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# Association of Traumatic Police Event Exposure With Sleep Quality and Quantity in the BCOPS Study Cohort

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***Abstract:*** *Police officers are exposed to traumatic and life-threatening events, which may lead to sleep problems. Prior studies of police officers have found them to have poor sleep quality and reduced sleep time. This study examined associations between traumatic events and sleep quality. Participants were 372 police officers from the Buffalo Cardio-metabolic Occupational Police Stress (BCOPS) Study. Police incidents were measured by the Police Incident Survey; sleep quality and quantity were derived from the Pittsburgh Sleep Quality Index (PSQI). Analysis of covariance (ANCOVA) was used to examine mean PSQI scores across categories of traumatic event frequency. Models were adjusted for age, education and ethnicity and stratified by sex and workload. In men, significant associations were found for the 'shooting of another officer' and sleep quality (p-value = 0.024) and sleep disturbances (p-value=0.022). In women, seeing more 'abused children' was associated with poorer sleep quality (p-value=0.050); increasing frequency of 'seeing victims of a serious traffic accident' was associated with shorter sleep duration (p-value=0.032). Increased frequency of 'seeing dead bodies' was associated with poorer sleep quality (p-value=0.040) and shorter sleep duration (p-value=0.048). Among women with a high workload, a significant inverse association was found between 'seeing serious traffic accident victims' and global sleep quality (p-value = 0.031). In conclusion, a significant inverse association between frequency of select traumatic events and sleep quality was found in male and female police officers. The significant events differed by sex. Future research could examine longitudinal associations between career-long traumatic event exposures and sleep quality and how these associations differ by sex.* [International Journal of Emergency Mental Health and Human Resilience, 2013, 15(4), pp. 255-266].

Key words: *traumatic, sleep, stress, law enforcement.*

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## Introduction

Emergency personnel, including police officers are known to face many stressful incidents as part of their routine work environment. These important events largely include life-threatening interventions necessary to save or protect human life and can give rise to multiple forms of trauma and anxiety (Lavie, 2001). In a study by Violanti and Aron (1994), police officers ranked 'killing someone in the line of duty', 'the experience of a fellow officer being killed', and 'physical attack' as the three highest ranked stressors they could experience throughout the entire duration of their career. Furthermore, all of the top five and seven of the top 10 events were traumatic events. These types of inherent stressors have been associated with increased stress levels after an officer experiences 'the most traumatic event of their tenure' (Liberman et al., 1997).

Patterson (2001) found that police officers experience approximately 3.4 traumatic events for every six months in the police force. Trauma and serious events can significantly impact the health of police officers (Neylan, Metzler, Best, Weiss, Fagan, et al., 2002). Traumatic events can lead to sleep problems lasting for extensive periods of time, often leading to increased fatigue and anxiety (Lavie, 2001). In a cohort of police officers from New York, NY, Oakland, CA and San Jose, CA, critical incident exposure was found to be significantly associated with police officers' global sleep score; officers reported increased sleep problems as exposure to critical incidents increased (Neylan et al., 2002). Further, an inverse relationship was found between traumatic stress symptoms and health functioning and this association was mediated by inadequate sleep (Mohr et al., 2003). This means that traumatic stress can lead to inadequate sleep, which directly affects physical health. Thus the relationship between symptoms of stress and overall health functioning in police officers may be strongly influenced by quantity and quality of sleep.

In general, police officers have poorer sleep quality and sleep less with an average sleep time of 370 minutes compared to 405 minutes for non-police controls (Neylan et al., 2002). Inadequate sleep is known to affect overall health, and is exhibited through deficient moral reasoning (Olsen, Pallesen, & Eid, 2010) and an increase in reported days off from work (Phillips, Magan, Gerhardstein, & Cecil, 1991). Results from a recent study conducted on this cohort of police officers showed that those who exhibited very short or long sleep duration had significantly higher levels of leptin, known to be associated with an increased risk of obesity- and cardiovascular-related health problems (Charles et al., 2011).

Certain individual characteristics may be associated with increased effects of trauma exposure. Kaufmann, Rutkow, Spira & Mojtabai (2013) found a significant association between traumatic event exposure and incident psychological distress among early career police officers. Females have been found to experience traumatic stress differently than their male counterparts (Tolin & Foa, 2006), and often experience increases in severity compared to males (Brewin, Andrews & Valentine, 2000). Exploring these differences within this high stress occupational group has not previously been undertaken, yet understanding groups who may be more adversely impacted is important for developing intervention strategies.

