Gomer, 2003; Rodin, McAvay, & Timko, 1988). Other studies have shown similar results, indicating that the best predictor of future depression in the elderly was current sleep disturbance, with females having a higher incidence rate than males (Livingston, Blizard, & Mann, 1993; Roberts, Shema, Kaphan, & Strawbridge, 2000; Rodin et al., 1988; Sukegawa et al., 2003). Studies with younger populations have also found a higher risk of depression in young men who reported difficulty sleeping (Chang, Ford, Mead, Copper-Patrick, & Klag, 1997).

Sleep disorders are common in the general population, affecting up to one-third of adults in the United States (Seidel et al., 2009), while more than a one-quarter of US adults have reported not getting enough sleep (Ram, Seirawan, Kumar, & Clark, 2009). Those who have reported extraordinary stress commonly report sleep problems (Rosen, Reynolds, Yeager, Houck, & Hurwitz, 1991). Considering the high prevalence of sleep disturbances and the close relation between sleep and depression, sleep quality can be an important indicator of quality of life (Seidel et al., 2009).

Chronic sleep deprivation may lead to alterations in daily circadian rhythms (Bollinger, Bollinger, Oster, & Solbach, 2010; Maurovich-Horvat, Pollmacher, & Sonka, 2008). Sleep disorders have been found to be associated with a decrease in performance of routine daily activities, such as concentration and recall (Alapin et al., 2000; Ram et al., 2009).

While there has been evidence of a bi-directional association between poor sleep and depression (Tractenberg, Singer, & Kaye, 2005), longitudinal studies have shown that poor sleep can lead to depression. A study of twins found longitudinal associations between sleep problems and depressive symptoms among children aged eight to ten (Gregory, Rijsdijk, Lau, Dahl, & Eley, 2009). Another prospective study demonstrated that sleep disturbance was an independent risk factor for depression recurrence in community-dwelling older adults (Cho et al., 2008). Persons with insomnia symptoms have been shown to have an increased risk for developing depression (Chang et al., 1997; Szklo-Coxe, Young, Peppard, Finn, & Benca, 2010). Another study has shown that those with sleep related breathing disorders had higher odds of developing depression (Peppard, Szklo-Coxe, Hla, & Young, 2006).

Investigators from multiple disciplines, including molecular biology, neurology, and pathophysiology, have examined potential mechanisms that might link poor sleep and mental disorders (Meerlo, Mistlberger, Jacobs, Heller, & McGinty, 2009). A recent review concluded that altered sleep rhythm may interrupt melatonin secretion (Srinivasan et al., 2009), which itself may be a cause of depression, such as that caused by seasonal affective disorder (Kellner et al., 1997; Sack et al., 1990).

There is also evidence that full-time workers are more likely to experience shorter sleep duration (< 6 hours; Knutson, Van Cauter, Rathouz, DeLeire, & Lauderdale, 2010). Police officers may even be at a higher risk for sleep disturbances and shorter sleep duration than other occupational groups, due to their irregular shifts, overtime, required court attendance, and training (Vila & Kenney, 2002). Protective service occupations, of which police officers are a part, have over a 38% prevalence of short sleep duration (≤ 6 hours/night), and a higher prevalence ratio of short sleep when compared to the retail sales industry (PR = 1.16; 95% CI = [1.03, 1.31]; Luckhaupt, Tak, & Clavert, 2010). This short sleep duration, and perhaps associated poor sleep quality, may in turn lead to a greater likelihood of suffering from symptoms of depression. Not only could depression lead to a lower quality of life (Baldwin et al., 2001; Brummett et al., 2006; Carter, 2002), but it also could have a negative influence on work-life, by lowering performance (Dawson & Reid, 1997; Vila & Kenney, 2002).

This study investigates the cross-sectional association between sleep quality and depressive symptoms among police.

