

Shift-Work and Suicide Ideation Among Police Officers

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Background *This cross-sectional study assessed the association of shift work with suicide ideation among police officers.*

Methods *Shift work was based on daily payroll records over 5 years (41 women, 70 men). Standardized psychological measures were employed. ANOVA and Poisson regression were used to evaluate associations.*

Results *Among policewomen with increased depressive symptoms, prevalence of suicide ideation increased by 116% for every 10-unit increase in percentage of hours worked on day shift (prevalence ratio (PR) = 2.16; 95% confidence interval (CI) = 1.22–3.71). Among policemen with higher (but not lower) posttraumatic stress disorder (PTSD) symptoms, prevalence of suicide ideation increased by 13% with every 10-unit increase in the percentage of hours worked on afternoon shift (PR = 1.13; 95% CI = 1.00–1.22).*

Conclusion *Prevalence of suicide ideation significantly increased among policewomen with higher depressive symptoms and increasing day shift hours, and among policemen with higher PTSD symptoms with increasing afternoon shift hours. Am. J. Ind. Med. 51:758–768, 2008. Published 2008 Wiley-Liss, Inc.[†]*

KEY WORDS: *police; shift work; suicide ideation; depression; PTSD*

INTRODUCTION

The U.S. Bureau of Labor Statistics [2005] reports that approximately 3.2 million people perform shift work. Working at times other than the regular day shift has been reported to be a potential occupational stressor [Brugere et al., 1997] with associated health consequences such as increased risk of injuries [Smith et al., 1994], gastrointestinal symptoms [Caruso et al., 2004a], disruption of family and social lives [Colligan and Rosa, 1990], and mental disorders [Scott et al., 1997; Shields, 2002].

Policing is an occupation which requires shift work, and shift work imposes a rearrangement on awake and sleep time. Such changes lead to a disruption of circadian rhythm which in turn can lead to internal de-synchronization and subsequent psychological and physiological disturbances. Examples are affective states such as depression, decreased cognitive abilities, and fatigue [Scott et al., 1997; Rouch et al., 2005]. It is accepted that impulsiveness, aggression, irritability and angry outbursts are associated with sleep

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deprivation and circadian disruption [Vila, 2006]. Burke and Mikkelsen [2006] examined job satisfaction and meaningful work among a sample of police officers. Officers working on regular day shifts and with less exhaustion reported higher levels of work satisfaction and meaning [Vila, 2006].

Previous evidence indicates that police officers are at increased risk for suicide [Violanti et al., 1998; Kposowa, 1999; Charbonneau, 2000; Violanti, 2004]. On the individual level, depression, posttraumatic stress, and suicide ideation are considered risk factors for suicide [Kessler et al., 1999]. On the police organizational level, shift work may produce a disruption of normal circadian rhythm, which in turn can disrupt physiological as well as psychological processes [Vila, 2006].

Suicide ideation is an important risk factor for attempted and completed suicide [Morgan and Stanton, 1997; Young et al., 1998; Lynch et al., 1999; Lyon et al., 2000; Nugent and Williams, 2001]. Rothman and Strijdom [2002] reported that suicide ideation in South African Police was associated with a sense of incoherence, independence, and social status. Berg et al. [2003] conducted a nationwide study on suicidal ideation and attempts among 3,272 Norwegian police and found that 24% felt that life was not worth living, 6.4% seriously considered suicide, and 0.7% attempted suicide; serious suicidal ideation was mainly associated with personal and family problems. Violanti [2004] found that certain traumatic police work exposures were associated with an increased risk of high level posttraumatic stress disorder (PTSD) symptoms, which subsequently was linked with increased risk of alcohol use and suicide ideation. The combined impact of PTSD and increased alcohol use led to a tenfold increase in risk of suicide ideation.

PTSD is a unique set of symptoms brought about by exposure to traumatic events that compromises the physical integrity or life of an individual and produces intense fear [Diagnostic and Statistical Manual of Mental Disorders IV, 1994]. Many work-related exposures of police officers are traumatic compared to most occupations [Paton et al., 2000]. Faced with responding to fatal accidents, crime, child abuse, homicide, suicide, and rape, police officers are exposed to all the potential factors that can precipitate a traumatic response [Carlier et al., 2000]. Studies of veterans with PTSD have reported an increased risk of suicidal behavior [Hendin and Haas, 1991] and 82.6% of veterans in outpatient treatment reported symptoms of suicidal ideation [Freeman et al., 2000]. Moreover, a high preponderance of anxiety disorders, particularly PTSD, has been found in veterans with completed suicide, relative to the general population of completed suicides [Lehmann et al., 1995].