The purpose of this study was to assess: (1) whether an association exists between police-specific traumatic events and sleep quality and quantity among police officers, and (2) whether the association differs between male and female officers. Hypotheses for this study were as follows: (1) officers with increased exposure to individual traumatic events will have higher PSQI global sleep scores than officers with a fewer number of traumatic events; and (2) the association will be significantly modified by sex, with stronger associations being observed among female officers.

## METHODS

### *Subjects*

Participants were 464 police officers who participated in the Buffalo Cardio-Metabolic Occupational Police Stress Study (BCOPS). The BCOPS Study was a cross-sectional epidemiologic study conducted between 2004-2009 to examine the association between workplace stress and subclinical cardiovascular disease (CVD). Inclusion criteria include sworn police officer status and willingness to participate in the study. Two female officers who were pregnant at the time of exam were excluded from participating. Officers missing more than two responses on the variables of interest and 33 retired police officers were excluded. The resulting final sample size was 372 officers: 269 males and 103 females. The study was approved by the University of New York at Buffalo Internal Review Board and the National Institute for Occupational Safety and Health Human Subjects Review Board.

*Police Incident Survey*

To assess traumatic event experiences, participants completed the Police Incident Survey (PIS). This 9-item self-report survey asks individual questions about police-specific events inherent to the police environment. For each of the eight questions and additional open-ended 'other' incident question, participants indicated if they had experienced the event within the past 12 months of duty. If the event occurred, the participant reported the frequency of that event in the past year and how many months had passed since the event last occurred. The eight traumatic events included the shooting of another officer, being involved in a shooting, and seeing abused children, victims of a serious traffic accident, someone die in front of you, dead bodies, severely assaulted victims, and homicide victims. These events were selected from prior research of psychological distress in police officers (Violanti & Aron, 1993).

*Sleep Quality and Quantity*

Subjective sleep quality and quantity were characterized with the Pittsburgh Sleep Quality Index (PSQI), an instrument previously validated with polysomnography, the benchmark of an overnight sleep study (Carpenter & Andrykowski, 1997; Aloba, Adewuya, Ola, & Mapayi, 2007). The 19-item PSQI questionnaire is a measure of sleep quality within the past month. Seven subscales: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction, and a 'global' score are derived. Subscale scores range from '0-better' to '3-worse' with higher scores indicating greater sleep problems. Hours of sleep are calculated from the question 'during the past month, how many hours of actual sleep did you get at night?'. Minutes of sleep latency were calculated from the question 'during the past month, how long, in minutes, has it usually taken you to fall asleep each night?'. 'Global' scores range from 0-21 with higher scores indicating poor sleep quality and lower scores indicating good sleep quality. A value of five has been previously identified as meeting the highest sensitivity (89.6%) and specificity (86.5%) criteria necessary to separate sufficient and insufficient sleep within clinical populations (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). Similarly, other PSQI validity studies have found the threshold of nine or more to be highly sensitive and specific (93% and 100% respectively) when examining clinical insomnia (Fichtenburg, Putnam, Mann, Zafonte, & Millard, 2001).

*Statistical Methods*

Descriptive statistics to characterize the study population included age, sex, education, years of police service, rank, shiftwork, and body mass index. Prevalence estimates and means (standard deviations, SD) were calculated for the traumatic events and the PSQI global score, sleep duration, sleep latency and the subscales. Analysis of variance (ANOVA) and covariance (ANCOVA) were used to examine mean PSQI global score, hours of sleep duration, minutes of sleep latency, and the sleep disturbance and sleep quality subscale scores across the categories of the Police Incident Survey. Tests for trend were obtained from linear contrasts. The multivariable models were adjusted for age, race/ethnicity and education. The models were stratified on sex and workload as the tests for interaction were significant ($p < 0.20$). All analyses were conducted using the SAS software, Version 9.1 (SAS Institute, Cary NC).

## RESULTS

The majority of subjects were male (72.3%) and white (77.4%), and on average were 41.3 years of age (Table 1). The mean number of years of service was 14.6 years, slightly higher for men than women. The majority held the rank of patrol officer (68.7% men, 78.6% women). About 26.0% of men and 12.6% of women had prior service in the U.S. military. The majority of men worked a non-day shift (42.3% afternoon, 28.1% night); the majority of women worked day shift (69.6%). A majority of both men and women reported having a high workload. Women were more likely to be current cigarette smokers than men (26.7% vs. 13.8%); men reported consuming more alcoholic beverages than women (6.2 vs. 3.9 drinks per week).