METHOD

A study involving health outcomes associated with stress among police officers includes analysis of the research question under study: is sleep quality associated with depression? Three hundred ninety-one officers from the Buffalo, New York Police Department reported on sleep and depression

by completing the Pittsburgh Sleep Quality Index (PSQI) and the Center for Epidemiological Studies Depression (CES-D) questionnaires (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989; Radloff, 1977). Data were collected from 2004 through 2009. Informed consent was obtained from all participants in the study. This study was approved by the State University of New York at Buffalo's Internal Review Board. The population size of the Buffalo Police Department was non-stationary throughout the data collection period, but was 710 at the beginning of the study in 2004. A total of 464 officers were examined during this period. Among the 464 officers, 41 were missing either PSQI or CES-D data and were excluded from analysis. Another 32 officers were retired when the data were collected and were also excluded from analysis, resulting in a final sample size of 391.

Assessment of Sleep Quality

Sleep quality was assessed using the PSQI, an instrument that has been shown to have high internal consistency, reliability, and validity (Beck, Schwartz, Towsley, Dudley, & Barsevick, 2004; Knutson, Rathouz, Yan, Liu, & Lauderdale, 2006; Smyth, 2003). Participants completed the questionnaire based on their sleep behaviors in the past month. The questionnaire uses a series of nine questions, some of which have multiple parts. Five of these questions use a Likert scale ranging from 0 to 3, indicating the frequency of the sleep problem (0 = not during the past month; 1 = less than once a week; 2 = once or twice a week; 3 = three or more times a week). The answers to the nine questions are used to determine the scores of seven components that make up the PSQI: subjective sleep quality (a self rating of overall sleep quality); sleep latency (how long it takes to fall asleep after going to bed); sleep duration (how many hours of actual sleep per night); habitual sleep efficiency (number of hours of sleep divided by the number of hours of being in bed); sleep disturbances (waking up too early, bathroom use, cannot breathe comfortably, cough or snore loudly, feeling too hot or cold, having bad dreams, or having pain); use of sleep medication (frequency of sleep medication use, either prescribed or over-the-counter, within the past month); and daytime dysfunction (trouble staying awake or having the enthusiasm to get things done).

These seven components also incorporate Likert scores that range from 0 to 3. These component scores are then summed to give an overall global PSQI score, ranging from 0 to 21. This score can be used as a continuous variable, but also is used to differentiate between poor quality sleep (a score of five or higher) and good quality (a score of four or lower) sleep.

Assessment of Depressive Symptoms

Depressive symptoms were assessed using the CES-D, a self-report instrument commonly used to measure a participant's level of depressive symptoms in the past week. It consists of twenty questions, each of which uses a Likert scale ranging from 0 to 3, with higher scores indicating an increased frequency of the depressive symptom over the past week (0 = less than once a day; 1 = one to two days out of the week; 2 = three to four days out of the week; 3 = five to seven days out of the week). The sum of the scores for the twenty questions gives an overall CES-D score ranging from 0 to 60. This score can be used as a continuous number, but also is used to identify possible depression in participants, when the score is 16 or higher.

Assessment of Covariates

Officers were given self- and interviewer-administered questionnaires to provide information on demographic characteristics, lifestyle behaviors, and medical history. The following variables were selected as covariates based on the literature, biological plausibility, or statistical significance. For smoking status, participants were categorized as *never smokers, current smokers,* or *former smokers*. Marital status included six categories which were collapsed into three groups (single, divorced, and married). Educational status was categorized as *<12 years of school to graduate degree.* These categories were collapsed into three levels (high school or less, less than four years of college, and four or more years of college). Waist circumference, measured as distance around the waist in centimeters, and number of alcohol drinks per week (one drink being defined as a 12 ounce bottle of beer, one medium sized glass of wine, or one shot of liquor) were also categorized by ordered tertiles. Medication use was determined from actual medications that particpants reported taking in the previous two weeks. Sleep medication was defined as prescription medications specifically used for sleep.

Statistical Analysis

Statistical methods included univariate analyses, Pearson and Spearman correlations, analyses of variance (ANOVAs), and analyses of covariance (ANCOVAs). The variable of

interest was the mean CES-D score, as it associated with the PSQI scores. Global PSQI and the seven components were analyzed both as continuous variables and by ordination. PSQI global scores were categorized into quintiles, for descriptive clarity. The lowest quintile was composed of global scores 0-4, reflecting the "good sleep quality" group. The other four quintiles were established to have approximately equal sample sizes (PSQI score ranges 5-6, 7-8, 9-11, and 12+, respectively). Components of the PSQI were categorized by the participant's component score, resulting in values of 0, 1, 2, and 3, reflecting increasing frequency or intensity of the sleep condition.

