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Title: The impact of shift work characteristics, shift work schedules and sleep on burnout in police officers

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Abstract

Objectives: To examine associations between shift work characteristics and schedules on burnout in police and whether sleep duration and sleepiness were associated with burnout.

Methods: Police officers (n=3140) completed the Maslach Burnout Inventory (emotional exhaustion, depersonalisation, personal accomplishment) and self-reported shift schedules (irregular, rotating, fixed), shift characteristics (night, duration, frequency, work hours), sleep duration and sleepiness.

Results: Irregular schedules, long shifts (≥11 hours), mandatory overtime, short sleep and sleepiness were associated with increased risk of overall burnout in police. Police working a greater frequency of long shifts were more likely to have emotional exhaustion (adjusted odds ratio 1.91, 95% CI 1.35-2.72) than those not working long shifts. Night shifts were associated with depersonalisation (1.32, 1.05-1.66) compared to not working nights. Long work weeks (≥48 hours), compared to shorter weeks, were associated with low personal accomplishment (1.33, 1.12-1.58). Police working mandatory overtime had increased risk of emotional exhaustion (1.37, 1.14-1.65) than those who did not. Compared to fixed schedules, irregular schedules were associated with emotional exhaustion and depersonalisation (1.91, 1.44-2.54 and 1.39, 1.02-1.89, respectively). Police sleeping <6 hours were more likely to have emotional exhaustion (1.60, 1.33-1.93) than those sleeping longer, and excessive sleepiness was associated with emotional exhaustion (1.81, 1.50-2.18).

Conclusions: Irregular schedules and increased night shifts, sleep disturbances and work hours were related to higher burnout risk in police. Future research should evaluate work schedules in law enforcement that optimise shift duration and frequency, and increase consistency in scheduling and control over work hours to limit burnout in police.

Key words: mental health, sleep, burnout, shift work, police

Strengths and limitations of this study

- The study examined burnout, shift work and sleep in a large sample of police officers (n=3140) from across North America.
- Shift work characteristics and schedules were closely examined in police, providing information on night shifts, long work shifts and long work weeks, overtime (voluntary and mandatory) and different work schedules (irregular, rotating and fixed)
- Sleep and shift information were based on self-reports, and thus may be subject to response bias.
- Due to the cross-sectional design of the study, associations between shift work, sleep and burnout can be inferred but not causality.

INTRODUCTION

A major source of occupational stress for police officers is shift work, which can involve day, night and long duration shifts and long work weeks,[1 2] as well as rotating, fixed and irregular shift schedules.[3] Chronic exposure to occupational stressors can lead to burnout, which is a psychological syndrome comprising three dimensions: Emotional exhaustion (EE), depersonalisation (DP), and a perceived lack of personal accomplishment (PA).[4] Burnout can have a negative impact on the individual worker, the people whom they serve, and their organisation, with consequences including reduced productivity and decision making,[5] increased absenteeism and risk of leaving the job.[6] Indeed, retirements due to psychological ill health account for 46% of medical retirements among police in the United Kingdom.[7] In North American police, sleep disorders have been associated with increased risk of mental health outcomes, including depression and anxiety, and EE and DP burnout dimensions.[3] In addition to sleep, other work-related factors may also have a negative influence on the health of personnel engaged in shift work, however, few studies have examined how specific characteristics of shift work impact burnout in police.

Police have traditionally worked 8- to 10-hour shifts, although increasingly, departments are implementing compressed weekly schedules which involve officers working 11-, 12- and 16-hour shifts.[1 3] Long shifts are related to increased sleepiness[8] and may reduce the opportunity for sleep, potentially impairing police officers' ability to recover from work demands.[9] Short sleep has been found to associate with burnout in shift working occupations,[10] including law enforcement,[11] although few studies have examined the impact of sleepiness on burnout specifically in police. Recovery between shifts may be further restricted by night work, which can cause sleep loss and circadian misalignment, and is shown in other healthcare occupations to confer a greater risk of burnout when compared to day shifts.[10] A high degree of burnout has also been associated with working more night shifts among physicians,[12] and

longer duration shifts and work weeks in nurses[13 14] and emergency medical technicians (EMTs).[15] Although hours of work were not significantly associated with burnout in resident physicians, burnout was related to increased difficulty concentrating on work.[16] In police, officers who were continuously engaged in shift work were reported to have lower PA, but this study did not describe the relationship between regular shift work and EE or DP, nor did it distinguish between the different *shift types* in policing,[19] such as night and long duration shifts. Furthermore, police also work a variety of different schedules including irregular, rotating and fixed shifts,[9] and often do overtime which may be associated with burnout[17] but to date, the effect of work schedules and shift characteristics on burnout has not been systematically examined in police.

In this cross-sectional study, we examined whether characteristics of shifts (night, shift duration, frequency, weekly work and overtime hours) as well as shift schedules (irregular, rotating, fixed) were associated with burnout in police. Given that short sleep and sleepiness are also common stressors among police and potential consequences of shift work,[3] a secondary aim was to investigate associations between sleep duration and sleepiness on burnout risk in police.

METHODS

Participants

Volunteers were invited to participate through meetings at police departments and advertisements in police magazines, newsletters and on police-focused websites. In total, 6022 sworn North American police officers expressed interest in the study. Of those, 4957 consented to participate in a survey, either online or, in a few departments, on-site (via pencil/paper). Participant recruitment and survey administration details have been described

previously.[3] The survey assessed demographics and health information and participants reported work and sleep hours in the past 4 weeks and completed the Maslach Burnout Inventory (MBI). Of the 4957 officers who participated, 3140 completed at least one burnout dimension subscale in the MBI and were eligible for analyses. All participants provided informed consent and were eligible for a prize drawing valued up to $1000 USD.

Measures

Burnout was assessed using the MBI–Human Services Survey,[4] which consists of 22 items that assess the three burnout dimensions: EE, DP, and PA. Participants rated the frequency with which they experienced each item on a 7-point Likert scale (0=never; 6=everyday). EE and DP were defined as dichotomous variables, in which a high or low-moderate risk score were determined (high EE ≥27 points; high DP ≥13 points). PA was defined as either high-moderate or low (≥39 points). Participants were considered to have high *overall burnout* if they had both high EE and DP, with or without low PA.[16 18]

Work information was determined using items from both the baseline and a concurrent monthly report. Participants were asked how frequently they worked night shifts (shifts involving ≥6 hours on-duty between 10PM-8AM), with responses from "never or nearly never", "1-2 times per month", "3-4 times per month", "1-2 times per week", "3-4 times per week" and "nearly every day". To determine the frequency of long work shifts, participants reported the shift length they worked each week for the previous 4 weeks (i.e., 8-10, 11-15, 16-19, 20-23 or ≥24 hours). Based on previous research in human service occupations,[14] *long work shifts* were classified as ≥11 hours, from which officers were grouped into those working 0, >0 to <2, ≥2 to <4, and ≥4 long shifts per week.

Participants' usual shift schedules were categorized as 'fixed', 'irregular', 'rotating' or 'other' schedules. Participants reporting that they "do not have a variable work schedule" were classified as having 'fixed' schedules. Schedules were categorized as 'rotating' if officers reported working shifts that rotated on a day-to-evening, day-to-night or evening-to-night basis. Irregular schedules were defined as shifts that rotated, but did not follow a consistent pattern, and 'other' comprised schedules that included non-day-to-day rotations (e.g., weekly/monthly rotations). Total work hours across the month were recorded using a validated questionnaire,[19] with those recording ≥48 hours per week considered to be working *long work weeks*. Participants also recorded if they completed mandatory and/or voluntary overtime over the last 4 weeks, and the total number of hours they slept each week for the previous 4 weeks. For sleep duration, the combined total of the 4 weeks was used to calculate the average sleep duration per 24 hours, and short sleep was defined as <6 hours sleep per 24 hours. Daytime sleepiness was measured using the Epworth Sleepiness Scale (ESS; range 0-24), and a score ≥11 indicated excessive sleepiness.[20]

Statistical analysis

Multiple logistic regression models were used for cross-sectional analysis of associations between shift work (shift work characteristics and schedules), sleep duration, sleepiness and burnout (Overall burnout, EE, DP, PA). The models were adjusted for age, Body Mass Index (BMI), gender, marital status, hypertension, exercise (per week), cigarette smoking (yes/no), caffeine and alcohol consumption (yes/no during last week), primary police activity (patrol officer, supervisor/manager, detective), years as police officer, and seniority. These potentially confounding factors were selected based on prior studies.[3 21-24] Each confounder was tested individually with the burnout outcome, and we only included those that were significant (p<0.10) in initial models. A backward elimination method was used to remove

those that were not significant in the final model. Unadjusted and adjusted odds ratio with 95% Confidence Intervals (CI) are reported. Statistical analyses were conducted using SPSS (IBM Corp, Version 24.0, Armonk, NY) and significance set at $p<0.05$.

Patient and public involvement

The current study was based on secondary data from a pre-existing data set. Therefore, patients and the general public were not involved in the development of the research questions, outcome measures or design of the study.

RESULTS

Police officers were aged 38.5 ± 8.3 (mean ± SD) years and had 12.7 ± 8.2 years of experience in law enforcement. Female officers (16.7%) in our sample were slightly over-represented compared to police in North America (12.2%).[25] The sample was predominantly white (Table 1), with racial and ethnic minority groups slightly under-represented compared to national police statistics.[25] The prevalence of overweight or obesity based on BMI were over-represented in the sample (80%) (Table 1) compared to general population data (70%).[26] Overall burnout was found in 17.7% of police. High EE and high DP were observed in 23.8% and 42.6% of the sample respectively, and low PA was observed in 24.1%. In the last month, 56.7% of police worked ≥1 night shift, 63.9% worked ≥1 long shift, and 41.2% had an irregular or rotating schedule. Mean total work hours were 192.27 ± 74.82 hours per month, mean mandatory overtime was 8.26 ± 14.14 hours per month, and mean voluntary overtime was 12.98 ± 19.83 hours per month. Short sleep duration was observed in 30.4% of police, and 25.8% had excessive sleepiness (Table 1).

Table 1. Participant characteristics

Characteristic	Data
n	3140
Age, mean (SD) y	38.48 (8.31)
Gender, n (%)	
Male	2609 (83.3)
Female	523 (16.7)
Not known	8 (0.3)
Body Mass Index, n (%)	
< 25 kg/m^2	610 (19.4)
≥ 25 and < 30 kg/m^2	1460 (46.5)
≥ 30 and < 35 kg/m^2	781 (24.9)
≥ 35 kg/m^2	271 (8.6)
Not known	18 (0.6)
Race, n (%)	
White	2681 (85.4)
Black	257 (8.2)
Asian	34 (1.1)
Native American	21 (0.7)
Pacific Islander	1 (0.03)
Other	100 (3.2)
Not known	46 (1.5)
Ethnicity, n (%)	
Hispanic	162 (5.2)
Other	2806 (89.4)
Not known	172 (5.5)
Overtime hours per month, mean (SD)	
Mandatory	8.26 (14.14)
Voluntary	12.98 (19.83)
Total	20.50 (24.62)
Night shift frequency, n (%)	
Never or nearly never	1290 (41.1)
1-4 per week	612 (19.5)
1-4 per month	584 (18.6)
Nearly every day	615 (19.6)
Not known	39 (1.2)
Long work shifts per week (≥11 hours), n (%)	
None	390 (12.4)
>0 - <2	1029 (32.8)
≥2 - <4	496 (15.8)
≥4	482 (15.4)
Not known	743 (23.7)
Work hours per week, n (%)	
<48 hours	1820 (58.0)
≥48 hours	1260 (40.1)
Not known	60 (1.9)

Table 1. *Continued.*

Characteristic	Data
Usual shift schedule, n (%)	
Fixed	1822 (58.0)
Irregular	274 (8.7)
Rotating	782 (24.9)
Other	239 (7.6)
Not known	23 (0.7)
Average sleep duration over the last 4 weeks*, n (%)	
<6 h	956 (30.4)
≥6 h	1780 (56.7)
Not known	404 (12.9)
Daytime sleepiness, n (%)	
Normal (<11 ESS) daytime sleepiness	2195 (69.9)
Excessive (≥11 ESS) daytime sleepiness	809 (25.8)
Not known	136 (4.3)
Burnout, n‡ (%)	
High EE	747 (23.8)
High DP	1338 (42.6)
Low PA	758 (24.1)
Overall burnout†	556 (17.7)
Police officers that had at least 1 dimension of burnout, n (%)	
No	1082 (34.5)
Yes	2058 (65.5)

*per 24-hour period; †defined as high EE, high DP, with or without low PA; ‡The burnout characteristics are not mutually exclusive (e.g., a participant could have both high EE and Low PA); EE, emotional exhaustion; DP, depersonalisation; PA, personal accomplishment; ESS, Epworth Sleepiness Scale; SD, standard deviation.