Of the eight types of traumatic events, male officers reported seeing a mean of 4.4 and women 4.0 different types of events in the past year (Table 2). Over 80% of men and over 70% of women reported seeing 'dead bodies' and 'severely assaulted victims' at least one time in the past year. Men reported seeing 'dead bodies' 7.6 times and 'severely assaulted victims' 14.7 times; women reported seeing 'dead bodies' 9.7 times and 'severely assaulted victims' 10.2 times in the past year. Women reported seeing more 'abused children' (8.6 times vs. 6.7 times), 'dead bodies' (9.7 times vs. 7.6 times), and other events (19.8 times vs. 12.4 times) than their male counterparts. Men reported being involved in a shooting (7.1 times vs. 6.1 times), seeing 'severely assaulted

Table 1.
Demographic and lifestyle characteristics by sex.

| Characteristic | Total N = 372 | | Men N = 269 | | Women N = 103 | |
|---|---|---|---|---|---|---|
| | N | Mean (SD) or % | N | Mean (SD) or % | N | Mean (SD) or % |
| Age, years | | | | | | |
| Mean | 372 | 41.3 (6.7) | 269 | 41.4 (7.0) | 103 | 41.1 (5.7) |
| < 40 | 154 | 41.4 | 114 | 42.4 | 40 | 38.8 |
| 40 – 49 | 170 | 45.7 | 116 | 43.1 | 54 | 52.4 |
| 50+ | 48 | 12.9 | 39 | 14.5 | 9 | 8.7 |
| Race/Ethnicity | | | | | | |
| White | 284 | 77.4 | 209 | 79.2 | 75 | 72.8 |
| African American | 76 | 20.7 | 48 | 18.2 | 28 | 27.2 |
| Hispanic | 7 | 1.9 | 7 | 2.7 | 0 | 0.0 |
| Education | | | | | | |
| High school or less | 39 | 10.5 | 35 | 13.1 | 4 | 3.9 |
| Less than 4 years college | 209 | 56.3 | 146 | 54.5 | 63 | 61.2 |
| 4 or more years college | 123 | 33.2 | 87 | 32.5 | 36 | 35.0 |
| Marital Status | | | | | | |
| Single | 48 | 12.9 | 24 | 8.9 | 24 | 23.3 |
| Married | 271 | 72.9 | 211 | 78.4 | 60 | 58.3 |
| Divorced | 53 | 14.3 | 34 | 12.6 | 19 | 18.5 |
| Police Service, years | | | | | | |
| Mean | 372 | 14.6 (7.0) | 269 | 15.0 (7.2) | 103 | 13.7 (6.5) |
| 0 – 9 | 102 | 27.4 | 66 | 24.5 | 36 | 35.0 |
| 10 – 14 | 88 | 23.7 | 67 | 24.9 | 21 | 20.4 |
| 15 – 19 | 83 | 22.3 | 61 | 22.7 | 22 | 21.4 |
| 20+ | 99 | 26.6 | 75 | 27.9 | 24 | 23.3 |
| Rank | | | | | | |
| Patrol Officer | 263 | 71.5 | 182 | 68.7 | 81 | 78.6 |
| Sergeant/Lieutenant/Captain | 61 | 16.6 | 48 | 18.1 | 13 | 12.6 |
| Detective/Executive/Other | 44 | 12.0 | 35 | 13.2 | 9 | 8.7 |
| Prior Military Experience | 83 | 22.3 | 70 | 26.0 | 13 | 12.6 |
| Shiftwork | | | | | | |
| Day | 150 | 40.7 | 79 | 29.6 | 71 | 69.6 |
| Afternoon | 131 | 35.5 | 113 | 42.3 | 18 | 17.7 |
| Night | 88 | 23.9 | 75 | 28.1 | 13 | 12.8 |
| Workload | | | | | | |
| Low/Moderate | 133 | 36.2 | 85 | 31.7 | 48 | 48.5 |
| High | 234 | 63.8 | 183 | 68.3 | 51 | 51.5 |
| Alcohol Intake, drinks/week | 367 | 5.6 (9.4) | 266 | 6.2 (10.3) | 101 | 3.9 (6.2) |
| Smoking Status | | | | | | |
| Current | 64 | 17.3 | 37 | 13.8 | 27 | 26.7 |
| Former | 83 | 22.4 | 53 | 19.7 | 30 | 29.7 |
| Never | 223 | 60.3 | 179 | 66.5 | 44 | 43.6 |
| Physical Activity Index | 368 | 21.1 (17.3) | 266 | 21.0 (17.4) | 102 | 21.5 (17.1) |
| Body Mass Index, $kg/m^2$ | | | | | | |
| Mean | 370 | 29.1 (4.7) | 268 | 30.3 (4.1) | 102 | 26.1 (4.7) |
| < 25 | 70 | 18.8 | 20 | 7.4 | 50 | 48.5 |
| 25 – 29.9 | 159 | 42.7 | 123 | 45.7 | 36 | 35.0 |
| 30+ | 143 | 38.4 | 126 | 46.8 | 17 | 16.5 |