Bivariate associations between PSQI scores or CES-D scores and selected covariates were assessed using Pearson's and Spearman's correlation and ANOVAs. Means, standard deviations, and p-values obtained from ANOVA/ANCOVA models were used to assess associations between PSQI and CES-D scores. The *p*-values for linear trend in mean CES-D values across PSQI scores were based on linear regression. For PSQI components yielding ordered categories linear contrasts were used.

Effect modification for categorical covariates, including gender, were assessed, setting statistical significance at an alpha level of 0.20 for interaction, to account for the decreased statistical power when assessing interaction terms. All data were analyzed using SAS version 9.1 (SAS Institute, Inc., 2008).

RESULTS

The study sample included 107 policewomen and 284 policemen with a mean age of 40.7 years (Table 1). The majority of participants were white (78.2%) and had received some college education (90.0%). 17.2% of participants reported that they were current smokers; 16.8% of female participants and 10.2% of male participants had a CES-D score of sixteen or greater, indicating possible depression; 71.0% of female and 64.4% of male participants had a PSQI score of five or greater, indicating poor sleep quality.

Analyses of variance showed that several specific components (habitual sleep efficiency and daytime dysfunction, as well as sleep disturbances being borderline non-significant) were significantly higher for women than men (Table 1). There were no statistically significant differences between men and women for the components subjective sleep quality, sleep latency, sleep duration, or use of medication, as well as global PSQI score.

Associations between covariates and CES-D scores are shown in Table 2. Few of the covariates were significantly associated with CES-D scores, although alcohol intake was for both male officers ($p = 0.020$) and female officers ($p = 0.031$). Antidepressant use was also significantly associated with CES-D scores for both men ($p = 0.005$) and women ($p = 0.002$).

There were strong correlations between CES-D scores and the PSQI global score and the seven PSQI components (data not shown, *p*-values < 0.001). All tests for interaction, with the above listed covariates, were not statistically significant *(p*-interaction > 0.20). Although the test for interaction between gender and sleep was not significant ($p = 0.781$), the results are presented separately for men and women to provide results for both genders, given the limited availability of findings for female officers.

Among male officers, mean CES-D values increased significantly across increasing quintiles of PSQI score (4.72, 5.60, 7.88, 12.67, and 12.65 respectively; p for trend < 0.001; Table 3). The results were similar for female officers, with mean CES-D values increasing significantly across increasing quintiles of PSQI score (5.53, 6.21, 13.08, 10.88, 12.63, respectively; *p* for trend = 0.001).

Results were similar for male officers when looking at mean CES-D scores across PSQI component levels, with significant results for the following components: subjective sleep quality (*p*-trend < 0.001), sleep latency (*p*-trend < 0.001), sleep duration (*p*-trend <0.001), sleep disturbances (*p*-trend < 0.001), use of sleep medication (*p*-trend < 0.001), and daytime dysfunction (*p*-trend < 0.001; Table 4).

These results were only slightly attenuated for men, although they still remained statistically significant, even after multivariate adjustment for possible confounders (age, sex, smoking status, number of alcohol drinks per week, marital status, and waist circumference), which were chosen a priori.

Female officers also had significantly increasing CES-D values across component scores, for the following components: subjective sleep quality (*p*-trend < 0.001), sleep latency (*p*-trend = 0.029 and daytime dysfunction (*p*-trend = 0.019), with sleep disturbances being borderline non-significant (*p*-trend = 0.052; Table 5).

The results for female officers were attenuated for the component sleep latency after multivariate adjustment. The results for the quintiles of the global score and other sig-

Table 1.
Demographic and lifestyle variables by gender, 2004-2009.

Values are means (standard deviations) for continuous variables and number (percent) for categorical variables.