Shift characteristics and burnout

The odds of high EE increased in a dose-response manner as a function of the number of long shifts worked per week, with police completing ≥4 long shifts per week having the greatest risk (adjusted odds ratio 1.91, 95% CI 1.35-2.72), compared to no long shifts. A similar relationship was demonstrated for overall burnout, with police working >0 to <2 and ≥4 long shifts per week more likely to have overall burnout (1.44, 95% CI 1.02-2.02 and 1.78, 95% CI 1.21-2.61, respectively) compared to no long shifts. Police working long shifts were also more likely to have low PA compared to no long shifts (Table 2); even one long shift per month increased the risk of burnout (1.4- to 1.5-fold increase; Table S5). Working ≥48 hours per week was associated with an increased risk of low PA (1.33, 95% CI 1.12-1.58) compared to shorter weeks, but not overall burnout or EE. Neither long shift frequency nor weekly work hours were related to DP. Compared to police who never/nearly never work night shifts, those working night shifts nearly every day were at an increased risk of high DP (1.32, 95% CI 1.05-1.66). Police reporting mandatory overtime had an increased risk of overall burnout (1.40, 95% CI 1.14-1.71), high EE (1.37, 95% CI 1.14-1.65) and DP (1.30, 95% CI 1.10-1.53), whereas voluntary overtime was only associated with high DP (1.18, 95% CI 1.01-1.39). Reporting any overtime (mandatory or voluntary) was also associated with overall burnout (1.36, 95% CI 1.06-1.75) and high DP (1.47, 95% CI 1.21-1.80). Overtime was not related to PA.

Work schedules and burnout

Police working irregular schedules were at greatest risk of overall burnout (2.12, 95% CI 1.57-2.85), followed by high EE (1.91, 95% CI 1.44-2.54), and high DP (1.39, 95% CI 1.02-1.89) compared to those working fixed schedules. Compared to fixed schedules, police reporting rotating and 'other' schedules were more likely to have EE (1.30, 95% CI 1.06-1.59

and 1.44, 95% CI 1.05-1.98, respectively), but these associations were weaker than those observed for irregular shifts. Furthermore, police working rotating schedules were less likely to have low PA (0.74, 95% CI 0.59-0.91) compared to fixed shifts. Rotating or 'other' schedules were not associated with overall burnout or DP, and irregular or 'other' shift schedules were not related to PA (Table 3).

Table 2. High burnout outcomes associated with shift work characteristics in police (n=3140)

Shift work characteristic, *n*†	Positive result in police with burnout, No./No. total (%)		Unadjusted		Adjusted¶	
			OR (95% CI)	*P* Value	OR (95% CI)	*P* Value
	High EE	Low-moderate EE				
Night shift frequency						
Never/nearly never	290/734 (39.5)	935/2220 (42.1)				
1-4 per month	154/734 (21.0)	435/2220 (19.6)	1.14 (0.91 - 1.43)	0.252	1.13 (0.90 - 1.43)	0.292
1-4 per week	141/734 (19.2)	411/2220 (18.5)	1.11 (0.88 - 1.40)	0.395	1.06 (0.84 - 1.35)	0.628
Nearly every day	149/734 (20.3)	439/2220 (19.8)	1.09 (0.87 - 1.37)	0.438	1.12 (0.88 - 1.41)	0.363
n	2954					
Long work shifts per week (≥11 hours)						
0	69/575 (12.0)	296/1719 (17.2)				
>0 - <2	255/575 (44.3)	732/1719 (42.6)	1.49 (1.11 - 2.01)	0.008	1.48 (1.09 - 2.02)	0.013
≥2 - <4	123/575 (21.4)	355/1719 (20.7)	1.49 (1.07 - 2.07)	0.020	1.49 (1.05 - 2.11)	0.024
≥4	128/575 (22.3)	336/1719 (19.5)	1.63 (1.17 - 2.28)	0.004	1.91 (1.35 - 2.72)	<0.001
n	2294					
Long work weeks						
<48 hours	417/731 (40.9)	1303/2204 (59.1)				
≥48 hours	314/731 (43.0)	901/2204 (40.9)	1.09 (0.92 - 1.29)	0.324	1.14 (0.96 - 1.36)	0.141
n	2935					
Mandatory overtime						
No	305/653 (46.7)	1056/1911 (55.3)				
Yes	348/653 (53.3)	855/1911 (44.7)	1.41 (1.18 - 1.68)	<0.001	1.37 (1.14 - 1.65)	0.001
n	2564					
Voluntary overtime						
No	306/646 (47.4)	881/1935 (45.5)				
Yes	340/646 (52.6)	1054/1935 (54.5)	0.93 (0.78 - 1.11)	0.417	0.94 (0.78 - 1.12)	0.475
n	2581					
Any overtime (Mandatory or voluntary)						
No	143/618 (23.1)	487/1799 (27.1)				
Yes	475/618 (76.9)	1312/1799 (72.9)	1.23 (1.00 - 1.53)	0.055	1.21 (0.97 - 1.50)	0.095
n	2417					
	High DP	Low-moderate DP				
Night shift frequency						
Never/nearly never	481/1320 (36.4)	771/1700 (45.4)				
1-4 per month	285/1320 (21.6)	316/1700 (18.6)	1.45 (1.19 - 1.76)	<0.001	1.21 (0.96 - 1.51)	0.101
1-4 per week	254/1320 (19.2)	314/1700 (18.5)	1.30 (1.06 - 1.86)	0.011	1.07 (0.84 - 1.35)	0.592
Nearly every day	300/1320 (22.7)	299/1700 (17.6)	1.61 (1.32 - 1.96)	<0.001	1.32 (1.05 - 1.66)	0.018
n	3020					
Long work shifts per week (≥11 hours)						
0	151/1027 (14.7)	226/1316 (17.2)				
>0 - <2	476/1027 (46.3)	535/1316 (40.7)	1.33 (1.05 - 1.69)	0.019	1.20 (0.93 - 1.54)	0.157
≥2 - <4	218/1027 (21.2)	268/1316 (20.4)	1.22 (0.93 - 1.60)	0.157	1.09 (0.81 - 1.45)	0.578
≥4	182/1027 (17.7)	287/1316 (21.8)	0.95 (0.72 - 1.25)	0.712	0.96 (0.71 - 1.29)	0.804
n	2343					
Long work weeks						
<48 hours	789/1325 (59.5)	976/1674 (58.3)				
≥48 hours	536/1325 (40.5)	698/1674 (41.7)	0.95 (0.82 - 1.10)	0.492	0.98 (0.83 - 1.15)	0.779
n	2999					
Mandatory overtime						
No	568/1199 (47.4)	814/1424 (57.2)				
Yes	631/1199 (52.6)	610/1424 (42.8)	1.48 (1.27 - 1.73)	<0.001	1.30 (1.10 - 1.53)	0.002
n	2623					
Voluntary overtime						
No	521/1196 (43.6)	694/1444 (48.1)				
Yes	675/1196 (56.4)	750/1444 (51.9)	1.20 (1.03 - 1.40)	0.021	1.18 (1.01 - 1.39)	0.042
n	2640					
Any overtime (Mandatory or voluntary)						
No	235/1130 (20.8)	406/1345 (30.2)				
Yes	895/1130 (79.2)	939/1345 (69.8)	1.65 (1.37 - 1.98)	<0.001	1.47 (1.21 - 1.80)	<0.001
n	2475					

Table 2. *Continued*

Shift work characteristic, *n*[†,‡]	Positive result in police with high burnout, No./No. total (%)		Unadjusted		Adjusted[¶]	
			OR (95% CI)	*P* Value	OR (95% CI)	*P* Value
	Low PA	Moderate-high PA				
Night shift frequency						
Never/nearly never	313/752 (41.6)	895/2181 (41.0)				
1-4 per month	146/752 (19.4)	430/2181 (19.7)	0.97 (0.77 - 1.22)	0.799	0.98 (0.78 - 1.24)	0.874
1-4 per week	150/752 (19.9)	411/2181 (18.8)	1.04 (0.83 - 1.31)	0.713	1.10 (0.87 - 1.39)	0.426
Nearly every day	143/752 (18.9)	445/2181 (20.4)	0.92 (0.73 - 1.15)	0.467	1.01 (0.80 - 1.28)	0.936
n		2933				
Long work shifts per week (≥11 hours)						
0	76/591 (12.9)	292/1685 (17.3)				
>0 - <2	250/591 (42.3)	733/1685 (43.5)	1.31 (0.98 - 1.75)	0.068	1.27 (0.95 - 1.71)	0.114
≥2 - <4	133/591 (22.5)	340/1685 (20.2)	1.50 (1.09 - 2.08)	0.013	1.46 (1.05 - 2.03)	0.024
≥4	132/591 (22.3)	320/1685 (19.0)	1.59 (1.15 - 2.19)	0.005	1.43 (1.02 - 1.99)	0.036
n		2276				
Long work weeks						
<48 hours	399/750 (53.2)	1323/2168 (61.0)				
≥48 hours	351/750 (46.8)	845/2168 (39.0)	1.38 (1.17 - 1.63)	<0.001	1.33 (1.12 - 1.58)	0.001
n		2918				
Mandatory overtime						
No	370/653 (56.7)	973/1902 (51.2)				
Yes	283/653 (43.3)	929/1902 (48.8)	0.80 (0.67 - 0.96)	0.015	0.85 (0.71 - 1.02)	0.075
n		2555				
Voluntary overtime						
No	298/672 (44.3)	886/1899 (46.7)				
Yes	374/672 (55.7)	1013/1899 (53.3)	1.01 (0.92 - 1.31)	0.302	1.08 (0.90 - 1.29)	0.418
n		2571				
Any overtime (Mandatory or voluntary)						
No	164/623 (26.3)	456/1786 (25.5)				
Yes	459/623 (73.7)	1130/1786 (74.5)	0.96 (0.78 - 1.18)	0.697	1.04 (0.84 - 1.29)	0.728
n		2409				
	Overall burnout	No overall burnout				
Night shift frequency						
Never/nearly never	202/545 (37.1)	1085/2547 (42.6)				
1-4 per month	121/545 (22.2)	489/2547 (19.2)	1.32 (1.04 - 1.71)	0.025	1.25 (0.97 - 1.61)	0.092
1-4 per week	110/545 (20.2)	473/2547 (18.6)	1.25 (0.97 - 1.61)	0.089	1.11 (0.85 - 1.14)	0.449
Nearly every day	112/545 (20.6)	500/2547 (19.6)	1.20 (0.93 - 1.55)	0.154	1.12 (0.86 - 1.45)	0.407
n		3092				
Long work shifts per week (≥11 hours)						
0	51/426 (12.0)	338/1967 (17.2)				
>0 - <2	191/426 (44.8)	835/1967 (42.5)	1.52 (1.09 - 2.12)	0.015	1.44 (1.02 - 2.02)	0.038
≥2 - <4	88/426 (20.7)	408/1967 (20.7)	1.43 (0.98 - 2.08)	0.061	1.36 (0.93 - 2.00)	0.116
≥4	96/426 (22.5)	386/1967 (19.6)	1.65 (1.14 - 2.39)	0.008	1.78 (1.21 - 2.61)	0.003
n		2393				
Long work weeks						
<48 hours	309/547 (56.5)	1503/2524 (59.5)				
≥48 hours	238/547 (43.5)	1021/2524 (40.5)	1.13 (0.94 - 1.37)	0.188	1.13 (0.94 - 1.37)	0.201
n		3071				
Mandatory overtime						
No	222/496 (44.8)	1196/2178 (54.9)				
Yes	274/496 (55.2)	982/2178 (45.1)	1.50 (1.24 - 1.83)	<0.001	1.40 (1.14 - 1.71)	0.001
n		2674				
Voluntary overtime						
No	225/489 (46.0)	1016/2201 (46.2)				
Yes	264/489 (54.0)	1185/2201 (53.8)	1.01 (0.83 - 1.23)	0.952	1.01 (0.83 - 1.24)	0.910
n		2690				
Any overtime (Mandatory or voluntary)						
No	97/471 (20.6)	564/2048 (27.5)				
Yes	374/471 (79.4)	1484/2048 (72/5)	1.56 (1.31 - 1.87)	<0.001	1.36 (1.06 - 1.75)	0.017
n		2519				

EE, emotional exhaustion; DP, depersonalisation; PA, personal accomplishment; OR, odds ratio; CI, confidence interval; †The *n* presented represents the sample for each unadjusted analysis. The *n* for the adjusted analyses are in Supplement 1, Table S2; ‡Some participants did not provide sufficient information from which to determine their shift work characteristics. The *n* presented are from those who answered sufficiently; ¶Adjusted for age, BMI, gender, marital status, hypertension, cigarette use, caffeine use, alcohol, second job, primary activity, years as police officer, exercise frequency, and seniority. Variables included in each model are in Supplement 1, Table S2.