Depression associated with shift work and changing schedules may lead to chronic fatigue and exhaustion [Cukrowicz et al., 2006]. Sabo et al. [1990], in a retrospective study of the electroencephalographic (EEG) sleep of patients with major depression with and without a history of suicide

attempt, found suicide attempters had longer sleep latency and lower sleep efficiency than normal controls. Mehmet et al. [1997] found that suicidal depressed patients had significantly lower scores of subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency than non-suicidal patients.

Based on the above studies, it is possible that police officers are at increased risk for suicide ideation, and that shift-work and suicide ideation may be related. A review of relevant literature failed to uncover studies examining these associations among police officers. Additionally, many studies mention that shift work is a significant police “stressor,” but very few provide empirical evidence that this is the case. In this cross sectional study, we hypothesize that shift work is associated with suicide ideation among police officers, and that this association may be influenced by depression and PTSD symptoms.

MATERIALS AND METHODS

Study Participants

This cross-sectional study was initiated among 115 randomly selected police officers (from a total of 934 officers), with an over-sampling of women. A mid-sized urban police department was the selected sample site. Of the 115 officers, 111 had complete information available on the primary variables. No specific inclusion criteria were indicated for the study, other than the participant was a sworn police officer and willing to participate in the study. One hundred percent of the random sample generated voluntarily agreed to participate in the study. See Violanti et al. [2006] for a complete review of similar methodology used in a follow-up study.

All participants were required to sign a consent form if they desired to volunteer for the study, and were told that they could withdraw at any time. The study was fully explained to participants and any questions were answered. The Internal Review Boards of the State University of New York at Buffalo, NY and the National Institute for Occupational Safety and Health approved the study.

Measures

Shift work

An objective measure of shift work was developed from the payroll records of police officers in this study. A day-by-day account of shifts was compiled for each officer spanning the most recent 5 years of their police career. Work history data, from 1994 to date of exam at baseline (1999–2000), were available for 111 of the 115 officers. Five shift-work variables were developed from these data: (1) percent hours on day shift; (2) percent hours on afternoon shift; (3) percent hours on midnight shift; (4) number of shift changes; and (5)

total hours per week (included regular work hours only and excluded time spent in court). All shifts worked over the 5-year period were categorized based on start times of 0400–1100 hr for the day shift, 1200–1900 hr for the afternoon shift and 2000–0300 hr for the midnight shift. Total hours worked as well as hours worked during the day, afternoon and midnight shift were computed for each participant. Taking into account the length of time a participant was working (from first date of work or the date when records were first available to date of exam at baseline), the computed hours were standardized on a weekly basis (hours worked per week) and percent of total hours worked on each shift was calculated. Officers were then classified into one of those three shifts based on whichever shift had the largest percentage of hours worked for a given officer. The majority of the recorded start times among officers who were assigned the day shift (>95%) were 0600 or 0700 hr. For the afternoon shift, >93% of the start times were 1500 or 1600 hr and 98% of the start times for night shift workers were 2100 hr. We compared the shift work status of the officers for the 30, 60, and 90 days, and 5 years prior to the date of exam. There was good consistency in the shifts assigned (i.e., very little variability) regardless of the length of time prior to the date of exam, therefore we used the results for the previous 5 years.

Frequency of shift change was defined as the number of times an officer switched (changed) shifts (e.g., from day to afternoon, etc.) over a 5-year period. Although assigned permanent shifts, officers would occasionally work for an absent colleague on a shift other than their regularly scheduled shift. There was no routine forward or backward rotation. The above shift-work exposure variables were computed for regular scheduled work. Composite exposure variables reflecting percent of hours worked at various shifts and total hours worked were created from regular time.

Suicide ideation

The question “Have you ever thought about suicide” (yes or no response), was obtained from the Beck Suicide Ideation Scale [Beck and Steer, 1993]. In the scale, the purpose of this item is to make a first assessment of any suicide ideation by the respondent. A positive response instructs the respondent to continue answering other items on suicide proclivity and/or plans. Since our primary interest in the present inquiry concerned suicide ideation, and subsequent questions may have been disturbing to participants, we employed only this question.

Depressive symptoms

The Center for Epidemiologic Studies Depression (CES-D) scale is a 20-item measure of symptoms of depression [Radloff, 1977]. Respondents rate items on a 4-point scale according to how often the symptom occurred in

the past 7 days: 1 (rarely or none of the time, less than 1 day), 2 (some or little of the time, 1–2 days), 3 (occasionally or a moderate amount of the time, 3–4 days), and 5 (most of all of the time, 5–7 days). CES-D scores range from 0 to 60. Respondents with scores between 0 and 15 are unlikely to be clinically depressed, scores of 16–21 indicate mild to moderate depression, and scores of 22 or greater are associated with major depression [Radloff, 1977]. A score of 16 or higher is generally considered indicative of depression [McDowell and Newell, 1996]. The CES-D has acceptable reliability (Chronbach alpha of 0.85), and a split-half reliability ranging from 0.76 to 0.85 [Radloff, 1977].