Characteristc	All	Men	Women	*p*-value*
	N = 391	*n* = 284	*n* = 107	
Age (years)	40.70 (7.14)	40.72 (7.52)	40.64 (6.04)	0.924
Waist Circumference (cm)	93.81 (14.16)	99.03 (11.24)	80.11 (11.67)	<0.001
Alcohol Intake (drinks/week)	5.43 (9.20)	6.00 (10.07)	3.91 (6.11)	0.014
Race (%)				
Caucasian	301 (78)	222 (80)	79 (74)	0.053
African American	77 (20)	49 (18)	28 (27)	
Hispanic American	7 (2)	7 (2)	0 (0)	
Smoking Status (%)				
Current	67 (17)	39 (14)	28 (27)	<0.001
Former	89 (23)	59 (21)	30 (28)	
Never	233 (60)	186 (65)	47 (45)	
Education (%)				
High School or less	39 (10)	35 (12)	4 (4)	0.039
< 4 years of college	218 (56)	153 (54)	65 (61)	
≥ 4 years of college	133 (34)	95 (34)	38 (35)	
Marital Status (%)				
Single	52 (13)	27 (10)	25 (23)	<0.001
Married	284 (73)	222 (78)	62 (58)	
Divorced	55 (14)	35 (12)	20 (19)	
Antidepressant Use (%)	29 (7)	17 (6)	12 (11)	0.079
Sleep Medication (%)	7 (2)	4 (1)	3 (3)	0.513
CES-D Score	7.79 (7.08)	7.40 (6.58)	8.81 (8.21)	0.354
PSQI Global Score	6.46 (3.36)	6.27 (3.18)	6.94 (3.76)	0.102
PSQI Components				
Subjective Sleep Quality	1.36 (0.75)	1.35 (0.70)	1.36 (0.88)	0.897
Sleep Latency	1.13 (1.02)	1.12 (0.98)	1.16 (1.10)	0.734
Sleep Duration	1.05 (0.96)	1.05 (0.95)	1.05 (1.00)	0.956
Habitual Sleep Efficiency	0.45 (0.84)	0.39 (0.79)	0.60 (0.93)	0.039
Sleep Disturbances	1.28 (0.59)	1.25 (0.59)	1.37 (0.59)	0.058
Use of Medication	0.34 (0.82)	0.32 (0.84)	0.37 (0.80)	0.595
Daytime Dysfunction	0.85 (0.77)	0.79 (0.76)	1.03 (0.79)	0.006

**Based on difference between genders using t-tests (for continuous variables) and chi-square and Fisher's exact tests (for categorical variables).*

nificant components were slightly attenuated, but remained statistically significant.

Analyses were also performed after excluding all officers who were taking medications for depression and/or to aid sleep to determine whether results were similar after exclusion. Twenty-nine officers were taking medication for depression and seven officers were taking medication for sleep, with four of the officers taking medication for both. The trend and statistical significance for the association between CES-D and PSQI quintiles did not change for the remaining 359 officers.

Shift work was also analyzed, as it can have an impact on sleep quality. Shift work did not have an influence, as either a confounding variable or effect modifier, and was thus left out of the models (data not shown).

Table 2.
Associations of selected covariates with CES-D.

Covariate	Males*	*p*-value	Females*	*p*-value*
Age (years)	-0.002	0.976	-0.0002	0.999
Waist Circumference (cm)	0.023	0.709	0.105	0.286
Alcohol Intake (drinks/week)	0.140	0.020	0.211	0.031
Antidepressant Use				
Yes	11.76 (9.56)	0.065	15.61 (12.38)	0.002
No	7.12 (6.27)		7.95 (7.17)	
Sleep Medication Use				
Yes	13.25 (8.18)	0.073	14.67 (4.93)	0.212
No	7.32 (6.53)		8.64 (8.23)	
Race				
Caucasian	7.62 (6.93)	0.207	9.05 (7.75)	0.619
African American	5.81 (4.30)		8.14 (9.51)	
Hispanic American	7.89 (4.31)		n/a	
Smoking Status				
Current	9.15 (7.51)	0.200	8.94 (7.07)	0.999
Former	7.03 (6.59)		8.83 (8.58)	
Never	7.15 (6.34)		8.90 (8.86)	
Education				
High School or less	6.71 (5.63)	0.808	8.25 (9.98)	0.894
< 4 years of college	7.38 (6.87)		8.55 (6.83)	
≥ 4 years of college	7.56 (6.38)		9.32 (10.19)	
Marital Status				
Single	7.91 (7.50)	0.622	7.66 (5.23)	0.646
Married	7.20 (6.31)		8.91 (8.34)	
Divorced	8.26 (7.59)		9.95 (10.72)	

*Associations are Pearson correlation coefficients for continuous variables or mean (standard deviation) values for categorical variables.