Table 2.
Occurrence and frequency of Police Incident Survey events by sex.

| Traumatic Events | Men | | Women | |
|---|---|---|---|---|
| | Occurrence N (%) | Frequency Mean (SD) | Occurrence N (%) | Frequency Mean (SD) |
| Mean number of traumatic events | | 4.4 (2.1) | | 4.0 (2.2) |
| Shooting of another officer | 29 (10.8) | 1.5 (0.9) | 4 (3.9) | 1.3 (0.5) |
| Involvement in a shooting | 25 (9.4) | 7.1 (7.7) | 7 (6.8) | 6.1 (7.2) |
| Seeing abused children | 172 (63.9) | 6.7 (10.5) | 65 (63.1) | 8.6 (13.1) |
| Seeing victims of a serious traffic accident | 170 (63.2) | 5.4 (5.3) | 63 (61.2) | 4.9 (4.7) |
| Seeing someone die in front of you | 98 (36.4) | 2.3 (2.3) | 24 (23.3) | 1.5 (0.7) |
| Seeing dead bodies | 220 (81.8) | 7.6 (9.3) | 78 (76.5) | 9.7 (21.9) |
| Seeing severely assaulted victims | 217 (80.7) | 14.7 (14.6) | 75 (72.8) | 10.2 (11.4) |
| Seeing victims of a homicide | 191 (71.0) | 6.0 (7.9) | 59 (57.3) | 4.4 (6.0) |
| Other events | 71 (27.1) | 12.4 (17.0) | 36 (37.5) | 19.8 (45.9) |

victims' (14.7 times vs. 10.2 times), and seeing homicide victims (6.0 times vs. 4.4 times) more often than women. The majority of male officers (59.1%) and 45.7% of female officers reported experiencing at least five of the nine (including the open-ended category) types of traumatic events in the past year (Figure 1).

The mean global sleep score was slightly higher for female (mean 7.1, SD 3.8) compared to male officers (mean 6.3, SD 3.2) (Table 3). Over half of the officers were classified as having poor sleep quality (PSQI global score > 5): 53.9% of men and 57.3% of women. Over one-quarter of

Figure 1.
Number of traumatic events experienced in the past year by sex.