PTSD symptomatology

The Impact of Events Scale (IES) developed by Horowitz et al. [1979] was used to assess PTSD symptomatology. The IES consists of 15 items, with subscales measuring intrusive and avoidance symptoms associated with PTSD. Respondents were asked to rate the items on a 4-point scale according to how often each has occurred in the past 7 days. The points on the scale are: 0 (not at all), 1 (rarely), 3 (sometimes), and 5 (often). Corcoran and Fischer [1994] found that the subscales of the IES show very good internal consistency based on two separate sample groups. Their coefficients ranged from 0.79 to 0.92, with an average of 0.86 for the intrusive subscale and 0.90 for the avoidance subscale. The IES has been found to be sensitive to change, in terms of detecting the relevant differences in the response to traumatic events of varying severity by different groups [Corcoran and Fischer, 1994; Weiss and Marmar, 1997]. A Chronbach alpha value of 0.97 was found for IES in the present study sample.

Analysis Plan

Descriptive statistics were used to characterize the study population. Analyses of variance (ANOVA) models were used to examine trends or differences in mean values of the exposure variables across levels of selected covariates. Prevalence of suicide ideation was computed for selected covariates and by gender-specific tertiles of the shift-work variables. Tests for trend and chi-square tests of independence for nominal covariates were used to assess statistical significance. Poisson regression analyses relating tertiles of the shift-work variables to suicide ideation were performed, and estimates of prevalence ratios (PRs) and their 95% confidence intervals (CIs) were computed [Spiegelman and Hertzmark, 2005]. Age and education were included as potential confounders in the Poisson regression models. Effect modification or interaction was assessed for CES-D and IES scores. Both CES-D and IES scores were dichotomized using the gender-specific median values to allow adequate sample sizes in each strata. The criterion for statistical

significance for interaction was set at a *P*-value of <0.20, taking into consideration the decreased power as a result of reduced sample size.

RESULTS

The study sample (*n* = 111) included police officers, the majority of whom were Caucasian (70%), 44 years or younger (74%), had obtained some college education (81%), and were married (64%) (Table I). As age increased, the mean percentage of hours worked on the day shift increased (*P* for

trend = 0.002). As the number of years of service increased, the mean percentage of hours worked on the midnight shift decreased significantly (*P* for trend < 0.001) and the mean number of shift changes increased for regular time (*P* for trend = 0.017).

Among women, the prevalence of suicide ideation increased significantly as age increased (*P* for trend = 0.012) and as years of service increased (*P* for trend = 0.014) (Table II). As education level increased, the prevalence of suicide ideation decreased among both genders but the trend was only statistically significant among men (*P* for

TABLE I. Mean Values of Shift-Work Exposure Variables by Levels of Demographic and Lifestyle Characteristics

Characteristics	N	% hours on day shift ^a		% hours on afternoon shift ^a		% hours on midnight shift ^a		Shift changes (regular time)	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Race									
White	78	42.5	37.8	36.9	39.1	20.6	31.4	25.6	43.8
Black	24	58.9	38.5	25.7	31.9	15.4	24.9	22.4	24.0
Hispanic	9	56.3	39.0	23.2	27.3	20.5	32.8	6.6	8.2
<i>P</i> -value ^b		0.140		0.297		0.761		0.377	
Age groups (years)									
26–34	30	35.6	34.8	43.9	39.6	20.5	27.6	17.4	15.4
35–44	52	42.9	39.3	30.5	36.9	26.5	35.5	19.6	23.5
≥45	29	66.6	33.8	27.6	33.3	5.7	12.9	36.2	66.3
<i>P</i> -value ^c		0.002		0.092		0.054		0.063	
Education									
≤High school/GED	21	48.0	40.9	33.9	36.3	18.1	32.1	29.9	64.6
College < 4 years	33	45.0	39.9	35.1	37.9	19.8	29.8	19.2	15.9
College 4+ years	57	48.0	37.2	32.2	37.4	19.8	30.0	23.4	35.8
<i>P</i> -value ^c		0.999		0.858		0.827		0.515	
Marital status									
Single	25	54.3	38.8	21.2	33.9	24.5	34.6	15.2	14.9
Married	70	42.5	37.7	38.4	37.3	19.0	29.7	27.7	45.7
Divorced	16	56.2	39.5	30.3	37.8	13.5	23.8	17.1	27.8
<i>P</i> -value ^b		0.249		0.126		0.518		0.302	
Years of service									
1–5	24	43.6	31.5	22.6	32.5	33.8	31.6	10.5	12.2
6–10	16	34.3	37.0	33.8	36.0	31.8	38.3	17.1	13.6
11–15	30	37.8	42.1	45.0	42.0	17.2	33.3	21.4	20.6
15+	41	61.1	36.6	31.0	34.9	7.9	15.3	34.7	58.4
<i>P</i> -value ^c		0.074		0.235		<0.001		0.017	
Rank									
Police officer	73	41.1	38.8	34.9	39.3	24.0	32.3	17.2	18.2
Sergeant/lieutenant	15	56.6	37.4	26.2	34.3	17.2	26.3	18.5	16.8
Captain/detective	22	58.5	34.4	34.6	31.9	7.0	20.7	48.0	75.6
<i>P</i> -value ^b		0.099		0.709		0.063		0.004	