Table 3. High burnout outcomes associated with shift work schedules in police (n=3140)

Shift work schedule, *n*[†,‡]	Positive result in police with high burnout, No./No. total (%)		Unadjusted		Adjusted[¶]	
			OR (95% CI)	*P* Value	OR (95% CI)	*P* Value
	High EE	Low-moderate EE				
Fixed	382/743 (51.4)	1366/2227 (61.3)				
Irregular	96/743 (12.9)	168/2227 (7.5)	2.04 (1.55 – 2.69)	<0.001	1.91 (1.44 - 2.54)	<0.001
Rotating	200/743 (26.9)	534/2227 (24.0)	1.34 (1.10 - 1.63)	0.004	1.30 (1.06 - 1.59)	0.011
Other	65/743 (8.7)	159/2227 (7.1)	1.46 (1.07 - 1.99)	0.016	1.44 (1.05 - 1.98)	0.024
n	2970					
	High DP	Low-moderate DP				
Fixed	740/1331 (55.6)	1038/1703 (61.0)				
Irregular	146/1331 (11.0)	117/1703 (6.9)	1.75 (1.35 - 2.27)	<0.001	1.39 (1.02 - 1.89)	0.038
Rotating	343/1331 (25.8)	416/1703 (24.4)	1.16 (0.96 - 1.37)	0.096	0.97 (0.80 - 1.18)	0.830
Other	102/1331 (7.7)	132/1703 (7.8)	1.08 (0.82 - 1.43)	0.566	1.07 (0.78 - 1.45)	0.665
n	3034					
	Low PA	Moderate-high PA				
Fixed	481/754 (63.8)	1244/2196 (56.6)				
Irregular	73/754 (9.7)	192/2196 (8.7)	0.98 (0.74 - 1.31)	0.909	1.02 (0.76 - 1.36)	0.919
Rotating	152/754 (20.2)	584/2196 (26.6)	0.67 (0.55 - 0.83)	<0.001	0.74 (0.59 - 0.91)	0.004
Other	48/754 (6.4)	176/2196 (8.0)	0.71 (0.50 - 0.99)	0.042	0.73 (0.52 - 1.02)	0.068
n	2950					
	Overall burnout	No overall burnout				
Fixed	279/553 (50.5)	1539/2555 (60.2)				
Irregular	82/553 (14.8)	192/2555 (7.5)	2.36 (1.77 - 3.14)	<0.001	2.12 (1.57 - 2.85)	<0.001
Rotating	146/553 (26.4)	632/2555 (24.7)	1.27 (1.02 - 1.59)	0.031	1.24 (0.99 - 1.56)	0.065
Other	46/553 (8.3)	192/2555 (7.5)	1.32 (0.94 - 1.87)	0.114	1.29 (0.91 - 1.84)	0.153
n	3108					

EE, emotional exhaustion; DP, depersonalisation; PA, personal accomplishment; OR, odds ratio; CI, confidence interval; [†]The *n* presented represents the sample for each unadjusted analysis. The *n* for the adjusted analyses are in Supplement 1, Table S2; ‡Some participants did not provide sufficient information from which to determine their shift work schedule. The *n* presented are from those who answered sufficiently; [¶]Adjusted for age, BMI, gender, marital status, hypertension, cigarette use, caffeine use, alcohol use, second job, primary activity, years as police officer, exercise frequency, and seniority. Variables included in each model are in Supplement 1, Table S2.

Sleep and burnout

Police who reported, on average, short sleep (<6 hours) were more likely to have overall burnout (1.49, 95% CI 1.21-1.81) and high EE (1.60, 95% CI 1.33-1.93) compared to those sleeping ≥6 hours. Short sleep was not associated with DP or PA (Table 4). Police with excessive sleepiness were more likely to have overall burnout (1.72, 95% CI 1.41-2.11), high EE (1.81, 95% CI 1.50-2.18), high DP (1.48, 95% CI 1.23-1.78) and less likely to have low PA (0.77, 95% CI 0.63-0.94) compared to police with normal sleepiness.

Table 4. High burnout outcomes associated with sleep duration and sleepiness in police (n=3140)

Sleep characteristics, *n*†,‡	Positive result in police with high burnout, No./No. total (%)		Unadjusted		Adjusted¶	
			OR (95% CI)	*P* Value	OR (95% CI)	*P* Value
	High EE	Low-moderate EE				
Sleep duration						
≥6 hours per night	371/654 (56.7)	1334/1956 (68.2)				
<6 hours per night	283/654 (43.3)	622/1956 (31.8)	1.64 (1.36 - 1.96)	<0.001	1.60 (1.33 - 1.93)	<0.001
n	2610					
Sleepiness						
<11 ESS	451/714 (63.2)	1652/2158 (76.6)				
≥11 ESS	263/714 (36.8)	506/2158 (23.4)	1.90 (1.59 - 2.28)	<0.001	1.81 (1.50 - 2.18)	<0.001
n	2872					
	High DP	Low-moderate DP				
Sleep duration						
≥6 hours per night	755/1206 (62.6)	989/1469 (67.3)				
<6 hours per night	451/1206 (37.4)	480/1469 (32.7)	1.23 (1.05 - 1.44)	0.011	1.13 (0.96 - 1.33)	0.151
n	2675					
Sleepiness						
<11 ESS	875/1286 (68.0)	1267/1639 (77.3)				
≥11 ESS	411/1286 (32.0)	372/1639 (22.7)	1.60 (1.38 - 1.89)	<0.001	1.48 (1.23 - 1.78)	<0.001
n	2925					
	Low PA	Moderate-high PA				
Sleep duration						
≥6 hours per night	470/688 (68.3)	1224/1913 (64.0)				
<6 hours per night	218/688 (31.7)	689/1913 (36.0)	0.82 (0.68 - 0.99)	0.041	0.85 (0.70 - 1.03)	0.091
n	2601					
Sleepiness						
<11 ESS	561/727 (77.2)	1519/2124 (71.5)				
≥11 ESS	166/727 (22.8)	605/2124 (28.5)	0.74 (0.61 - 0.91)	0.003	0.77 (0.63 - 0.94)	0.012
n	2851					
	Overall burnout	No overall burnout				
Sleep duration						
≥6 hours per night	279/491 (56.8)	1497/2238 (66.9)				
<6 hours per night	212/491 (43.2)	741/2238 (33.1)	1.54 (1.26 - 1.87)	<0.001	1.48 (1.21 - 1.81)	<0.001
n	2729					
Sleepiness						
<11 ESS	338/532 (63.5)	1852/2464 (75.2)				
≥11 ESS	194/532 (36.5)	612/2464 (24.8)	1.74 (1.42 - 2.12)	<0.001	1.72 (1.41 - 2.11)	<0.001
n	2996					

EE, emotional exhaustion; DP, depersonalisation; PA, personal accomplishment; ESS, Epworth Sleepiness Scale; OR, odds ratio; CI, confidence interval; †The *n* presented represents the sample for each unadjusted analysis. The *n* for the adjusted analyses are in Supplement 1, Table S2; ‡Some participants did not provide sufficient information from which to determine their sleep duration and sleepiness. The *n* presented are from those who answered sufficiently; ¶Adjusted for age, BMI, gender, marital status, hypertension, cigarette use, caffeine use, alcohol use, second job, primary activity, years as police officer, exercise frequency, and seniority. Variables included in each model are in Supplement 1, Table S2.

DISCUSSION

In this sample of North American police officers, 17% exhibited overall burnout, which is higher than the 10% previously observed in office workers.[18] Two-thirds of the sample (65.5%) were also found to have at least one dimension of burnout, and this too exceeds levels reported in other human service occupations and the general population.[27] Long shifts, mandatory overtime, short sleep and sleepiness were each associated with significantly increased risk of overall burnout in police. Among the different schedules, officers working irregular shifts had a 2-fold higher risk of overall burnout, demonstrating the risk of burnout associated with this schedule for the first time in police. For individual dimensions of burnout, almost half (43%) of police had high depersonalisation, while nearly a quarter had high emotional exhaustion (24%) and low personal accomplishment (24%). The prevalence of DP was higher in this sample of police compared to the US general population (15%), and EE levels were similar to general population data (23%).[27] The risk of EE was higher in police working a greater frequency of long shifts, and working night shifts were associated with an increased risk of DP. Long work weeks were associated with low PA, and mandatory, but not voluntary, overtime increased EE. There was an increased likelihood of EE among police reporting short sleep, and an increased risk for each dimension of burnout in those with excessive sleepiness.

Police regularly completing long work shifts were at increased risk of overall burnout, EE and low PA. Previous studies in nurses have reported similar associations between increased hours of work on the most recent shift and high burnout.[13 14] We expand on these findings by demonstrating how the risk of EE is dependent on the number of long shifts worked, with working ≥4 long shifts associated with nearly double the risk of EE. Working ≥1 long shift per

month and ≥4 long shifts per week were also associated with low PA and overall burnout, but the risk conferred by other shift frequencies (i.e., >0 to <2, 2 to <4 long shifts per week) was less consistent for these aspects of burnout. In contrast to a prior study,[24] working ≥48 hours per week was associated with low PA, which along with long shifts, were the only shift characteristics to increase the risk of low PA in police. This finding could reflect that police were working long hours but not experiencing a sense of accomplishment from their work in return.[4] Compared to weekly work hours, however, the associations between long work shifts and burnout were typically stronger and affected more burnout dimensions. This is an important detail, as it demonstrates how the distribution of work hours, not just total overall hours, influences burnout in police. This suggests the need for shorter and less compressed shifts that spread work hours across the week to reduce burnout. For instance, Amendola et al.[8] found that police working 10-hour shifts reported longer sleep and higher quality of work-life balance compared 8- or 12-hour shifts, although burnout was not examined in that study. Further research is needed to examine whether shortening shift lengths, as well as limiting the frequency of long work shifts, also reduces burnout in police as it has been shown in EMTs.[15]

Mandatory overtime was associated with an increased risk of overall burnout, high EE, and DP among police. Conversely, voluntary overtime was not associated with EE or overall burnout, but was associated with high DP. A prior study in police failed to show a relationship between overtime (combined voluntary and mandatory) and burnout.[17] The results of our study suggest the control a police officer has over overtime may influence the impact of this shift characteristic on burnout, in particular overall burnout and EE. This interpretation is supported by research from Beckers *et al*.[28] in full-time workers who reported involuntary overtime was associated with

high emotional fatigue and low job satisfaction, and classified involuntary overtime workers as a burnout risk group.[28] In their study, Becker and colleagues[28] did not examine DP, but based on our findings in police, it is possible that voluntary (and mandatory) overtime may pose a risk to this dimension. Further research determining the specific durations of overtime associated with high burnout and which dimensions of burnout is needed to inform policies regarding the safe provision of work hours in excess of normal shift lengths.

Increased frequency of night shifts was associated with high DP in police, but not overall burnout, EE or PA. Researchers have reported associations between increased night work and burnout in nurses, but only for overall burnout and EE.[12 29] Furthermore, the rate of night shifts per month was not found to associate with burnout among healthcare workers.[29] These inconsistencies may reflect differences among human service professions and perhaps their physical environments (e.g., lighting levels that affect mood and alertness)[30] that may impact the manifestation of burnout dimensions. For instance, healthcare workers typically develop higher rates of EE,[31] whereas police report greater DP,[32] as demonstrated in the current study. High DP reflects a critical relationship between people and their work, as it refers to negative feelings and attitudes toward one's clients.[4] Therefore, high DP in police could be due to the difficult nature of some of the people with whom police interact. In addition to sleep disruption with night work, police encounter more stressful events at night.[33] Sleep is further disrupted among people with untreated sleep disorders, and common sleep disorders are shown to increase the likelihood of police demonstrating anger towards suspects or citizens.[3] Thus, the combination of poor mood, sleep and difficult clients may explain the increased risk of DP associated with regular night work in police. Further research comparing police attitudes towards clients with whom they

interact at night compared to the day is needed to understand the mechanisms underpinning the increased risk of DP conferred by night shifts in police.