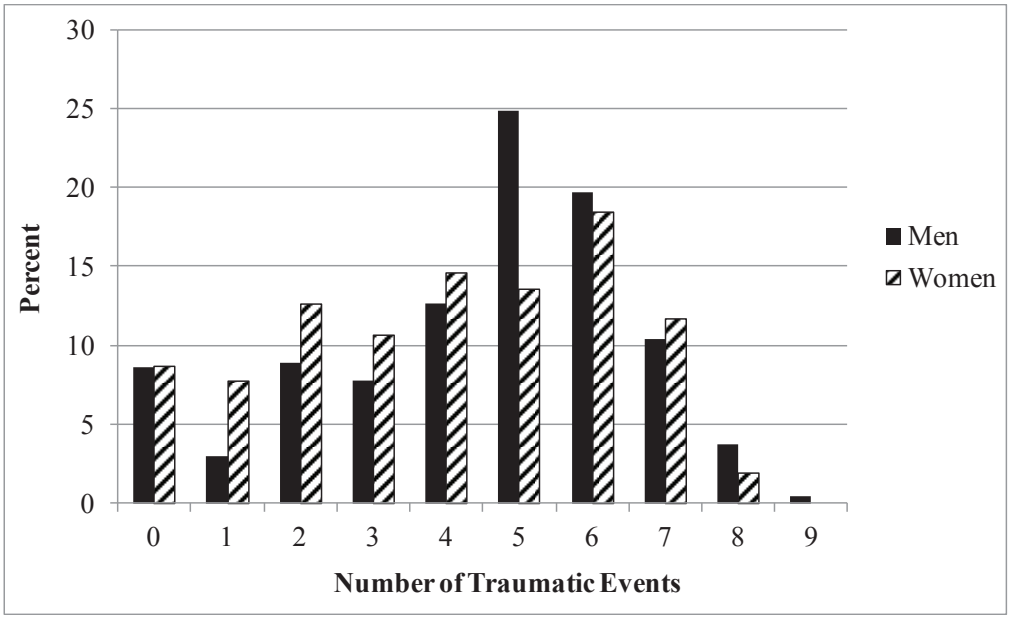

Table 3.
Sleep quality and quantity by sex.

| | Men | | Women | |
|---|---|---|---|---|
| PSQI Components | Mean (SD) | N (%) | Mean (SD) | N (%) |
| Global Score | 6.3 (3.2) | | 7.1 (3.8) | |
| Good (≤5) | | 124 (46.1) | | 44 (42.7) |
| Poor (> 5) | | 145 (53.9) | | 59 (57.3) |
| 6 – 8 | | 76 (28.5) | | 20 (19.6) |
| ≥9 | | 69 (25.8) | | 39 (38.2) |
| Sleep duration, hours | 6.1 (1.2) | | 6.1 (1.2) | |
| Sleep latency, minutes | 22.7 (18.1) | | 23.5 (16.9) | |
| Subscales* | | | | |
| Subjective sleep quality | 1.4 (0.7) | | 1.4 (0.9) | |
| Sleep latency | 1.1 (1.0) | | 1.2 (1.1) | |
| Sleep duration | 1.1 (0.9) | | 1.0 (1.0) | |
| Habitual sleep efficiency | 0.4 (0.8) | | 0.6 (0.9) | |
| Sleep disturbances | 1.3 (0.6) | | 1.4 (0.6) | |
| Use of medication | 0.3 (0.8) | | 0.4 (0.8) | |
| Daytime dysfunction | 0.8 (0.7) | | 1.0 (0.8) | |

* Scores range from 0 (better) to 3 (worse).

men and 38.2% of women had a global sleep score of 9 or greater which has been used in the literature as a cutpoint for insomnia (Fichtenberg, Putnam, Mann, Zafonte & Millard, 2001). Both male and female officers reported taking approximately 23 minutes to fall asleep at bedtime and then sleeping about six hours. For the PSQI subscales, both men and women officers reported higher (worse) scores for subjective sleep quality, sleep disturbances, sleep latency, and sleep duration compared to habitual sleep efficiency and sleep medication use. Women reported slightly higher daytime dysfunction than men.

The mean PSQI global score, sleep duration, sleep latency and the sleep quality and sleep disturbance subscales were examined across categories of traumatic event occurrence. No associations were found between traumatic events and sleep quality in the unadjusted or age-adjusted models (data not shown). There was significant interaction by sex. After stratification by sex, significant associations between traumatic events and sleep quality were found in the unadjusted model and multivariable-adjusted model. Select results from the multivariable model are presented in Table 4. In men, significant associations were found for the 'shooting of another officer' and sleep quality and sleep disturbance. As the number of occurrences increased (range 0 – 5 events), sleep quality worsened (p-value = 0.024) and the number of sleep disturbances increased (p-value = 0.022). Several events were associated with sleep quality in women. Seeing more 'abused children' was associated with poorer sleep quality (p-value = 0.050), while increasing frequency of 'seeing victims of a serious traffic accident' was associated with shorter sleep duration (p-value = 0.032). Increased frequency of 'seeing dead bodies' was associated with poorer sleep quality (p-value = 0.040) and shorter sleep duration (p-value = 0.048).