SD, standard deviation.

^aThe percent of hours on each shift are based on both regular time and over-time.

^bANOVA (test of differences in means).

^cTest for trend.

TABLE II. Prevalence of Suicide Ideation by Demographic and Life Style Characteristics, Stratified by Gender

Characteristics	Women (N = 41)			Men (N = 70)		
	N	%	P-value	N	%	P-value
Race						
White	30	30.0	0.449*	48	20.1	0.234*
Black	11	18.2		13	15.4	
Hispanic	0	0.0		9	44.4	
Age group (years)						
26–34	12	8.3	0.012**	18	22.2	0.669**
35–44	23	26.1		29	27.6	
≥45	6	66.7		23	17.4	
Education						
≤High school/GED	6	50.0	0.267**	15	53.3	0.002**
College <4 years	13	23.1		20	20.0	
College 4+ years	22	22.7		35	11.4	
Marital status						
Single	12	8.3	0.211*	13	23.1	0.810*
Married	19	36.8		51	21.6	
Divorced	10	30.0		6	33.3	
Years of service						
1–5	10	0.0	0.014**	14	21.4	0.832**
6–10	9	22.2		7	28.6	
11–15	11	36.4		19	26.3	
>15	11	45.5		30	20.0	
Rank						
Police officer	31	19.4	0.057*	42	21.4	0.397*
Sergeant/lieutenant	6	33.3		9	11.1	
Captain/detective	4	75.0		18	33.3	

*Chi-square test.

**Test for linear trend.

trend = 0.002). Alcohol intake and smoking habits were not significantly associated with shift-work and suicide ideation (data not shown).

The prevalence (%) and PR of suicide ideation among women by six shift-work variables are presented in Table III. The prevalence of suicide ideation increased with increasing percentage of hours worked on the day shift (P for trend = 0.013). Women who worked a high percentage of hours on the day shift had a 50% prevalence of suicide ideation whereas those who worked a low percentage of hours had a prevalence of 7.7%. The corresponding PRs showed an increasing trend for suicide ideation across tertiles which attenuated slightly after adjustment for age and education (P for trend = 0.142). In addition, the prevalence of suicide ideation decreased with total hours of work per week, although the trends were not statistically significant (P for trend = 0.156). The adjusted PRs of suicide ideation for total hours worked per week decreased monotonically (P for trend = 0.309).

The prevalence and PRs of suicide ideation among men by the six shift-work variables are presented in Table IV. Increasing prevalence of suicide ideation was observed with increasing percentage of hours worked on the midnight shift (P for trend = 0.160). In addition, the PRs were elevated among officers who worked medium and high percentages of hours on the midnight shift; they tended to be more likely to report suicide ideation compared to officers in the low category (PR = 2.16, 95% CI = 0.77–6.06 and PR = 2.12, 95% CI = 0.68–6.55, respectively). However, these elevated PRs were not statistically significant.

In Table V, the associations between the shift-work variables and suicide ideation are presented, stratified by depression scores at the median values for both women and men. There was a significant interaction between depression scores and day shift work for suicide ideation among women (P for interaction = 0.010). Among women with higher depression scores, the prevalence of suicide ideation increased by 116% for every 10-unit increase in the percentage of hours

TABLE III. Prevalence and Prevalence Ratios of Suicide Ideation by Gender-Specific Tertiles of Shift-Work Variables Among Women