‡Indicates a significant association at the 0.05 level, using correlation analyses for continuous variables and ANOVAs for categorical variables.

DISCUSSION

The results of this study show that in both male and female officers sleep quality is strongly associated with depression, with depressive symptom scores increasing as sleep quality worsens. These associations remained significant after adjustment for several covariates: age, smoking status, number of drinks per week, marital status, and waist circumference. These results are consistent with previous studies, including those that specifically use the PSQI and CES-D questionnaires, where: for patient caregivers, depressive symptoms are higher when sleep quality is worse, and that this association may be stronger in females (Carter, 2002); there was a statistically significant increase in PSQI-J (Pittsburgh Sleep Quality Index – Japanese version) scores in older adults who had depression symptoms, based on the Geriatric Depression Scale, versus those who were in the control (non-depressive) group (Sukegawa et al., 2003); a study looking at subjective sleep quality in suicidal and non-suicidal patients reported a significantly higher PSQI score for suicidal depressive patients over those who were non-suicidal, as well as increased scores in several of the PSQI's components (Agargun, Kara, & Solmaz, 1997); a study looking at sleep quality during pregnancy found that sleep problems, as measured by the PSQI, may be prospective risk factors for increases in depressive symptoms, as measured by the Beck Depression Inventory (Skouteris, Wertheim, Germano, Paxton, & Milgrom, 2009); Kuwaiti college students showed

Table 3.
Mean CES-D score by quintiles of PSQI score and gender.

Gender	PSQI Score	*n*	Unadjusted Mean (SD)	Age adjusted Mean (SE)	Multivariable Adjusted* Mean (SE)
Male	Glocal Score				
	0-4	101	4.72 (4.71)	4.72 (0.58)	4.89 (0.60)
	5-6	67	5.60 (4.41)	5.61 (0.71)	5.63 (0.74)
	7-8	46	7.88 (6.63)	7.87 (0.86)	7.76 (0.87)
	9-11	53	12.67 (7.78)	12.67 (0.80)	12.64 (0.81)
	12+	17	12.65 (6.77)	12.66 (1.41)	12.43 (1.56)
	p-trend‡		<0.001	<0.001	<0.001
Female	Global Score				
	0-4	31	5.53 (3.72)	5.53 (1.39)	5.34 (1.55)
	5-6	24	6.21 (7.28)	6.08 (1.60)	6.29 (1.69)
	7-8	13	13.08 (8.77)	12.95 (2.16)	12.73 (2.26)
	9-11	23	10.88 (9.72)	10.85 (1.62)	11.06 (1.72)
	12+	16	12.63 (9.79)	12.97 (2.02)	11.75 (2.30)
	p-trend		0.001	0.001	0.008

*Adjusted for age, smoking status, alcohol intake (drinks per week), marital status, and waist circumference.

‡*p*-trend obtained from linear regression.

significant correlations between insomnia and depression, as measured by the CES-D (El-Anzi, 2006).

This study also showed statistically significant associations for some of the PSQI's seven components. In men, a worsening of depressive symptoms tended to occur with higher component scores (lower sleep quality) of subjective sleep quality, sleep latency, sleep duration, sleep disturbances, use of medication, and daytime dysfunction. In women, it occurred with higher component scores of subjective sleep quality and daytime dysfunction.

Although mean values of CES-D did increase with increasing values of PSQI, most scores were still below the threshold for being at-risk for depression (CES-D $\geq$ 16).

One limitation of this study is that the design is cross-sectional. While our hypothesis follows biological theory that poor sleep could lead to depression, our study cannot make causal inferences.

This study has several strengths. The participation rate was relatively high, with nearly two-thirds of Buffalo police officers participating. Both the PSQI and the CES-D are validated instruments for measuring sleep quality and depression. Many possible confounding variables were available for adjustment, to ensure the validity of the reported association between PSQI and CES-D scores.