Police officers who reported short sleep had a greater risk of overall burnout and EE, while sleepiness increased the likelihood for all aspects of burnout. Similar sleepiness levels have been related to high burnout in medical students.[23] Our findings for sleep duration are also consistent with research showing short sleep over a month increases overall burnout in police.[11] Inadequate sleep may impair police officers' ability to recover from occupational demands, potentially explaining the heightened burnout risk in those reporting short sleep in this study. Achieving sufficient sleep can be difficult when working at night and/or long hours, as these shifts may limit sleep opportunities at night and involve attempts by the shiftworker to sleep at times of the day when alertness levels are high (and sleep propensity is low).[34] Indeed, when restricting the sample to police regularly completing long shifts, officers reporting short sleep and excessive sleepiness had a 2-fold increased risk of EE (Table S3). These findings highlight the health burden of sleepiness and sleep loss in law enforcement, and the need for interventions that address sleep in addition to optimising shift schedules.

Police working irregular shifts were more likely to have overall burnout, high EE and DP compared to officers working fixed shifts. Canadian workers completing non-standard schedules (shifts other than fixed 9AM-5PM) have also been found to have increased overall burnout and EE,[35] but to our knowledge, this is the only other study to have investigated the impact of irregular or non-standard schedules on burnout. A growing body of research suggests that greater variability in sleep duration and bedtimes predict worse mental health.[36] Workers with irregular

shifts are likely to have more variability in their sleep patterns,[37] which in turn, may explain the increased burnout risk among police engaged in this schedule. Considering 8.9% of our sample worked irregular shifts, our findings may have implications for arranging work schedules to limit irregular shifts to reduce burnout. Rotating shifts were also common among police in our study (24.9%), and associated with high EE and moderate-high PA. Conversely, nurses working fixed shifts compared to rotating schedules are reported to have greater EE and DP,[38] but not low PA, with those working fixed night and morning shifts showing the highest levels of EE and DP.[39] The hazards related to fixed night shifts are well documented,[40] although in the current study it was not possible to identify the types of fixed shifts police completed. There is also a diverse range of shift rotations in policing, which were grouped into one variable (i.e., rotating schedules) in our study. Different shift rotations and types of fixed shifts may have varying effects on burnout that require further examination.

A limitation of this study was the use of self-reported shift and sleep characteristics. Although some questions used to record police officers' work and sleep hours have been validated,[19] participants were required to report and recall this information for the prior month. A further limitation was the cross-sectional design. Future longitudinal studies using objective work and sleep measures are needed to examine the causality within our findings.

The results of this study among police contribute to a growing evidence-base in shift workers that indicates how the number of long shifts and night shifts, mandatory overtime and short sleep and sleepiness raise the risk of burnout. Importantly, we further demonstrate that irregular schedules present a significant risk for burnout. These findings support future research in police

that trials reducing the rate of long shifts and night shifts per week in vulnerable officers, and preventing irregular schedules where possible. Although shift work is unavoidable for industries such as law enforcement, optimising work hours in relation to control over overtime, consistency of schedules and reducing duration and frequency of night and long shifts should be explored as a way to lower the high level of burnout among police, leading to improved health for personnel, and enhanced performance for their department and communities whom they serve.

Contribution statement:

SAP, APW, LKB, CSO, JPS, SQ, SWL, CAC and SMWR contributed to the design of the study. LKB, CSO, JPS, SQ, SWL, CAC and SMWR contributed to data collection. SAP, APW, LKB and SMWR conducted the data analysis. SAP, APW, LKB, CSO, JPS, SQ, SWL, CAC and SMWR contributed to the interpretation of the data, and the preparation and refinement of the final manuscript.

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Data sharing statement:

No additional data available.

Ethics approval:

This study was approved by the Ethics Committees of Partners HealthCare and Monash University.

Competing interests statement:

SAP, APW, JPS, SQ and CSO report no conflicts of interest. SMWR reports that he has served as a consultant through his institution to Philips Respironics, EdanSafe, National Transport Commission, Vanda Pharmaceuticals, Rail, Bus and Train Union, Tontine Group, Australian Workers' Union, Transport Accident Commission, Meda Consumer Healthcare, New South Wales Department of Education and Communities, and has through his institution received grants from Philips Respironics and Vanda Pharmaceuticals and reimbursements for conference travel expenses from Vanda Pharmaceuticals. SMWR currently serves as a consult to, and is a Program Leader for, the Cooperative Research Centre for Alertness, Safety and Productivity. SMWR institution has received equipment donations or other support from Compumedics, Philips Lighting, Optalert and Tyco Healthcare. SMWR is a former President of the Australasian Sleep Association and is a Director of the Sleep Health Foundation. SMWR has also served as an expert witness and/or consultant to shift work organizations. LKB reports research support from Cephalon, NFL charities, Sysco and San Francisco Bar Pilots. LKB has received consulting/lecture fees or served as a board member for Alertness Solution, Ceridian, Davis Joint Unified School Board, San Jose State University Foundation, Pugot Sound Pilots, Sygma and

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Supplement

Table S1. High burnout outcomes associated with shift work characteristics in police (n=3140)

Shift work characteristic, *n*†	Positive result in police with burnout, No./No. total (%)		Unadjusted		Adjusted¶	
			OR (95% CI)	*P* Value	OR (95% CI)	*P* Value
	High EE	Low-moderate EE				
Total hours of overtime			1.00 (1.00 - 1.01)	0.275	1.00 (1.00 - 1.01)	0.181
n	2728					
	High DP	Low-moderate DP				
Total hours of overtime			1.00 (1.00 - 1.01)	0.104	1.00 (1.00 - 1.01)	0.182
n	2788					
	Low PA	Moderate-high PA				
Total hours of overtime			1.00 (1.00 - 1.01)	0.024	1.00 (1.00 - 1.01)	0.031
n	2717					
	Overall burnout	No overall burnout				
Total hours of overtime			1.00 (1.00 - 1.01)	0.169	1.00 (1.00 - 1.01)	0.163
n	2845					

EE, emotional exhaustion; DP, depersonalisation; PA, personal accomplishment; OR, odds ratio; CI, confidence interval; †The *n* presented represents the sample for each unadjusted analysis. The *n* for the adjusted analyses are in Supplement 1, Table S2; ‡Some participants did not provide sufficient information from which to determine their overtime. The *n* presented are from those who answered sufficiently; ¶Adjusted for age, BMI, gender, marital status, hypertension, cigarette use, caffeine use, alcohol, second job, primary activity, years as police officer, exercise frequency, and seniority. Variables included in each model are in Supplement 1, Table S2.

Table S2. Variables included in the models used to examine associations between shift characteristics, shift schedules, sleep, and burnout outcomes

Shift work and sleep characteristics, *n*‡	**Emotional Exhaustion**	**Depersonalisation**	**Personal Accomplishment**	**Burnout (High EE+DP)**
Night shift frequency	Gender, cigarette use, seniority	Age, cigarette use, second job, primary activity, years in law enforcement, seniority	Age, BMI†, cigarette use, caffeine use, exercise	Age, cigarette use, seniority
n	2882	2440	2837	3015
Long work shifts	Gender, cigarette use, exercise, seniority	Age, cigarette use, caffeine use, primary activity, years in law enforcement, seniority	Age, caffeine use, exercise	Gender, cigarette use, seniority
n	2220	2250	2252	2328
Long work weeks	Gender, cigarette use, seniority	Age, cigarette use, second job, primary activity, seniority	Age, BMI†, cigarette use, exercise	Age, cigarette use, seniority
n	2862	2479	2873	2994
Shift rotation	Gender, cigarette use, seniority	Age, cigarette use, second job, primary activity, years in law enforcement, seniority	Age, BMI†, cigarette use, caffeine use, exercise	Age, cigarette use, years in law enforcement, seniority
n	2894	2451	2889	2992
Mandatory OT hours	Gender, cigarette use, seniority	Age, cigarette use, second job, primary activity, years in law enforcement, seniority	Age, BMI†, cigarette use, primary activity, exercise	Age, cigarette use, seniority
n	2512	2353	2515	2622
Voluntary OT hours	Gender, cigarette use, seniority	Age, cigarette use, primary activity, seniority	Age, BMI†, cigarette use, primary activity, seniority	Age, cigarette use, seniority
n	2531	2587	2508	2639
Total OT hours	Gender, cigarette use, seniority	Age, cigarette use, primary activity, years in law enforcement, seniority	Age, cigarette use, exercise	Age, cigarette use, seniority
n	2675	2713	2690	2791
Sleepiness	Gender, cigarette use, exercise, seniority	Age, cigarette use, second job, primary activity, seniority	Age, BMI†, cigarette use, exercise	Age, cigarette use, seniority
n	2772	2375	2800	2921
Sleep duration	Gender, cigarette use, seniority	Age, cigarette use, caffeine use, primary activity, exercise, seniority	Age, BMI†, cigarette use, primary activity, exercise	Age, primary activity, seniority
n	2554	2595	2560	2663

EE, emotional exhaustion; DP, depersonalization; OT, overtime; BMI, body mass index; †BMI was a continuous variable; ‡The *n* presented represents the sample for the adjusted analyses.

Table S3. High burnout outcomes associated with sleep and sleepiness in police regularly working night shifts (1-4 nights per week or night shifts nearly every day; n=1199)

Sleep characteristic, *n*†	Positive result in police with high burnout, No./No. total (%)		Unadjusted		Adjusted¶	
			OR (95% CI)	*P* Value	OR (95% CI)	*P* Value
	High EE	Low-moderate EE				
Sleep duration						
≥6 hours per night	140/273 (51.3)	451/775 (58.2)				
<6 hours per night	133/273 (48.7)	324/775 (41.8)	1.32 (1.00 - 1.74)	0.048	1.37 (1.03 - 1.82)	0.029
n	1048					
Sleepiness						
<11 ESS	159/278 (57.2)	601/822 (73.1)				
≥11 ESS	119/278 (42.8)	221/822 (26.9)	2.04 (1.53 - 2.70)	<0.001	2.02 (1.51 - 2.70)	<0.001
n	1100					
	High DP	Low-moderate DP				
Sleep duration						
≥6 hours per night	293/515 (56.9)	317/557 (56.9)				
<6 hours per night	222/515 (43.1)	240/557 (43.1)	1.00 (0.79 - 1.28)	0.995	1.02 (0.79 - 1.32)	0.867
n	1072					
Sleepiness						
<11 ESS	327/533 (61.4)	446/590 (75.6)				
≥11 ESS	206/533 (38.6)	144/590 (24.4)	1.95 (1.51 - 2.52)	<0.001	2.06 (1.58 - 2.68)	<0.001
n	1123					
	Low PA	Moderate-high PA				
Sleep duration						
≥6 hours per night	161/274 (58.8)	444/786 (56.5)				
<6 hours per night	113/274 (41.2)	342/786 (43.5)	0.91 (0.69 - 1.20)	0.513	0.90 (0.67 - 1.19)	0.447
n	1060					
Sleepiness						
<11 ESS	210/281 (74.7)	551/826 (66.7)				
≥11 ESS	71/281 (25.3)	275/826 (33.3)	.068 (0.50 - 0.92)	0.012	0.70 (0.51 - 0.95)	0.024
n	1107					
	Overall burnout	No overall burnout				
Sleep duration						
≥6 hours per night	111/207 (53.6)	511/890 (57.4)				
<6 hours per night	96/207 (46.4)	379/890 (42.6)	1.17 (0.86 - 1.58)	0.322	1.25 (0.92 - 1.71)	0.154
n	1097					
Sleepiness						
<11 ESS	121/214 (56.5)	667/934 (71.4)				
≥11 ESS	93/214 (43.5)	267/934 (28.6)	1.92 (1.42 - 2.61)	<0.001	2.04 (1.49 - 2.79)	<0.001
n	1148					

EE, emotional exhaustion; DP, depersonalisation; PA, personal accomplishment; ESS, Epworth Sleepiness Scale; OR, odds ratio; CI, confidence interval; †The *n* presented represents the sample for each unadjusted analysis. The *n* for the adjusted analyses are in Supplement 1, Table S7; ‡Some participants did not provide sufficient information from which to determine their sleep duration and sleepiness. The *n* presented are from those who answered sufficiently; ¶Adjusted for age, BMI, gender, marital status, hypertension, cigarette use, caffeine use, alcohol use, second job, primary activity, years as police officer, exercise frequency, and seniority. Variables included in each model are in Supplement 1, Table S7.