Shift-work variables	N	%	Unadjusted		Model 1		Model 2	
			PR	95% CI	PR	95% CI	PR	95% CI
% of hours on day shift								
0.19–63.16	13	7.7	1.00	Referent	1.00	Referent	1.00	Referent
64.58–91.57	14	21.4	2.79	0.33–23.52	2.32	0.28–19.13	2.32	0.27–19.90
92.39–99.74	14	50.0	6.50	0.92–45.89	4.50	0.59–34.29	4.52	0.60–33.88
<i>P</i> -value		0.013	0.061		0.147		0.142	
% of hours on afternoon shift								
0–1.37	13	30.8	1.00	Referent	1.00	Referent	1.00	Referent
1.39–13.35	14	35.7	1.16	0.39–3.41	0.90	0.28–2.84	0.92	0.26–3.24
15.64–98.85	14	14.3	0.46	0.10–2.12	0.58	0.14–2.40	0.59	0.14–2.56
<i>P</i> -value		0.324	0.323		0.447		0.482	
% of hours on midnight shift								
0–0.76	13	38.5	1.00	Referent	1.00	Referent	1.00	Referent
0.96–6.05	14	35.7	0.93	0.35–2.48	1.07	0.41–2.78	1.18	0.47–2.92
6.94–97.86	14	7.1	0.19	0.03–1.39	0.25	0.03–1.98	0.24	0.03–1.97
<i>P</i> -value		0.064	0.101		0.192		0.184	
Number of shift changes in regular time								
1–5	12	50.0	1.00	Referent	1.00	Referent	1.00	Referent
6–10	15	13.3	0.27	0.07–1.09	0.32	0.08–1.22	0.32	0.08–1.30
11–115	14	21.4	0.43	0.14–1.36	0.58	0.18–1.90	0.59	0.18–1.92
<i>P</i> -value		0.117	0.149		0.371		0.378	
Total hours per week								
18.55–28.38	13	38.5	1.00	Referent	1.00	Referent	1.00	Referent
28.98–34.39	14	28.6	0.74	0.25–2.18	0.61	0.23–1.64	0.56	0.20–1.46
34.49–38.09	14	14.3	0.37	0.09–1.59	0.48	0.11–2.20	0.39	0.06–2.38
<i>P</i> -value		0.156	0.182		0.347		0.309	

(%) = prevalence; PR = prevalence ratio; CI = confidence interval.

P-values test linear trend in prevalence (%) or prevalence ratios (PRs).

Model 1: age-adjusted.

Model 2: age- and education-adjusted.

worked on the day shift (PR = 2.16; 95% CI = 1.22–3.71), whereas this association was not observed among women with lower depression scores. Due to the inter-relatedness of these shift-work variables, the opposite result was observed among female officers who worked on the afternoon shift. Women with higher depression scores who worked on the afternoon shift had a significantly lower prevalence of suicide ideation (PR = 0.58; 95% CI = 0.36–0.95). Among men with higher depression scores, the prevalence of suicide ideation was significantly increased for every 10-unit change in percentage of hours worked on the midnight shift (PR = 1.11; 95% CI = 1.00–1.07) and in the number of shift changes during regular work time (PR = 1.04; 95% CI = 1.01–1.07), yet there was no evidence of interaction.

In Table VI, the associations are presented stratified by median IES score. Working on the midnight shift appeared to be protective for suicide ideation among women, particularly among those with higher IES scores, although there was no

evidence of interaction. In contrast, the prevalence of suicide ideation increased for every 10-unit change in shift changes made during regular work time among women with lower IES scores (PR = 1.13; 95% CI = 1.01–1.26). Among men with higher IES scores, the prevalence of suicide ideation increased with every 10-unit change in the percentage of hours on the afternoon shift (PR = 1.13; 95% CI = 1.00–1.22) and with the number of shift changes during regular work time (PR = 1.06; 95% CI = 1.03–1.09). IES interacted significantly with work on the afternoon shift for suicide ideation (*P* for interaction = 0.059). Interestingly, men with lower IES scores had increased prevalence of suicide ideation with midnight shift work (PR = 1.24; 95% CI = 1.05–1.47).

DISCUSSION

Overall, the prevalence of suicide ideation for both women (25%) and men (23.1%) police officers was above the

TABLE IV. Prevalence and Prevalence Ratios of Suicide Ideation by Gender-Specific Tertiles of Shift-Work Variables Among Men