Another strength is that this study presents information on police officers, a population that is at high risk for poor sleep from work-related stress and shift work. The potential depressive symptoms that may result can have a negative impact on home and work life. This study also provides new information regarding women police officers, a population that has a scarcity of studies in the literature.

In summary, the results of this study show that as sleep quality gets worse, depressive symptoms do as well. In a profession that requires high levels of alertness, as well as sometimes requiring instantaneous decisions, it would be optimal if police officers were well rested, and thus have fewer depressive symptoms and correspondingly higher cognitive skills. For future investigations, the use of a prospective study design would enhance the inferences that could be drawn from these findings.

Table 4.
Mean CES-D score by PSQI component score for Male Officers.

PSQI	*n*	Unadjusted Mean (SD)	Age adjusted Mean (SE)	Multivariable Adjusted Mean (SE)
Subjective Sleep Quality				
0 (very good)	21	3.44 (2.78)	3.44 (1.35)	3.60 (1.43)
1 (fairly good)	158	5.99 (6.00)	5.98 (0.49)	6.04 (0.51)
2 (failry bad)	89	9.98 (6.83)	9.98 (0.65)	10.10 (0.67)
3 (very bad)	16	12.20 (6.99)	12.24 (1.55)	11.21 (1.65)
p-trend‡		<0.001	<0.001	<0.001
Sleep Latency				
0 (15 min)	87	5.92 (5.34)	5.92 (0.69)	6.17 (0.70)
1 (16-30 min)	111	6.59 (6.11)	6.59 (0.61)	6.53 (0.64)
2 (31-60 min)	51	10.17 (8.15)	10.17 (0.90)	10.18 (0.90)
3 (> 60 min)	35	9.63 (6.71)	9.63 (1.08)	9.47 (1.12)
p-trend		<0.001	<0.001	0.001
Sleep Duration				
0 (> 7 hours)	98	6.62 (6.66)	6.63 (0.66)	6.74 (0.69)
1 (6-7 hours)	95	6.92 (5.98)	6.92 (0.67)	7.06 (0.68)
2 (5-6 hours)	69	7.75 (6.24)	7.75 (0.78)	7.83 (0.80)
3 (< 5 hours)	22	11.85 (8.21)	11.86 (1.38	11.17 (1.44)
p-trend		0.208	0.211	0.429
Habitual Sleep Efficiency				
0 (< 85%)	216	6.58 (6.03)	6.58 (0.44)	6.63 (0.45)
1 (75-84%)	39	10.49 (8.48)	10.49 (1.03)	10.71 (1.05)
2 (65-74%)	16	9.88 (6.14)	9.88 (1.62)	9.20 (1.68)
3 (3+/week)	13	8.74 (6.45)	8.74 (1.80)	8.85 (1.81)
p-trend		0.315	0.317	0.388
Sleep Disturbances				
0 (0 times)	18	3.06 (3.15)	2.98 (1.48)	3.20 (1.55)
1 (<1/week)	183	6.42 (5.91)	6.42 (0.46)	6.49 (0.47)
2 (1-2/week)	78	10.34 (7.43)	10.36 (0.71)	10.50 (0.74)
3 (3+/week)	5	13.00 (5.39)	13.01 (2.79)	11.70 (3.16)
p-trend		<0.001	<0.001	<0.001
Use of Medication				
0 (0 times)	240	6.84 (6.15)	6.84 (0.42)	6.85 (0.42)
1 (<1/week)	16	7.75 (7.01)	7.75 (1.61)	8.10 (1.61)
2 (1-2/week)	8	11.63 (6.97)	11.64 (2.28)	11.75 (2.28)
3 (3+/week)	20	12.15 (8.78)	12.15 (1.44)	12.83 (1.51)
p-trend		<0.001	<0.001	<0.001
Daytime Dysfunction				
0 (0 times)	108	4.12 (4.05)	4.11 (0.56)	4.03 (0.59)
1 (<1/week)	137	8.19 (6.46)	8.19 (0.50)	8.27 (0.50)
2 (1-2/week)	30	13.57 (7.25)	13.66 (1.07)	14.11 (1.11)
3 (3+/week)	9	14.11 (7.85)	14.05 (1.94)	13.69 (2.08)
p-trend		<0.001	<0.001	<0.001

**Adjusted for age, smoking status, alcohol intake (drinks/week), marital status, and waist circumference.*
‡*p*-trend obtained from linear contrast for all PSQI components except for sleep duration, where linear regression was used.