Table S4. High burnout outcomes associated with sleep and sleepiness in police regularly working long work shifts (>2 long work shifts per week; n=978)

Sleep characteristic, *n*†	Positive result in police with high burnout, No./No. total (%)		Unadjusted		Adjusted¶	
			OR (95% CI)	*P* Value	OR (95% CI)	*P* Value
	High EE	Low-moderate EE				
Sleep duration						
≥6 hours per night	105/228 (46.1)	398/617 (64.5)				
<6 hours per night	123/228 (53.9)	219/617 (35.5)	2.13 (1.56 - 2.90)	<0.001	2.02 (1.46 - 2.78)	<0.001
n	845					
Sleepiness						
<11 ESS	139/234 (59.4)	502/664 (75.6)				
≥11 ESS	95/234 (40.6)	162/664 (24.4)	2.12 (1.55 - 2.90)	<0.001	1.99 (1.43 - 2.77)	<0.001
n	898					
	High DP	Low-moderate DP				
Sleep duration						
≥6 hours per night	198/371 (53.4)	317/486 (65.2)				
<6 hours per night	169/371 (46.6)	173/487 (34.8)	1.64 (1.24 - 2.16)	<0.001	1.46 (1.09 - 1.97)	0.012
n	857					
Sleepiness						
<11 ESS	244/384 (63.5)	403/523 (77.1)				
≥11 ESS	140/384 (36.5)	120/523 (22.9)	1.93 (1.44 - 2.58)	<0.001	1.97 (1.46 - 2.66)	<0.001
n	907					
	Low PA	Moderate-high PA				
Sleep duration						
≥6 hours per night	159/252 (63.1)	340/581 (58.5)				
<6 hours per night	93/252 (36.9)	241/581 (41.5)	0.83 (0.61 - 1.12)	0.216	0.88 (0.65 - 1.20)	0.428
n	833					
Sleepiness						
<11 ESS	187/250 (74.8)	439/630 (69.7)				
≥11 ESS	63/250 (25.2)	191/630 (30.3)	0.77 (0.56 - 1.08)	0.131	0.79 (0.57 - 1.12)	0.184
n	880					
	Overall burnout	No overall burnout				
Sleep duration						
≥6 hours per night	77/169 (45.6)	444/706 (62.9)				
<6 hours per night	92/169 (54.5)	262/706 (37.1)	2.03 (1.44 - 2.84)	<0.001	1.92 (1.35 - 2.72)	<0.001
n	875					
Sleepiness						
<11 ESS	101/175 (57.7)	560/754 (74.3)				
≥11 ESS	74/175 (42.3)	194/754 (25.7)	2.12 (1.50 - 2.98)	<0.001	2.03 (1.43 - 2.89)	<0.001
n	929					

EE, emotional exhaustion; DP, depersonalisation; PA, personal accomplishment; ESS, Epworth Sleepiness Scale; OR, odds ratio; CI, confidence interval; †The *n* presented represents the sample for each unadjusted analysis. The *n* for the adjusted analyses are in Supplement 1, Table S7; ‡Some participants did not provide sufficient information from which to determine their sleep duration and sleepiness. The *n* presented are from those who answered sufficiently; ¶Adjusted for age, BMI, gender, marital status, hypertension, cigarette use, caffeine use, alcohol use, second job, primary activity, years as police officers, exercise frequency, and seniority. Variables included in each model are in Supplement 1, Table S7.

Table S5. High burnout outcomes associated with working at least 1 long shift in the past 4 weeks (n=3140)

Worked >0 Long Shifts in Past 4 Weeks, *n*†	Positive result in police with high burnout, No./No. total (%)		Unadjusted		Adjusted¶	
			OR (95% CI)	*P* Value	OR (95% CI)	*P* Value
	High EE	Low-moderate EE				
No	69/575 (12.0)	296/1719 (17.2)				
Yes	506/575 (88.0)	1423/1719 (82.8)	1.53 (1.52 - 2.02)	0.003	1.54 (1.51 - 2.06)	0.004
n	2294					
	High DP	Low-moderate DP				
No	151/1027 (14.7)	226/1316 (17.2)				
Yes	876/1027 (85.3)	1090/1316 (82.8)	1.20 (0.96 - 1.51)	0.107	1.12 (0.88 - 1.41)	0.365
n	2343					
	Low PA	Moderate-high PA				
No	76/591 (12.9)	292/1685 (17.3)				
Yes	515/591 (87.1)	1393/1685 (82.7)	1.42 (1.08 - 1.86)	0.011	1.35 (1.03 - 1.78)	0.033
n	2276					
	Overall burnout	No overall burnout				
No	51/426 (12.0)	338/1967 (17.2)				
Yes	375/426 (88.0)	1629/1967 (82.8)	1.53 (1.11 - 2.09)	0.009	1.43 (1.04 - 1.98)	0.029
n	2393					

EE, emotional exhaustion; DP, depersonalisation; PA, personal accomplishment; OR, odds ratio; CI, confidence interval; †The *n* presented represents the sample for each unadjusted analysis. The *n* for the adjusted analyses are in Supplement 1, Table S7; ‡Some participants did not provide sufficient information from which to determine their long shifts. The *n* presented are from those who answered sufficiently; ¶Adjusted for age, BMI, gender, marital status, hypertension, cigarette use, caffeine use, alcohol use, second job, primary activity, years as police officers, exercise frequency, and seniority. Variables included in each model are in Supplement 1, Table S7.

Table S6. Variables included in models used to examine associations between sleep and sleepiness, shift schedules and burnout outcomes in police regularly working night shifts, extended shifts or fixed shift schedules

Shift work and sleep characteristics, *n*‡	**Emotional Exhaustion**	**Depersonalisation**	**Personal Accomplishment**	**Burnout (High EE+DP)**
(Night shift sample) Sleep duration	Seniority, gender	Age, marital status, years in law enforcement, seniority	Age, †BMI, exercise	Primary activity, seniority
n	1040	1051	1050	1087
(Night shift sample) Sleepiness	Gender, cigarette use, seniority	Age, years in law enforcement	Age, cigarette use, exercise	Age, primary activity, seniority
n	1092	1109	1096	1136
(Extended shift sample) Sleep duration	Gender, seniority	Age, blood pressure, primary activity, seniority	Age, cigarette use, exercise	Age, seniority
n	813	782	827	842
(Extended shift sample) Sleepiness	Gender, seniority	Age, exercise	Age, cigarette use, exercise	Seniority
n	856	904	876	887
>0 Long shifts in past 4 weeks	Gender, Cigarette use, seniority	Age, cigarette use, caffeine use, primary activity, years in law enforcement, seniority	Age, caffeine use, exercise	Cigarette use, seniority
n	2230	2250	2252	2330

EE, emotional exhaustion; DP, depersonalization; OT, overtime; BMI, body mass index; †BMI was a continuous variable; ‡The *n* presented represents the sample for the adjusted analyses.

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Reported on Page No.
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	Page 2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	Page 2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Pages 4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	Page 5
Methods			
Study design	4	Present key elements of study design early in the paper	Pages 5-6 with additional details presented in Ref#3
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Pages 5-6 with additional details presented in Ref# 3
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	Pages 5-6 with additional details presented in Ref# 3
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Pages 6-7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Pages 6-7
Bias	9	Describe any efforts to address potential sources of bias	Pages 5-6
Study size	10	Explain how the study size was arrived at	Pages 5-6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Pages 6-7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	Pages 7-8
		(*b*) Describe any methods used to examine subgroups and interactions	Page 7
		(*c*) Explain how missing data were addressed	Pages 9-10, reported in Table 1; Pages 13-15, reported in Table 2; Page 16, reported in Table 3; Page 18, reported in Table 4.
		(*d*) If applicable, describe analytical methods taking account of sampling	N/A

		strategy	
		(*e*) Describe any sensitivity analyses	N/A
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Pages 5-6
		(b) Give reasons for non-participation at each stage	Pages 5-6
		(c) Consider use of a flow diagram	Not included
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Pages 8-10, Reported in Table 1
		(b) Indicate number of participants with missing data for each variable of interest	Pages 9-10, Reported in Table 1
Outcome data	15*	Report numbers of outcome events or summary measures	Pages 8-10, Reported in Table 1
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Pages 11-18, and reported in tables 2-4
		(*b*) Report category boundaries when continuous variables were categorized	Pages 11-18, and reported in tables 2-4
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Supplement 1, Pages 1-6
Discussion			
Key results	18	Summarise key results with reference to study objectives	Page 19
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Page 23
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Pages 18-24
Generalisability	21	Discuss the generalisability (external validity) of the study results	Pages 18-24
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Page 24

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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The associations between shift work characteristics, shift work schedules, sleep and burnout in North American police officers: a cross-sectional study

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Title: The associations between shift work characteristics, shift work schedules, sleep and burnout in North American police officers: a cross-sectional study

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Abstract

Objectives: To examine associations between shift work characteristics and schedules on burnout in police and whether sleep duration and sleepiness were associated with burnout.

Methods: Police officers (n=3140) completed the Maslach Burnout Inventory (emotional exhaustion, depersonalisation, personal accomplishment) and self-reported shift schedules (irregular, rotating, fixed), shift characteristics (night, duration, frequency, work hours), sleep duration and sleepiness.

Results: Irregular schedules, long shifts (≥11 hours), mandatory overtime, short sleep and sleepiness were associated with increased risk of overall burnout in police. Police working a greater frequency of long shifts were more likely to have emotional exhaustion (adjusted odds ratio 1.91, 95% CI 1.35-2.72) than those not working long shifts. Night shifts were associated with depersonalisation (1.32, 1.05-1.66) compared to not working nights. Police working mandatory overtime had increased risk of emotional exhaustion (1.37, 1.14-1.65) than those who did not. Compared to fixed schedules, irregular schedules were associated with emotional exhaustion and depersonalisation (1.91, 1.44-2.54 and 1.39, 1.02-1.89, respectively). Police sleeping <6 hours were more likely to have emotional exhaustion (1.60, 1.33-1.93) than those sleeping longer, and excessive sleepiness was associated with emotional exhaustion (1.81, 1.50-2.18).

Conclusions: Irregular schedules and increased night shifts, sleep disturbances and work hours were related to higher burnout risk in police. Future research should evaluate work schedules in law enforcement that optimise shift duration and frequency, and increase consistency in scheduling and control over work hours to limit burnout in police.

Key words: mental health, sleep, burnout, shift work, police

Strengths and limitations of this study

- The study examined burnout, shift work and sleep in a large sample of police officers (n=3140) from across North America.
- Shift work characteristics and schedules were closely examined in police, providing information on night shifts, long work shifts and long work weeks, overtime (voluntary and mandatory) and different work schedules (irregular, rotating and fixed)
- Sleep and shift information were based on self-reports, and thus may be subject to response bias.
- Due to the cross-sectional design of the study, associations between shift work, sleep and burnout can be inferred but not causality.

INTRODUCTION

A major source of occupational stress for police officers is shift work, which can involve day, night and long duration shifts and long work weeks,[1 2] as well as rotating, fixed and irregular shift schedules.[3] Chronic exposure to occupational stressors can lead to burnout, which is a psychological syndrome comprising three dimensions: Emotional exhaustion (EE), depersonalisation (DP), and a perceived lack of personal accomplishment (PA).[4] Burnout can have a negative influence on the individual worker, the people whom they serve, and their organisation, with consequences including reduced productivity and decision making,[5] increased absenteeism and risk of leaving the job.[6] Indeed, retirements due to psychological ill health account for 46% of medical retirements among police in the United Kingdom.[7] In North American police, sleep disorders have been associated with increased risk of mental health outcomes, including depression and anxiety, and EE and DP burnout dimensions.[3] In addition to sleep, other work-related factors may also have a negative influence on the health of personnel engaged in shift work, however, few studies have examined how specific characteristics of shift work relate to burnout in police.

Police have traditionally worked 8- to 10-hour shifts in the United States, although increasingly, departments are implementing compressed weekly schedules which involve officers working 11-, 12- and 16-hour shifts.[1 3 8] Long shifts are related to increased sleepiness[8] and may reduce the opportunity for sleep, potentially impairing police officers' ability to recover from work demands.[9] Short sleep has been found to associate with burnout in shift working occupations,[10] including law enforcement,[11] although few studies have examined the relationship between sleepiness and burnout specifically in police. Recovery between shifts may be further restricted by night work, which can cause sleep loss and circadian misalignment, and is shown in other healthcare occupations to confer a greater risk of burnout when compared to day shifts.[10] A high degree of burnout has also been associated

with working more night shifts among physicians,[12] and longer duration shifts and work weeks in nurses[13 14] and emergency medical technicians (EMTs).[15] Although hours of work were not significantly associated with burnout in resident physicians, burnout was related to increased difficulty concentrating on work.[16] In police, officers who were continuously engaged in shift work were reported to have lower PA, but this study did not describe the relationship between regular shift work and EE or DP, nor did it distinguish between the different *shift types* in policing,[17] such as night and long duration shifts. Furthermore, police also work a variety of different schedules including irregular, rotating and fixed shifts,[9] and often do overtime which may be associated with burnout[18] but to date, the potential relationship between work schedules and shift characteristics on burnout has not been systematically examined in police.