Shift-work variables	N	%	Unadjusted		Model 1		Model 2	
			PR	95% CI	PR	95% CI	PR	95% CI
% of hours on day shift								
0.70–6.01	23	34.8	1.00	Referent	1.00	Referent	1.00	Referent
8.09–54.05	24	12.5	0.36	0.11–1.19	0.36	0.11–1.19	0.43	0.13–1.39
58.01–99.82	23	21.7	0.63	0.24–1.62	0.68	0.26–1.83	0.76	0.31–1.87
<i>P</i> -value		0.292	0.335		0.449		0.547	
% of hours on afternoon shift								
0.18–5.21	23	17.4	1.00	Referent	1.00	Referent	1.00	Referent
5.99–63.13	24	33.3	1.92	0.67–5.51	1.98	0.70–5.59	1.59	0.62–4.12
65.43–98.35	23	17.4	1.00	0.28–3.52	0.95	0.27–3.28	1.11	0.30–4.14
<i>P</i> -value		1.000	1.000		0.931		0.872	
% of hours on midnight shift								
0–1.57	23	13.0	1.00	Referent	1.00	Referent	1.00	Referent
1.62–17.58	24	25.0	1.92	0.54–6.77	1.88	0.55–6.37	2.16	0.77–6.06
18.48–96.56	23	30.4	2.33	0.69–7.93	2.26	0.69–7.47	2.12	0.68–6.55
<i>P</i> -value		0.160	0.177		0.180		0.193	
Number of shift changes in regular time								
0–8	25	28.0	1.00	Referent	1.00	Referent	1.00	Referent
9–24	22	18.2	0.65	0.22–1.92	0.62	0.21–1.87	0.64	0.23–1.79
25–286	23	21.7	0.78	0.29–2.11	0.77	0.28–2.11	0.97	0.38–2.43
<i>P</i> -value		0.596	0.619		0.616		0.941	
Total hours per week								
13.52–31.87	23	21.7	1.00	Referent	1.00	Referent	1.00	Referent
31.96–35.57	24	20.8	0.96	0.32–2.88	0.98	0.33–2.89	1.18	0.41–3.43
35.58–38.90	23	26.1	1.20	0.43–3.38	1.21	0.43–3.37	0.94	0.35–2.51
<i>P</i> -value		0.726	0.730		0.717		0.904	

(%) = prevalence; PR = prevalence ratio; CI = confidence interval.

P-values test linear trend in prevalence (%) or prevalence ratios (PRs).

Model 1: age-adjusted.

Model 2: age- and education-adjusted.

TABLE V. Prevalence Ratios for Suicide Ideation by Two CES-D Groups for Both Men and Women

Shift-work variables	Women					Men				
	CES-D score ≥ 7 (n = 22)		CES-D score 1–6 (n = 18)		<i>P</i> *	CES-D score ≥ 6 (n = 32)		CES-D score 1–5 (n = 33)		<i>P</i> *
	PR	95% CI	PR	95% CI		PR	95% CI	PR	95% CI	
% of hours on day shift ^a	2.16	1.22–3.71	1.01	0.96–1.45	0.010	0.87	0.76–1.01	1.15	0.91–1.45	0.649
% of hours on afternoon shift ^a	0.58	0.36–0.95	1.07	0.77–1.49	0.024	1.03	0.90–1.16	0.96	0.77–1.21	0.994
% of hours on midnight shift ^a	0.29	0.10–0.91	0.45	0.11–1.88	0.739	1.11	1.00–1.23	0.81	0.60–1.09	0.590
Number of shift changes in regular time ^a	0.40	0.13–1.23	1.06	0.25–4.51	0.567	1.04	1.01–1.07	1.04	0.90–1.21	0.700
Total hours per week ^a	0.74	0.26–2.14	0.10	0.02–0.57	0.513	1.72	0.54–5.46	0.83	0.16–4.24	0.333

PR = prevalence ratio; CI = confidence interval; CES-D = Center for Epidemiologic Studies on Depression scale.

^aEstimates of the prevalence ratio and their 95% CI are for each 10% change (for % hours on day, afternoon and midnight shift), each 10-unit change (for number of shift changes in regular time) and each 10-hr change (for total hours per week).

**P*-values for the interaction between CES-D and shift-work variables.

TABLE VI. Prevalence Ratios for Suicide Ideation by Two IES Groups for Both Men and Women

Shift-work variables	Women					Men				
	IES score ≥ 5 (n = 21)		IES score 1–4 (n = 20)		P*	IES score ≥ 10.6 (n = 35)		IES score 1–10.5 (n = 35)		P*
	PR	95% CI	PR	95% CI		PR	95% CI	PR	95% CI	
% of hours on day shift ^a	1.27	0.90–1.79	1.54	0.94–2.50	0.928	0.95	0.83–1.10	0.93	0.73–1.18	0.837
% of hours on afternoon shift ^a	0.94	0.68–1.29	0.76	0.56–1.02	0.695	1.13	1.00–1.22	0.80	0.60–1.10	0.059
% of hours on midnight shift ^a	0.39	0.17–0.88	0.004	0.0–19.4	0.965	0.84	0.66–1.10	1.24	1.05–1.47	0.152
Number of shift changes in regular time ^a	0.82	0.42–1.61	1.13	1.01–1.26	0.298	1.06	1.03–1.09	0.51	0.11–2.41	0.179
Total hours per week ^a	0.36	0.10–1.27	0.81	0.19–3.46	0.623	1.31	0.37–4.68	2.57	0.35–18.95	0.735

IES = Impact of Events Scale; PR = prevalence ratio; CI = confidence interval.