In addition to sex, the models were adjusted separately for workload (p-interaction = 0.18). In women who reported having a high workload, a significant inverse association was found between 'seeing serious traffic accident victims' and sleep quality (p-value = 0.030) (Table 5). The association remained significant after adjustment for age (p-value =

Table 4.
Multivariable-adjusted* mean (SE) sleep quality scores by occurrence and frequency of traumatic events and sex.

| | Men | | | | | Women^ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Traumatic Event | N | Sleep Quality Score | Sleep Disturbance Score | Sleep Duration, Hours | Sleep Latency, Minutes | N | Sleep Quality Score | Sleep Disturbance Score | Sleep Duration, Hours | Sleep Latency, Minutes |
| **Shooting of another officer** | | | | | | | | | | |
| No | 240 | 1.4 (0.0) | 1.2 (0.0) | 6.1 (0.1) | 23.8 (1.1) | -- | | | | |
| 1 time | 17 | 1.0 (0.2) | 1.2 (0.1) | 6.1 (0.3) | 19.0 (4.2) | -- | | | | |
| 2-5 times | 11 | 1.8 (0.2) | 1.6 (0.2) | 5.8 (0.4) | 22.9 (5.1) | -- | | | | |
| *p-value*** | | *0.024* | *0.022* | *0.40* | *0.87* | | | | | |
| **Abused children** | | | | | | | | | | |
| No | 97 | 1.4 (0.1) | 1.3 (0.1) | 6.2 (0.1) | 23.9 (1.8) | 38 | 1.3 (0.1) | 1.5 (0.1) | 6.3 (0.2) | 21.9 (3.1) |
| 1-2 times | 53 | 1.3 (0.1) | 1.1 (0.1) | 6.1 (0.2) | 22.0 (2.4) | 15 | 1.2 (0.2) | 1.2 (0.2) | 6.4 (0.3) | 21.4 (4.8) |
| 3-5 times | 59 | 1.4 (0.1) | 1.2 (0.1) | 5.9 (0.2) | 24.8 (2.2) | 23 | 1.5 (0.2) | 1.3 (0.1) | 6.1 (0.3) | 24.4 (3.9) |
| 6-10 times | 38 | 1.3 (0.1) | 1.3 (0.1) | 6.0 (1.9) | 23.7 (2.8) | 16 | 1.5 (0.2) | 1.3 (0.1) | 5.7 (0.3) | 20.8 (4.7) |
| 11+ times | 21 | 1.2 (0.2) | 1.1 (0.1) | 6.5 (0.3) | 19.4 (3.7) | 11 | 1.8 (0.3) | 1.5 (0.2) | 5.8 (0.4) | 26.5 (5.7) |
| *p-value* | | *0.29* | *0.48* | *0.50* | *0.42* | | *0.050* | *0.78* | *0.08* | *0.57* |
| **Serious traffic accident victims** | | | | | | | | | | |
| No | 99 | 1.3 (0.1) | 1.2 (0.1) | 6.3 (0.1) | 23.4 (1.7) | 40 | 1.4 (0.1) | 1.4 (0.1) | 6.3 (0.2) | 22.5 (2.9) |
| 1-2 times | 50 | 1.4 (0.1) | 1.3 (0.1) | 5.9 (0.2) | 25.6 (2.4) | 29 | 1.3 (0.2) | 1.3 (0.1) | 6.4 (0.2) | 23.4 (3.4) |
| 3-5 times | 64 | 1.5 (0.1) | 1.3 (0.1) | 6.0 (0.1) | 20.1 (2.1) | 14 | 1.6 (0.2) | 1.6 (0.2) | 5.7 (0.3) | 16.8 (5.0) |
| 6+ times | 37 | 1.3 (0.1) | 1.3 (0.1) | 6.2 (0.2) | 22.6 (2.8) | 15 | 1.6 (0.2) | 1.3 (0.2) | 5.7 (0.3) | 26.7 (4.8) |
| *p-value* | | *0.90* | *0.59* | *0.98* | *0.44* | | *0.33* | *0.70* | *0.032* | *0.75* |
| **Dead bodies** | | | | | | | | | | |
| No | 49 | 1.3 (0.1) | 1.2 (0.1) | 6.2 (0.2) | 21.5 (2.5) | 24 | 1.4 (0.2) | 1.4 (0.1) | 6.2 (0.3) | 25.5 (4.0) |
| 1-2 times | 49 | 1.5 (0.1) | 1.2 (0.1) | 6.3 (0.2) | 25.0 (2.5) | 18 | 0.9 (0.2) | 1.3 (0.1) | 6.7 (0.3) | 18.6 (4.4) |
| 3-4 times | 81 | 1.3 (0.1) | 1.3 (0.1) | 5.9 (0.1) | 23.5 (1.9) | 24 | 1.5 (0.2) | 1.5 (0.1) | 5.9 (0.2) | 18.8 (3.8) |
| 5-10 times | 56 | 1.4 (0.1) | 1.3 (0.1) | 6.0 (0.2) | 23.1 (2.3) | 22 | 1.5 (0.2) | 1.4 (0.1) | 6.1 (0.3) | 26.4 (4.1) |
| 11+ times | 34 | 1.3 (0.1) | 1.1 (0.1) | 6.3 (0.2) | 24.1 (3.0) | 14 | 1.8 (0.2) | 1.3 (0.2) | 5.6 (0.3) | 25.1 (5.2) |
| *p-value* | | *0.95* | *0.74* | *0.76* | *0.71* | | *0.040* | *0.77* | *0.048* | *0.64* |