Table 5.
Mean CES-D score by PSQI component score for Female Officers.

PSQI	*n*	Unadjusted Mean (SD)	Age adjusted Mean (SE)	Multivariable Adjusted Mean (SE)
Subjective Sleep Quality				
0 (very good)	19	5.00 (2.87)	5.00 (1.73)	5.43 (1.92)
1 (fairly good)	40	6.31 (6.01)	6.31 (1.19)	6.02 (1.26)
2 (failry bad)	38	11.35 (8.90)	11.35 (1.22)	10.78 (1.30)
3 (very bad)	10	16.40 (12.04)	16.41 (2.38)	17.11 (2.47)
p-trend‡		<0.001	<0.001	<0.001
Sleep Latency				
0 (15 min)	39	6.50 (5.29)	6.48 (1.28)	6.55 (1.38)
1 (16-30 min)	30	8.10 (7.86)	8.11 (1.46)	8.06 (1.54)
2 (31-60 min)	20	13.25 (10.57)	13.24 (1.78)	13.59 (1.90)
3 (> 60 min)	18	10.07 (9.44)	10.11 (1.90)	9.08 (2.09)
p-trend		0.017	0.030	0.107
Sleep Duration				
0 (> 7 hours)	42	8.41 (6.70)	8.39 (1.29)	8.28 (1.43)
1 (6-7 hours)	27	8.37 (8.36)	8.34 (1.61)	8.55 (1.67)
2 (5-6 hours)	29	9.08 (8.94)	9.11 (1.55)	9.00 (1.65)
3 (< 5 hours)	9	11.11 (12.15)	11.20 (2.81)	10.36 (2.99)
p-trend		0.352	0.343	0.521
Habitual Sleep Efficiency				
0 (< 85%)	69	7.53 (7.15)	7.43 (0.98)	7.59 (1.05)
1 (75-84%)	19	13.70 (12.02)	13.85 (1.85)	13.94 (2.08)
2 (65-74%)	12	7.50 (4.85)	7.78 (2.36)	7.05 (2.57)
3 (3+/week)	7	10.43 (5.71)	8.74 (1.80)	9.14 (3.42)
p-trend		0.802	0.756	0.842
Sleep Disturbances				
0 (0 times)	5	5.40 (2.41)	5.33 (3.33)	6.09 (3.59)
1 (<1/week)	58	5.78 (5.27)	5.75 (0.98)	5.86 (1.06)
2 (1-2/week)	43	13.06 (9.84)	13.11 (1.14)	12.82 (1.23)
3 (3+/week)	1	13.00 (5.39)	18.73 (7.47)	n/a
p-trend		0.052	0.055	0.083
Use of Medication				
0 (0 times)	84	8.88 (8.47)	8.87 (0.90)	9.09 (0.95)
1 (<1/week)	10	5.40 (5.38)	5.35 (2.62)	4.71 (2.71)
2 (1-2/week)	9	11.22 (8.51)	11.36 (2.81)	9.80 (3.12)
3 (3+/week)	4	10.50 (7.33)	10.46 (4.13)	9.75 (4.51)
p-trend		0.419	0.417	0.622
Daytime Dysfunction				
0 (0 times)	28	6.40 (7.56)	6.40 (1.51)	6.10 (1.64)
1 (<1/week)	52	8.09 (7.70)	8.09 (1.11)	8.00 (1.14)
2 (1-2/week)	23	12.26 (8.76)	12.26 (1.67)	11.92 (1.76)
3 (3+/week)	4	15.25 (9.18)	15.25 (3.99)	17.10 (4.28)
p-trend		0.019	0.020	0.009

**Adjusted for age, smoking status, alcohol intake (drinks/week), marital status, and waist circumference.*
‡*p*-trend obtained from linear contrast for all PSQI components except for sleep duration, where linear regression was used.

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