^aEstimates of the prevalence ratio and their 95% CI are for each 10% change (for % hours on day, afternoon and midnight shift), each 10-unit change (for number of shift changes in regular time) and each 10-hr change (for total hours per week).

*P values for the interaction between IES and shift-work variables.

general population rate of approximately 13.5% [Kessler et al., 2005]. Results also indicated a higher prevalence for depression in these officers (12.5% for women and 6.2% for men officers) compared to the general population—data from the National Institute of Mental Health (NIMH) reported 5.2% prevalence for depression [Weissman et al., 1996]. Results from the Framingham Heart Study showed that 17% of women and 10% of men had CES-D scores indicative of depression [Wulsin et al., 2005].

Surprisingly, women officers who worked a greater percentage of their total hours on day shifts tended to have a higher prevalence of suicide ideation than those who worked midnights or afternoons. Among women with higher depression scores, the prevalence of suicide ideation increased by 116% for every 10-unit increase in the percentage of hours worked on the day shift (PR = 2.16; 95% CI = 1.22–3.71), whereas this association was not observed among women with lower depression scores. Additionally, those women with higher PTSD symptom levels also had higher ideation PRs during the day shift. It is possible that women officers may tend to feel more uneasy and stressed in a daytime male dominated work environment due to more frequent peer and public interaction. In contrast to midnights, day shifts expose women officers to considerably more male officers, administration, and public scrutiny [Patterson, 2003]. Dormann and Zapf [2002] argued that social stressors for police women such as shift work, social isolation, conflict with colleagues, social animosity or negative group climate have strong effects on strains, and are relatively strong predictors of depression. Additionally, day shifts may increase concerns about childcare and other family obligations at home. Barnett [2004] found that as a woman's work hours increased, her ratings of work interfering with family also increased. A different shift work association was observed among male officers. Increased

PRs of suicide ideation were observed with increasing percentage of hours worked on the midnight shift (P for trend = 0.160). Among male officers with higher depression scores, the prevalence of suicide ideation was significantly elevated with increasing percentage of hours worked on the midnight shift and with increasing number of shift changes. Higher depression and suicide ideation in males on the midnight shift may be accounted for in part by a stronger need by males to be part of the social cohesiveness associated with male peers in the police organization [Paton et al., 2000]. Working midnight shifts may lead to an isolation from the main thrust of male peer interaction and perpetuate feelings of disconnection from the group. This can prove stressful and exacerbate existing depressive states. Given the danger that officers face on a daily basis, such isolation can be meaningful in the sense that it negates the beneficial aspects of group social support. In addition, PTSD interacted significantly with suicide ideation on the afternoon shift (P for interaction = 0.059). Male officers with higher PTSD symptomatology and ideation who worked afternoon shifts may be further placed at risk for additional exposure to traumatic work events. Afternoon shifts are generally the busiest in terms of crime, traffic, and answering citizen complaints. Such exposure may only worsen PTSD present symptoms and thoughts of suicide.

Future Research Considerations

Biological

The present study examined several psychological and social variables associated with shift work and suicide ideation. Future investigations might consider the biological impact of shift work via circadian disruption on depression and suicide ideation. Disruptive circadian patterns have been

shown to dysregulate biological systems such as the hypothalamic–pituitary–adrenocortical (HPA) axis, which can lead to increased levels of the hormone cortisol found to be prominent in depression [Rosmond et al., 1998]. Motohashi [1990] examined circadian variations in suicide attempts in Tokyo from 1978 to 1985 and found a significant circadian variation in suicide attempts.

Altered circadian rhythms in cortisol and melatonin secretions have been found among those suffering from depression [Steiner and Brown, 1985]. Evidence suggests such abnormalities occur independently in both cortisol and melatonin secretion [Branchey et al., 1982; Steiner and Brown, 1985]. Depressed patients have been reported to have low nighttime plasma levels of melatonin [Steiner and Brown, 1985]. Stanley and Mann [1988] compared levels of melatonin in the pineal glands of 19 suicide victims and 19 non-suicide matched controls. They found that melatonin levels in suicide victims were significantly lower than those of non-suicide controls, consistent with reports of decreased nocturnal plasma melatonin levels in depressed patients [Branchey et al., 1982; Steiner and Brown, 1985].