* Models were adjusted for age, race/ethnicity, and education.
** p-values are from linear contrasts.
^ Cell sizes too small to report for the event 'shooting of another officer' in women.

Table 5.
Multivariable-adjusted* mean (SE) global sleep quality scores by occurrence and frequency of traumatic events by workload in women.

| Traumatic Event | Low or Moderate Workload^ | | | | High Workload | | | |
|---|---|---|---|---|---|---|---|---|
| | N | Unadjusted Mean (SD) | Age-Adjusted Mean (SE) | MV-Adjusted Mean (SE) | N | Unadjusted Mean (SD) | Age-Adjusted Mean (SE) | MV-Adjusted Mean (SE) |
| **Seeing serious traffic accident victims** | | | | | | | | |
| No | 21 | 7.9 (0.8) | 7.9 (0.8) | 6.5 (1.2) | 17 | 5.3 (0.9) | 5.3 (0.8) | 4.8 (1.2) |
| 1-2 times | 14 | 6.9 (1.0) | 6.9 (1.0) | 5.7 (1.2) | 14 | 6.5 (1.0) | 6.4 (0.9) | 5.8 (1.4) |
| 3-5 times | 5 | 5.0 (1.6) | 5.2 (1.7) | 4.3 (1.8) | 9 | 10.0 (1.2) | 1.0 (1.2) | 9.4 (1.6) |
| 6+ times | 5 | 8.0 (1.6) | 7.7 (1.7) | 5.7 (2.1) | 10 | 7.5 (1.1) | 7.5 (1.1) | 7.1 (1.4) |
| *p-value*** | | *0.79* | *0.68* | *0.55* | | *0.030* | *0.022* | *0.031* |
| **Seeing dead bodies** | | | | | | | | |
| No | -- | | | | 7 | 4.7 (1.4) | 5.0 (1.4) | 4.3 (1.9) |
| 1-2 times | -- | | | | 8 | 6.3 (1.3) | 5.8 (1.3) | 4.6 (2.1) |
| 3-4 times | -- | | | | 13 | 6.5 (1.0) | 6.8 (1.1) | 5.7 (1.6) |
| 5-10 times | -- | | | | 9 | 8.2 (1.3) | 9.0 (1.3) | 8.2 (1.9) |
| 11+ times | -- | | | | 11 | 8.5 (1.1) | 7.6 (1.3) | 6.6 (2.1) |
| *p-value*** | | | | | | *0.025* | *0.044* | *0.08* |

* Models were adjusted for age, race/ethnicity, and education.
** p-values are from linear contrasts.
^ Cell sizes too small to report for the event 'seeing dead bodies' in women who reported a low to moderate workload.

0.022) and multivariable adjustment for age, race and education (p-value = 0.031). Also in women with a high workload, a significant inverse association was found between 'seeing dead bodies' and sleep quality in the unadjusted (p-value = 0.025) and age-adjusted (p-value = 0.044) models. Multivariable adjustment attenuated the association slightly (p-value = 0.08). No associations were found in women who reported low or moderate workloads or in men.

## DISCUSSION

Police officers encounter a variety of stressors related to their job. These include stressors similar to other occupations, such as long work hours, administrative pressure and lack of organizational support. Yet, unlike many other occupations, officers are also exposed to serious, saddening and life-threatening events. In the current study, officers reported experiencing at least four different types of traumatic events in the past year with exposure to dead bodies, victims of assault, traffic accidents and abused children being the most frequently occurring in both male and female officers. Women officers reported higher frequency of seeing dead bodies and abused children than men, while men reported a higher frequency of seeing severely assaulted victims. Prior research has found that while men and women in the general population may experience different types of trauma, when controlling for type of trauma women have more severe post-traumatic stress disorder symptoms than men (Tolin & Foa, 2006).