In this cross-sectional study, we examined whether characteristics of shifts (night, shift duration, frequency, weekly work and overtime hours) as well as shift schedules (irregular, rotating, fixed) were associated with burnout in police. Given that short sleep and sleepiness are also common stressors among police and potential consequences of shift work,[3] a secondary aim was to investigate associations between sleep duration and sleepiness on burnout risk in police.

METHODS

Participants

Volunteers were invited to participate through meetings at police departments and advertisements in police magazines, newsletters and on police-focused websites. In total, 6022 sworn North American police officers expressed interest in the study. Of those, 4957 consented to participate in a survey, either online or, in a few departments, on-site (via

pencil/paper). Participant recruitment and survey administration details have been described previously.[3] The survey assessed demographics and health information and participants reported work and sleep hours in the past 4 weeks and completed the Maslach Burnout Inventory (MBI). Of the 4957 officers who participated, 3140 completed at least one burnout dimension subscale in the MBI and were eligible for analyses. All participants provided informed consent and were eligible for a prize drawing valued up to $1000 USD.

Measures

Burnout was assessed using the MBI–Human Services Survey,[4] which consists of 22 items that assess the three burnout dimensions: EE, DP, and PA. Participants rated the frequency with which they experienced each item on a 7-point Likert scale (0=never; 6=everyday). EE and DP were defined as dichotomous variables, in which a high (versus low-moderate) risk score for these dimensions were determined (high EE ≥27 points; high DP ≥13 points). PA was also a dichotomous variable, but it was scored in the opposite direction to EE and DP, in which low (versus high-moderate) scores indicated low PA (≤31 points). Participants were considered to have high *overall burnout* if they had both high EE and DP, with or without low PA.[19]

Work information was determined using items from both the baseline and a concurrent monthly report. Participants were asked how frequently they worked night shifts (shifts involving ≥6 hours on-duty between 10PM-8AM), with responses from "never or nearly never", "1-4 times per month", "1-4 times per week", and "nearly every day". To determine the frequency of long work shifts, participants reported the shift length they worked each week for the previous 4 weeks (i.e., 8-10, 11-15, 16-19, 20-23 or ≥24 hours). Based on previous research in human service occupations,[14] *long work shifts* were classified as ≥11

hours, from which officers were grouped into those working 0, >0 to <2, ≥2 to <4, and ≥4 long shifts per week.

Participants' usual shift schedules were categorized as 'fixed', 'irregular', 'rotating' or 'other' schedules. Participants reporting that they "do not have a variable work schedule" were classified as having 'fixed' schedules. Schedules were categorized as 'rotating' if officers reported working shifts that rotated on a day-to-evening, day-to-night or evening-to-night basis. Irregular schedules were defined as shifts that rotated, but did not follow a consistent pattern, and 'other' comprised schedules that included non-day-to-day rotations (e.g., weekly/monthly rotations). Total work hours across the month were recorded using a validated questionnaire,[20] with those recording ≥48 hours per week considered to be working *long work weeks*. This categorisation was based on prior benchmarking literature in the US which defines long work weeks as 48 or more hours per week,[21] and research which has shown this cut-off to be associated with burnout.[22] Participants also recorded if they completed mandatory and/or voluntary overtime over the last 4 weeks, and the total number of hours they slept each week for the previous 4 weeks. For sleep duration, the combined total of the 4 weeks was used to calculate the average sleep duration per 24 hours, and short sleep was defined as <6 hours sleep per 24 hours. Daytime sleepiness was measured using the Epworth Sleepiness Scale (ESS; range 0-24), and a score ≥11 indicated excessive sleepiness.[23]

Statistical analysis

Multiple logistic regression models were used for cross-sectional analysis of associations between shift work (shift work characteristics and schedules), sleep duration, sleepiness and burnout (Overall burnout, EE, DP, PA). A multicollinearity assessment using variance

inflation factor, correlation coefficient and tolerance values showed no collinearity in the predictor variables (Supplement 1, Table S1 and Table S2). The models were adjusted for age, Body Mass Index (BMI), gender, marital status, hypertension, exercise (per week), cigarette smoking (yes/no), caffeine and alcohol consumption (yes/no during last week), primary police activity (patrol officer, supervisor/manager, detective), years as police officer, and seniority. These potentially confounding factors were selected based on prior studies.[3 24-27] Each confounder was tested individually with the burnout outcome, and we only included those that were significant (p<0.10) in initial models.[28] A backwards elimination method was then used to remove those that were not significant at the <0.05 level when all variables were included in a single model. Factors that remained were used in the first step of a hierarchical logistic regression model. The predictor variables were then added in the second step of the model that included the selected confounding factors. Model fit was assessed using the omnibus test and goodness-of-fit indices (-2 log likelihood). Unadjusted and adjusted odds ratio with 95% Confidence Intervals (CI) are reported. Our analysis included several multilevel predictors, such as night shift frequency and shift work schedules. For night shift frequency, we hypothesised a priori that a greater frequency of night shifts would be more strongly associated with burnout compared to lower frequencies. Therefore, we compared *never/nearly never* working night shifts to working night shifts *nearly every day* and *1-4 times per week* to examine if high frequency compared to low frequency of night shifts were associated with worse burnout. Furthermore, we hypothesised a priori that more variable shift work would be related to high burnout, and thus compared *fixed shifts* to all other categories of shift work (i.e., *irregular, rotating* and *other*) to examine whether greater variation in schedules predicted higher burnout. Statistical analyses were conducted using SPSS (IBM Corp, Version 24.0, Armonk, NY) and significance set at p<0.05.

Patient and public involvement

The current study was based on secondary data from a pre-existing data set. Therefore, patients and the general public were not involved in the development of the research questions, outcome measures or design of the study.

RESULTS

Police officers were aged 38.5 ± 8.3 (mean ± SD) years and had 12.7 ± 8.2 years of experience in law enforcement. Female officers (16.7%) in our sample were slightly over-represented compared to police in North America (12.2%).[29] The sample was predominantly white (Table 1), with racial and ethnic minority groups slightly under-represented compared to national police statistics.[29] The prevalence of overweight or obesity based on BMI were over-represented in the sample (80.0%) (Table 1) compared to general population data (70%).[30] Overall burnout was found in 17.7% of police. High EE and high DP were observed in 23.8% and 42.6% of the sample respectively, and low PA was observed in 40.7%. In the last month, 56.7% of police worked ≥1 night shift, 63.9% worked ≥1 long shift, and 33.6% had an irregular or rotating schedule. Mean total work hours were 192.27 ± 74.82 hours per month, mean mandatory overtime was 8.26 ± 14.14 hours per month, and mean voluntary overtime was 12.98 ± 19.83 hours per month. Short sleep duration was observed in 30.4% of police, and 25.8% had excessive sleepiness (Table 1).

Table 1. Participant characteristics

Characteristic	Data
n	3140
Age, mean (SD) years	38.48 (8.31)
Gender, n (%)	
Male	2609 (83.3)
Female	523 (16.7)
Not known	8 (0.3)
Body Mass Index, n (%)	
< 25 kg/m^2	610 (19.4)
≥ 25 and < 30 kg/m^2	1460 (46.5)
≥ 30 and < 35 kg/m^2	781 (24.9)
≥ 35 kg/m^2	271 (8.6)
Not known	18 (0.6)
Race, n (%)	
White	2681 (85.4)
Black	257 (8.2)
Asian	34 (1.1)
Native American	21 (0.7)
Pacific Islander	1 (0.03)
Other	100 (3.2)
Not known	46 (1.5)
Ethnicity, n (%)	
Hispanic	162 (5.2)
Other	2806 (89.4)
Not known	172 (5.5)
Overtime hours per month, mean (SD)	
Mandatory	8.26 (14.14)
Voluntary	12.98 (19.83)
Total	20.50 (24.62)
Night shift frequency, n (%)	
Never or nearly never	1290 (41.1)
1-4 per week	612 (19.5)
1-4 per month	584 (18.6)
Nearly every day	615 (19.6)
Not known	39 (1.2)
Long work shifts per week (≥11 hours), n (%)	
None	390 (12.4)
>0 - <2	1029 (32.8)
≥2 - <4	496 (15.8)
≥4	482 (15.4)
Not known	743 (23.7)
Work hours per week, n (%)	
<48 hours	1820 (58.0)
≥48 hours	1260 (40.1)
Not known	60 (1.9)

Table 1. *Continued.*

Characteristic	Data
Usual shift schedule, n (%)	
Fixed	1822 (58.0)
Irregular	274 (8.7)
Rotating	782 (24.9)
Other	239 (7.6)
Not known	23 (0.7)
Average sleep duration over the last 4 weeks*, n (%)	
<6 h	956 (30.4)
≥6 h	1780 (56.7)
Not known	404 (12.9)
Daytime sleepiness, n (%)	
Normal (<11 ESS) daytime sleepiness	2195 (69.9)
Excessive (≥11 ESS) daytime sleepiness	809 (25.8)
Not known	136 (4.3)
Burnout, n‡ (%)	
High EE	747 (23.8)
High DP	1338 (42.6)
Low PA	1278 (40.7)
Overall burnout†	556 (17.7)
Police officers that had at least 1 dimension of burnout, n (%)	
No	1072 (34.1)
Yes	2068 (65.9)

*per 24-hour period; †defined as high EE, high DP, with or without low PA; ‡The burnout characteristics are not mutually exclusive (e.g., a participant could have both high EE and Low PA); EE, emotional exhaustion; DP, depersonalisation; PA, personal accomplishment; ESS, Epworth Sleepiness Scale; SD, standard deviation.

Shift characteristics and burnout

The odds of high EE increased in a dose-response manner as a function of the number of long shifts worked per week, with police completing ≥4 long shifts per week having the greatest risk (adjusted odds ratio 1.91, 95% CI 1.35-2.72), compared to no long shifts. A similar relationship was demonstrated for overall burnout, with police working >0 to <2 and ≥4 long shifts per week more likely to have overall burnout (1.44, 95% CI 1.02-2.02 and 1.78, 95% CI 1.21-2.61, respectively) compared to no long shifts (Table 2); even one long shift per month increased the risk of burnout (1.4- to 1.5-fold increase; Table S3, Table S4 and Table S5). Working ≥48 hours per week was associated with reduced odds of low PA (0.83, 95% CI 0.71-0.97) compared to shorter weeks. Neither long shift frequency nor weekly work hours were related to DP. Compared to police who never/nearly never work night shifts, those working night shifts nearly every day were at an increased risk of high DP (1.32, 95% CI 1.05-1.66). Working night shifts 1 to 4 times per week was associated with lower odds of low PA (0.79, 95% CI 0.64-0.98) compared to never working nights. Police reporting mandatory overtime had an increased risk of overall burnout (1.40, 95% CI 1.14-1.71), high EE (1.37, 95% CI 1.14-1.65) and DP (1.24, 95% CI 1.04-1.47), whereas voluntary overtime was only associated with high DP (1.19, 95% CI 1.02-1.40). Reporting any overtime (mandatory or voluntary) was also associated with overall burnout (1.36, 95% CI 1.06-1.75) and high DP (1.45, 95% CI 1.20-1.76). Overtime was not related to PA.

Work schedules and burnout

Police working irregular schedules were at greatest risk of overall burnout (2.12, 95% CI 1.57-2.85), followed by high EE (1.91, 95% CI 1.44-2.54), and high DP (1.39, 95% CI 1.02-1.89) compared to those working fixed schedules. Compared to fixed schedules, police reporting rotating and 'other' schedules were more likely to have EE (1.30, 95% CI 1.06-1.59

and 1.44, 95% CI 1.05-1.98, respectively), but these associations were weaker than those observed for irregular shifts. Furthermore, police working rotating schedules were more likely to have low PA (1.38, 95% CI 1.15-1.64) compared to fixed shifts. Rotating or 'other' schedules were not associated with overall burnout or DP, and irregular or 'other' shift schedules were not related to PA (Table 3).