Mediation of brain processes due to sleep deprivation and fatigue may also impact suicidal thinking. Killgore et al. [2007] suggested that sleep deprivation impairs the ability to integrate emotion and cognition to guide moral judgment. Sleep deprived participants showed significantly greater difficulty judging emotionally charged courses of action as “appropriate” relative to judging them as “inappropriate.” These findings suggest that sleep deprivation has a debilitating effect on judgment and decision making processes that depend heavily upon the integration of emotion with cognition, processes which are believed to be mediated by regions of ventromedial prefrontal cortex, the brain region most responsible for judgment and decision making. In such situations, persons may be more likely to consider suicide as an appropriate behavior.

In another study on judgment and sleep deprivation [Killgore et al., 2005], sleep deprivation was found to reduce regional cerebral metabolism within the prefrontal cortex. After sleep loss, individuals tended to make more risky decisions. These findings suggest that cognitive functions known to be mediated by the ventromedial prefrontal cortex, including decision making under conditions of uncertainty, may be particularly vulnerable to sleep loss. Suicidal thinking could result from shift-work related sleep deprivation that affects clear decision making [Rouch et al., 2005].

Police organizational policy

The duration of shifts may play a role in increasing fatigue and cognitive activity. There is presently a growing popularity of extended-hour shifts in police work. A 12-hr shift, especially one that requires day sleeping, may result in greater risk to safety because of fatigue combined with

disturbance to alertness and performance rhythms [Smith et al., 1998]. Increases in fatigue may be particularly problematic when shift workers are asked to cover a portion of the subsequent shift, or even work a double shift to cover for other officers on sick leave or vacation. Rosa [1995] examined the impact of 12-hr shifts on fatigue. Twelve-hour shifts showed increased discomfort and deterioration in performance as compared with shorter shifts. Work schedules differed by the time of day, fixed versus rotating schedules, speed of rotation, direction of rotation, number of hours worked per week, number of consecutive days worked, number of rest days, and number of weekends off. Relevant for the present study is a sense of social isolation that can occur on extended shifts, a condition conducive to increased suicide [Maris et al., 2000]. Under 8-hr shift systems, workers could be at work for 21 out of 28 days, whereas under many 12-hr shifts, they are at work for only 14 out of 28 days. This may lead to isolation as well as a lack of communication between co-workers and supervisory staff [Smith et al., 1998].

Limitations of this study include a sample size which precluded adequate estimation of PRs in some categories to further assess work characteristics such as symptoms related to depression and PTSD which might modify the association between shift work and suicide ideation. Furthermore, the small sample size prevented us from using clinically meaningful cut-points to assess effect modification by depressive and PTSD scores. Use of clinically meaningful cut-points instead of the median values for CES-D and IES scores may have provided additional useful information to occupational health clinicians and other health professionals. Another limitation is that self-reports on depression and suicide ideation are subject to bias, and are frequently underreported. This can result in an underestimation of associations and more conservative results.

There are other sources of depression and suicide ideation in police work which we have not examined. Given the sample size and analysis strategies available, the inclusion of more variables would likely lead to extremely small subcategories that are mentioned. These would not add any significant meaning to this study. Our focus in this investigation was shift work as one possible stressor; others will be investigated in the future.

Training and intervention may also impact depression and suicide ideation. There is some limited training in this department in stress management at the academy level. EAP programs are available for officers, but we do not have confidential EAP referral data available.

The Buffalo Police Department may be different from police departments around the country. The results of this study will be representative of other police departments around the country to the extent that the Buffalo PD is representative of other departments. It is certainly difficult to assure representativeness across all police departments,

given the large variety of shift scheduling practices across the country and world. A unique strength of the study was the excellent cooperation of officers, with 100% of the selected random sample of officers agreeing to participate.

CONCLUSION

Associations among shift work, depression, and suicide ideation in police work likely involves a complex interaction of work schedules, worker characteristics, and occupational exposures [Caruso et al., 2004b]. This study demonstrates the feasibility and necessity of performing a larger study with increased statistical power to help verify that shift work is a factor that is involved in the psychological health of police officers.

The results of this study suggest that shift work may in some way impact psychological well-being among police officers. Police organizations might consider these results when developing policies regarding the scheduling of shift rotation and over-time. Czeisler [1988] studied police officers who worked a 6-day, 8-hr schedule, rotating shifts every 8 days in a counterclockwise direction. This work schedule resulted in “a state of cumulative sleep deprivation for most...officers” that reduces performance and safety, and that “the officers had one of the worst profiles of alertness/sleepiness among shift workers evaluated nationwide” [Czeisler, 1988]. With this in mind, police organizations should seriously consider providing an optimal shift work plan for the sake of the health and psychological well being of personnel. Further longitudinal work, with a larger police sample and greater power, will help to substantiate the present results and provide some insight into the complex causal pathways involved among factors in the police occupation. To some extent, such studies may also further help to illustrate the impact of shift work in the general population.

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