In general, police officers reported high levels of poor sleep quality as measured by the PSQI. Over half of men and women had poor sleep quality, a finding similar to Neylan et al. (2002). Over one-quarter of men and 38% of women had a PSQI global score of nine or more. This cut point has been used in prior studies to screen for insomnia (Fichtenberg et al., 2001). Exposure to traumatic events may explain part of this occurrence along with other types of stressors and shift work. Of the specific types of sleep quality symptoms, officers experienced high levels of sleep disturbances (i.e. waking during sleep), shorter sleep duration, and increased sleep latency (i.e. trouble falling asleep). Women officers reported more daytime dysfunction than men. Neylan et al. (2002) found that police officers have poorer sleep quality and sleep about 35 minutes less per day than non-police officers. Having poor sleep quality is concerning, as it can affect physical and psychological health and, importantly for police officers, moral reasoning and performance (Vila, 2009). Sleep disturbances immediately after a traumatic event are predictive of future psychological and physical symptoms (Lavie, 2001).

The frequency of traumatic events was not associated with overall sleep quality in the total sample of police officers. This finding may not be surprising given similar results from other studies (Neylan et al., 2002; Crank & Caldero, 1991). However, significant associations were found when the associations were examined separately in male and female officers. Specifically, witnessing the shooting of a fellow officer was significantly associated with poor sleep quality and more sleep disturbances in male officers. This association was not found in women, which may in part be due to the infrequency of events reported in women (n = 4). Prior research by McCaslin et al., (2006) in police officers found that events involving high personal threats are associated with greater hyperarousal symptoms than those with lower personal threat. Sleep-related symptoms of hyperarousal include increased startle response and insomnia.

In female officers, seeing abused children, traffic accident victims and dead bodies were significantly associated with poor sleep quality, particularly shorter sleep duration. Brown and Fielding (1997) found that female officers experienced higher perceived stress when working with victims of violence and sexual assault than male officers. Similarly, Violanti (2004) found increased levels of traumatic stress in women officers who frequently responded to abused children and domestic issues. Perceived stress can lead to sleep problems (Hall et al., 2000). Further, women officers may be more likely to be assigned to cases involving abused children and women (Wertsch, 1998; Westmarland, 2001), and abused women have shown preference in having a female officer (Kennedy & Homant, 1983).

Interestingly, further stratification by sex and reported workload, revealed a significant association between seeing both traffic accident victims and dead bodies and sleep quality among women with a high workload. The association was not significant among women who reported a low or moderate workload. It may be that the combination of witnessing these traumatic events and increased routine or organizational stressors lead to poorer sleep quality. This is supported in the literature. Neylan et al. (2002) found that routine stressors were more strongly associated with poor sleep quality than traumatic duty-related stressors. Liberman and colleagues (2002) found a strong association between occupational stressors and psychiatric symptoms. Using the Spielberger Police Stress Survey, Violanti and Aron (1993) found organizational stressors better correlated with psychological distress than exposure to violence and danger. Prior research examining workload in police officers found differences in sources of stress between officers with high versus low workload levels (Stotland & Pendleton, 1989). Officers within the 'high workload' category cite generalized stress to both internal police duty and external home life (Stotland & Pendleton, 1989), while those with lower workload levels cite interpersonal relationships as significant stressors.

Limitations to this study are worth mentioning. This study was cross-sectional thereby negating conclusions about causality. Recall bias may be of concern as officers were asked to recall the frequency of traumatic events over the past year. However, Krinsley and colleagues (2003) found good consistency in reporting traumatic events among military veterans, who may be exposed to similar types of trauma as police officers. For a few of the traumatic events, the frequency of events was relatively low, particularly for female officers, which limited the ability to examine associations with sleep quality. Only the frequency of events was utilized from the open-ended traumatic event question. The type of events was not quantified in a meaningful way. However, events in this category deserve inclusion as officers felt these events were traumatic. Finally, the relationships established in this study may not be able to be generalized to other occupational populations of police officers and rescue workers.

Strengths of the study include the study population. Police officers are a known high risk occupational group who are exposed to varying types of trauma. Prior studies have examined associations between traumatic events and sleep quality but have not compared the association between specific types of traumatic events and sleep quality. In addition, the current study included a relatively large sample of female police officers, which provided the opportunity to examine differences by sex.

In summary, in this sample of police officers, there was a significant inverse association between specific types of traumatic events and overall sleep quality in female police officers. This association was strongest among women who reported having a high workload. Future research could examine longitudinal associations between prior traumatic event exposures (i.e. over a career) and sleep quality.

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