Table 2. High burnout outcomes associated with shift work characteristics in police (n=3140)

Shift work characteristic, *n*†	Positive result in police with burnout, No./No. total (%)		Unadjusted		Adjusted¶	
			OR (95% CI)	*P* Value	OR (95% CI)	*P* Value
	High EE	Low-moderate EE				
Night shift frequency						
Never/nearly never	290/734 (39.5)	935/2220 (42.1)				
1-4 per month	154/734 (21.0)	435/2220 (19.6)	1.14 (0.91 - 1.43)	0.252	1.13 (0.90 - 1.43)	0.292
1-4 per week	141/734 (19.2)	411/2220 (18.5)	1.11 (0.88 - 1.40)	0.395	1.06 (0.84 - 1.35)	0.628
Nearly every day	149/734 (20.3)	439/2220 (19.8)	1.09 (0.87 - 1.37)	0.438	1.12 (0.88 - 1.41)	0.363
n	2954					
Long work shifts per week (≥11 hours)						
0	69/575 (12.0)	296/1719 (17.2)				
>0 - <2	255/575 (44.3)	732/1719 (42.6)	1.49 (1.11 - 2.01)	0.008	1.48 (1.09 - 2.02)	0.013
≥2 - <4	123/575 (21.4)	355/1719 (20.7)	1.49 (1.07 - 2.07)	0.020	1.49 (1.05 - 2.11)	0.024
≥4	128/575 (22.3)	336/1719 (19.5)	1.63 (1.17 - 2.28)	0.004	1.91 (1.35 - 2.72)	<0.001
n	2294					
Long work weeks						
<48 hours	417/731 (40.9)	1303/2204 (59.1)				
≥48 hours	314/731 (43.0)	901/2204 (40.9)	1.09 (0.92 - 1.29)	0.324	1.14 (0.96 - 1.36)	0.141
n	2935					
Mandatory overtime						
No	305/653 (46.7)	1056/1911 (55.3)				
Yes	348/653 (53.3)	855/1911 (44.7)	1.41 (1.18 - 1.68)	<0.001	1.37 (1.14 - 1.65)	0.001
n	2564					
Voluntary overtime						
No	306/646 (47.4)	881/1935 (45.5)				
Yes	340/646 (52.6)	1054/1935 (54.5)	0.93 (0.78 - 1.11)	0.417	0.94 (0.78 - 1.12)	0.475
n	2581					
Any overtime (Mandatory or voluntary)						
No	143/618 (23.1)	487/1799 (27.1)				
Yes	475/618 (76.9)	1312/1799 (72.9)	1.23 (1.00 - 1.53)	0.055	1.21 (0.97 - 1.50)	0.095
n	2417					
	High DP	Low-moderate DP				
Night shift frequency						
Never/nearly never	481/1320 (36.4)	771/1700 (45.4)				
1-4 per month	285/1320 (21.6)	316/1700 (18.6)	1.45 (1.19 - 1.76)	<0.001	1.21 (0.96 - 1.51)	0.101
1-4 per week	254/1320 (19.2)	314/1700 (18.5)	1.30 (1.06 - 1.86)	0.011	1.07 (0.84 - 1.35)	0.592
Nearly every day	300/1320 (22.7)	299/1700 (17.6)	1.61 (1.32 - 1.96)	<0.001	1.32 (1.05 - 1.66)	0.018
n	3020					
Long work shifts per week (≥11 hours)						
0	151/1027 (14.7)	226/1316 (17.2)				
>0 - <2	476/1027 (46.3)	535/1316 (40.7)	1.33 (1.05 - 1.69)	0.019	1.20 (0.93 - 1.54)	0.157
≥2 - <4	218/1027 (21.2)	268/1316 (20.4)	1.22 (0.93 - 1.60)	0.157	1.09 (0.81 - 1.45)	0.578
≥4	182/1027 (17.7)	287/1316 (21.8)	0.95 (0.72 - 1.25)	0.712	0.96 (0.71 - 1.29)	0.804
n	2343					
Long work weeks						
<48 hours	789/1325 (59.5)	976/1674 (58.3)				
≥48 hours	536/1325 (40.5)	698/1674 (41.7)	0.95 (0.82 - 1.10)	0.492	0.98 (0.83 - 1.15)	0.779
n	2999					
Mandatory overtime						
No	568/1199 (47.4)	814/1424 (57.2)				
Yes	631/1199 (52.6)	610/1424 (42.8)	1.48 (1.27 - 1.73)	<0.001	1.24 (1.04 - 1.47)	0.014
n	2623					
Voluntary overtime						
No	521/1196 (43.6)	694/1444 (48.1)				
Yes	675/1196 (56.4)	750/1444 (51.9)	1.20 (1.03 - 1.40)	0.021	1.19 (1.02 - 1.40)	0.030
n	2640					
Any overtime (Mandatory or voluntary)						
No	235/1130 (20.8)	406/1345 (30.2)				
Yes	895/1130 (79.2)	939/1345 (69.8)	1.65 (1.37 - 1.98)	<0.001	1.45 (1.20 - 1.76)	<0.001
n	2475					

Table 2. *Continued*

Shift work characteristic, *n*[†,‡]	Positive result in police with high burnout, No./No. total (%)		Unadjusted		Adjusted[¶]	
			OR (95% CI)	*P* Value	OR (95% CI)	*P* Value
	Low PA	Moderate-high PA				
Night shift frequency						
Never/nearly never	532/1259 (42.3)	676/1674 (40.4)				
1-4 per month	247/1259 (19.6)	329/1674 (19.7)	0.95 (0.78 - 1.17)	0.645	0.94 (0.76 - 1.15)	0.544
1-4 per week	220/1259 (17.5)	341/1674 (20.4)	0.82 (0.67 - 1.01)	0.056	0.79 (0.64 - 0.98)	0.029
Nearly every day	260/1259 (20.7)	328/1674 (19.6)	1.01 (0.83 - 1.23)	0.943	0.92 (0.75 - 1.12)	0.401
n	2933					
Long work shifts per week (≥11 hours)						
0	167/962 (17.4)	201/1314 (15.3)				
>0 - <2	426/962 (44.3)	557/1314 (42.4)	0.92 (0.72 - 1.17)	0.500	0.90 (0.69 - 1.16)	0.399
≥2 - <4	193/962 (20.1)	280/1314 (21.3)	0.83 (0.63 - 1.09)	0.183	0.84 (0.63 - 1.12)	0.234
≥4	176/962 (18.3)	276/1314 (21.0)	0.77 (0.58 - 1.02)	0.063	0.77 (0.57 - 1.04)	0.085
n	2276					
Long work weeks						
<48 hours	770/1248 (61.7)	952/1670 (57.0)				
≥48 hours	478/1248 (38.3)	718/1670 (43.0)	0.82 (0.71 - 0.96)	0.011	0.83 (0.71 - 0.97)	0.017
n	2918					
Mandatory overtime						
No	562/1092 (51.5)	781/1463 (53.4)				
Yes	530/1092 (48.5)	682/1463 (46.6)	1.08 (0.92 - 1.26)	0.337	1.01 (0.86 - 1.18)	0.935
n	2555					
Voluntary overtime						
No	524/1093 (47.9)	660/1478 (47.9)				
Yes	569/1093 (52.1)	818/1478 (55.3)	0.88 (0.75 - 1.03)	0.098	0.89 (0.76 - 1.05)	0.156
n	2571					
Any overtime (Mandatory or voluntary)						
No	263/1030 (25.5)	357/1379 (25.9)				
Yes	767/1030 (74.5)	1022/1379 (74.5)	1.02 (0.85 - 1.23)	0.844	0.96 (0.80 - 1.17)	0.704
n	2409					
	Overall burnout	No overall burnout				
Night shift frequency						
Never/nearly never	202/545 (37.1)	1085/2547 (42.6)				
1-4 per month	121/545 (22.2)	489/2547 (19.2)	1.32 (1.04 - 1.71)	0.025	1.25 (0.97 - 1.61)	0.092
1-4 per week	110/545 (20.2)	473/2547 (18.6)	1.25 (0.97 - 1.61)	0.089	1.11 (0.85 - 1.14)	0.449
Nearly every day	112/545 (20.6)	500/2547 (19.6)	1.20 (0.93 - 1.55)	0.154	1.12 (0.86 - 1.45)	0.407
n	3092					
Long work shifts per week (≥11 hours)						
0	51/426 (12.0)	338/1967 (17.2)				
>0 - <2	191/426 (44.8)	835/1967 (42.5)	1.52 (1.09 - 2.12)	0.015	1.44 (1.02 - 2.02)	0.038
≥2 - <4	88/426 (20.7)	408/1967 (20.7)	1.43 (0.98 - 2.08)	0.061	1.36 (0.93 - 2.00)	0.116
≥4	96/426 (22.5)	386/1967 (19.6)	1.65 (1.14 - 2.39)	0.008	1.78 (1.21 - 2.61)	0.003
n	2393					
Long work weeks						
<48 hours	309/547 (56.5)	1503/2524 (59.5)				
≥48 hours	238/547 (43.5)	1021/2524 (40.5)	1.13 (0.94 - 1.37)	0.188	1.13 (0.94 - 1.37)	0.201
n	3071					
Mandatory overtime						
No	222/496 (44.8)	1196/2178 (54.9)				
Yes	274/496 (55.2)	982/2178 (45.1)	1.50 (1.24 - 1.83)	<0.001	1.40 (1.14 - 1.71)	0.001
n	2674					
Voluntary overtime						
No	225/489 (46.0)	1016/2201 (46.2)				
Yes	264/489 (54.0)	1185/2201 (53.8)	1.01 (0.83 - 1.23)	0.952	1.01 (0.83 - 1.24)	0.910
n	2690					
Any overtime (Mandatory or voluntary)						
No	97/471 (20.6)	564/2048 (27.5)				
Yes	374/471 (79.4)	1484/2048 (72/5)	1.56 (1.31 - 1.87)	<0.001	1.36 (1.06 - 1.75)	0.014
n	2519					

EE, emotional exhaustion; DP, depersonalisation; PA, personal accomplishment; OR, odds ratio; CI, confidence interval; †The *n* presented represents the sample for each unadjusted analysis. The *n* for the adjusted analyses are in Supplement 1, Table S6; ‡Some participants did not provide sufficient information from which to determine their shift work characteristics. The *n* presented are from those who answered sufficiently; ¶Adjusted for age, BMI, gender, marital status, hypertension, cigarette use, caffeine use, alcohol, second job, primary activity, years as police officer, exercise frequency, and seniority. Variables included in each model are in Supplement 1, Table S6, and model fit is reported in Supplement 1, Table S7.

Table 3. High burnout outcomes associated with shift work schedules in police (n=3140)

Shift work schedule, *n*[†,‡]	Positive result in police with high burnout, No./No. total (%)		Unadjusted		Adjusted[¶]	
			OR (95% CI)	*P* Value	OR (95% CI)	*P* Value
	High EE	Low-moderate EE				
Fixed	382/743 (51.4)	1366/2227 (61.3)				
Irregular	96/743 (12.9)	168/2227 (7.5)	2.04 (1.55 – 2.69)	<0.001	1.91 (1.44 - 2.54)	<0.001
Rotating	200/743 (26.9)	534/2227 (24.0)	1.34 (1.10 - 1.63)	0.004	1.30 (1.06 - 1.59)	0.011
Other	65/743 (8.7)	159/2227 (7.1)	1.46 (1.07 - 1.99)	0.016	1.44 (1.05 - 1.98)	0.024
n	2970					
	High DP	Low-moderate DP				
Fixed	740/1331 (55.6)	1038/1703 (61.0)				
Irregular	146/1331 (11.0)	117/1703 (6.9)	1.75 (1.35 - 2.27)	<0.001	1.39 (1.02 - 1.89)	0.038
Rotating	343/1331 (25.8)	416/1703 (24.4)	1.16 (0.96 - 1.37)	0.096	0.97 (0.80 - 1.18)	0.830
Other	102/1331 (7.7)	132/1703 (7.8)	1.08 (0.82 - 1.43)	0.566	1.07 (0.78 - 1.45)	0.665
n	3034					
	Low PA	Moderate-high PA				
Fixed	695/1271 (54.7)	1030/1679 (61.3)				
Irregular	107/1271 (8.4)	158/1679 (9.4)	1.00 (0.77 - 1.31)	0.978	0.97 (0.74 - 1.27)	0.845
Rotating	366/1271 (28.8)	370/1679 (22.0)	1.47 (1.23 - 1.74)	<0.001	1.38 (1.15 - 1.64)	<0.001
Other	103/1271 (8.1)	121/1679 (7.2)	1.26 (0.95 - 1.67)	0.104	1.27 (0.96 - 1.69)	0.100
n	2950					
	Overall burnout	No overall burnout				
Fixed	279/553 (50.5)	1539/2555 (60.2)				
Irregular	82/553 (14.8)	192/2555 (7.5)	2.36 (1.77 - 3.14)	<0.001	2.12 (1.57 - 2.85)	<0.001
Rotating	146/553 (26.4)	632/2555 (24.7)	1.27 (1.02 - 1.59)	0.031	1.24 (0.99 - 1.56)	0.065
Other	46/553 (8.3)	192/2555 (7.5)	1.32 (0.94 - 1.87)	0.114	1.30 (0.91 - 1.84)	0.153
n	3108					

EE, emotional exhaustion; DP, depersonalisation; PA, personal accomplishment; OR, odds ratio; CI, confidence interval; [†]The *n* presented represents the sample for each unadjusted analysis. The *n* for the adjusted analyses are in Supplement 1, Table S6; ‡Some participants did not provide sufficient information from which to determine their shift work schedule. The *n* presented are from those who answered sufficiently; [¶]Adjusted for age, BMI, gender, marital status, hypertension, cigarette use, caffeine use, alcohol use, second job, primary activity, years as police officer, exercise frequency, and seniority. Variables included in each model are in Supplement 1, Table S6, and model fit is reported in Supplement 1, Table S7.

Sleep and burnout

Police who reported, on average, short sleep (<6 hours) were more likely to have overall burnout (1.49, 95% CI 1.21-1.81), high EE (1.60, 95% CI 1.33-1.93) and low PA (1.24, 95% CI 1.05-1.47) compared to those sleeping ≥6 hours. Short sleep was not associated with DP (Table 4). Police with excessive sleepiness were more likely to have overall burnout (1.72, 95% CI 1.41-2.11), high EE (1.81, 95% CI 1.50-2.18) and high DP (1.48, 95% CI 1.23-1.78) compared to police with normal sleepiness (Table 4).

Table 4. High burnout outcomes associated with sleep duration and sleepiness in police (n=3140)

Sleep characteristics, *n*†,‡	Positive result in police with high burnout, No./No. total (%)		Unadjusted		Adjusted¶	
			OR (95% CI)	*P* Value	OR (95% CI)	*P* Value
	High EE	Low-moderate EE				
Sleep duration						
≥6 hours per night	371/654 (56.7)	1334/1956 (68.2)				
<6 hours per night	283/654 (43.3)	622/1956 (31.8)	1.64 (1.36 - 1.96)	<0.001	1.60 (1.33 - 1.93)	<0.001
n	2610					
Sleepiness						
<11 ESS	451/714 (63.2)	1652/2158 (76.6)				
≥11 ESS	263/714 (36.8)	506/2158 (23.4)	1.90 (1.59 - 2.28)	<0.001	1.81 (1.50 - 2.18)	<0.001
n	2872					
	High DP	Low-moderate DP				
Sleep duration						
≥6 hours per night	755/1206 (62.6)	989/1469 (67.3)				
<6 hours per night	451/1206 (37.4)	480/1469 (32.7)	1.23 (1.05 - 1.44)	0.011	1.13 (0.96 - 1.33)	0.151
n	2675					
Sleepiness						
<11 ESS	875/1286 (68.0)	1267/1639 (77.3)				
≥11 ESS	411/1286 (32.0)	372/1639 (22.7)	1.60 (1.38 - 1.89)	<0.001	1.48 (1.23 - 1.78)	<0.001
n	2925					
	Low PA	Moderate-high PA				
Sleep duration						
≥6 hours per night	670/1077 (62.2)	1024/1524 (67.2)				
<6 hours per night	407/1077 (37.8)	500/1524 (32.8)	1.24 (1.06 - 1.46)	0.009	1.24 (1.05 - 1.47)	0.011
n	2601					
Sleepiness						
<11 ESS	867/1224 (70.8)	1213/1627 (74.6)				
≥11 ESS	357/1224 (29.2)	414/1627 (25.4)	1.21 (1.02 - 1.43)	0.027	1.18 (0.99 - 1.41)	0.061
n	2851					
	Overall burnout	No overall burnout				
Sleep duration						
≥6 hours per night	279/491 (56.8)	1497/2238 (66.9)				
<6 hours per night	212/491 (43.2)	741/2238 (33.1)	1.54 (1.26 - 1.87)	<0.001	1.49 (1.21 - 1.81)	<0.001
n	2729					
Sleepiness						
<11 ESS	338/532 (63.5)	1852/2464 (75.2)				
≥11 ESS	194/532 (36.5)	612/2464 (24.8)	1.74 (1.42 - 2.12)	<0.001	1.72 (1.41 - 2.11)	<0.001
n	2996					

EE, emotional exhaustion; DP, depersonalisation; PA, personal accomplishment; ESS, Epworth Sleepiness Scale; OR, odds ratio; CI, confidence interval; †The *n* presented represents the sample for each unadjusted analysis. The *n* for the adjusted analyses are in Supplement 1, Table S6; ‡Some participants did not provide sufficient information from which to determine their sleep duration and sleepiness. The *n* presented are from those who answered sufficiently; ¶Adjusted for age, BMI, gender, marital status, hypertension, cigarette use, caffeine use, alcohol use, second job, primary activity, years as police officer, exercise frequency, and seniority. Variables included in each model are in Supplement 1, Table S6, and model fit is reported in Supplement 1, Table S7.

DISCUSSION

In this sample of North American police officers, 17% exhibited overall burnout, which is higher than the 10% previously observed in office workers.[19] Two-thirds of the sample (65.9%) were also found to have at least one dimension of burnout, and this too exceeds levels reported in other human service occupations and the general population.[31] Long shifts, mandatory overtime, short sleep and sleepiness were each associated with significantly increased risk of overall burnout in police. Among the different schedules, officers working irregular shifts had a 2-fold higher risk of overall burnout, demonstrating the risk of burnout associated with this schedule for the first time in police. For individual dimensions of burnout, almost half of police had high depersonalisation (43%), the same was true for low personal accomplishment (41%), while nearly a quarter had high emotional exhaustion (24%). The prevalence of DP was higher in this sample of police compared to the US general population (15%), and EE levels were similar to general population data (23%).[31] The risk of EE was higher in police working a greater frequency of long shifts, and working night shifts nearly every day were associated with an increased risk of DP. Long work weeks were associated with reduced odds of low PA, and mandatory, but not voluntary, overtime increased EE. There was an increased likelihood of EE and PA among police reporting short sleep, and an increased risk for EE and DP in those with excessive sleepiness.

Police regularly completing long work shifts were at increased risk of overall burnout and high EE. Previous studies in nurses have reported similar associations between increased hours of work on the most recent shift and high burnout.[13 14] We expand on these findings by demonstrating how the risk of EE is dependent on the number of long shifts worked, with

working ≥4 long shifts associated with nearly double the risk of EE. Working ≥1 long shift per month and ≥4 long shifts per week were also associated with high EE and overall burnout, but the risk conferred by other shift frequencies (i.e., >0 to <2, 2 to <4 long shifts per week) was less consistent for these aspects of burnout. Working ≥48 hours per week was associated with reduced odds of low PA in police, which contrasts research in physicians using a similar definition of weekly work hours,[22] as well as a prior study in UK police that defined long work weeks using a slightly higher threshold (≥49 hours per week).[27] Long work weeks and night shifts (1 to 4 per week) were the only shift characteristics in this study associated with reduced odds of low PA. Although these findings were unexpected, they may highlight certain aspects of shift work in policing that allow personnel to feel effective and a sense of accomplishment in their work, but further research that explores the relationships between PA and weekly night shifts (e.g., comparing 1-2 and 3-4 night shifts per week) and work hours (e.g., ≥49 or ≥60 hours) in more detail is needed to confirm these findings. Compared to weekly work hours, however, the associations between long work shifts and burnout were positive, typically stronger and affected more burnout dimensions. This is an important detail, as it demonstrates how the distribution of work hours, not just total overall hours, influences burnout in police. This suggests the need for shorter and less compressed shifts that spread work hours across the week to reduce burnout. For instance, Amendola et al.[8] found that police working 10-hour shifts reported longer sleep and higher quality of work-life balance compared 8- or 12-hour shifts, although burnout was not examined in that study. Further research is needed to examine whether shortening shift lengths, as well as limiting the frequency of long work shifts, also reduces burnout in police as it has been shown in EMTs.[15]

Mandatory overtime was associated with an increased risk of overall burnout, high EE, and DP among police. Conversely, voluntary overtime was not associated with EE or overall burnout, but was associated with high DP. A prior study in police failed to show a relationship between overtime (combined voluntary and mandatory) and burnout.[18] The results of our study suggest the control a police officer has over overtime may influence how closely this shift characteristic is associated with burnout, in particular overall burnout and EE. This interpretation is supported by research from Beckers *et al*.[32] in full-time workers who reported involuntary overtime was associated with high emotional fatigue and low job satisfaction, and classified involuntary overtime workers as a burnout risk group. In their study, Becker and colleagues[32] did not examine DP, but based on our findings in police, it is possible that voluntary (and mandatory) overtime may pose a risk to this dimension. Further research determining the specific durations of overtime associated with high burnout and which dimensions of burnout is needed to inform policies regarding the safe provision of work hours in excess of normal shift lengths.

Increased frequency of night shifts was associated with high DP in police, but not overall burnout or EE. Research has reported associations between increased night work and burnout in healthcare personnel, but only for overall burnout and EE.[12 33] Furthermore, the rate of night shifts per month was not found to associate with burnout among healthcare workers.[33] These inconsistencies may reflect differences among human service professions and perhaps their physical environments (e.g., lighting levels that affect mood and alertness)[34] that may impact the manifestation of burnout dimensions. For instance, healthcare workers typically develop higher rates of EE,[35] whereas police report greater DP,[36] as demonstrated in the current study. High DP reflects a critical relationship between people and their work, as it refers to negative feelings and

attitudes toward one's clients.[4] Therefore, high DP in police could be due to the difficult nature of some of the people with whom police interact. In addition to sleep disruption with night work, police encounter more stressful events at night.[37] Sleep is further disrupted among people with untreated sleep disorders, and common sleep disorders are shown to increase the likelihood of police demonstrating anger towards suspects or citizens.[3] Thus, the combination of poor mood, sleep and difficult clients may explain the increased risk of DP associated with regular night work in police. Further research comparing police attitudes towards clients with whom they interact at night compared to the day is needed to understand the mechanisms underpinning the increased risk of DP conferred by night shifts in police.

Police officers who reported short sleep had a greater risk of overall burnout, high EE and low PA, while sleepiness increased the likelihood for EE, DP and overall burnout. Similar sleepiness levels have been related to high burnout in medical students.[26] Our findings for sleep duration are also consistent with research showing short sleep over a month increases overall burnout in police.[11] Inadequate sleep may impair police officers' ability to recover from occupational demands, potentially explaining the heightened burnout risk in those reporting short sleep in this study. Achieving sufficient sleep can be difficult when working at night and/or long hours, as these shifts may limit sleep opportunities at night and involve attempts by the shift worker to sleep at times of the day when alertness levels are high (and sleep propensity is low).[38] Indeed, when restricting the sample to police regularly completing long shifts, officers reporting short sleep and excessive sleepiness had a 2-fold increased risk of EE (Table S8, Table S4 and Table S5). These findings highlight the health burden of sleepiness and sleep loss in law enforcement, and the need for interventions that address sleep in addition to optimising shift schedules.

Police working irregular shifts were more likely to have overall burnout, high EE and DP compared to officers working fixed shifts. Canadian workers completing non-standard schedules (shifts other than fixed 9AM-5PM) have also been found to have increased overall burnout and EE,[39] but to our knowledge, this is the only other study to have investigated the relationship between irregular or non-standard schedules and burnout. A growing body of research suggests that greater variability in sleep duration and bedtimes predict worse mental health.[40] Workers with irregular shifts are likely to have more variability in their sleep patterns,[41] which in turn, may explain the increased burnout risk among police engaged in this schedule. Considering 8.7% of our sample worked irregular shifts, our findings may have implications for arranging work schedules to limit irregular shifts to reduce burnout. Rotating shifts were also common among police in our study (24.9%), and associated with high EE and low PA. Conversely, nurses working fixed shifts compared to rotating schedules are reported to have greater EE and DP,[42] but not low PA, with those working fixed night and morning shifts showing the highest levels of EE and DP.[43] The hazards related to fixed night shifts are well documented,[44] although in the current study it was not possible to specifically identify the types of fixed shifts police completed (e.g., fixed night vs fixed day shifts). Despite this limitation, when we restricted the analysis to police only working fixed shifts, those reporting a greater frequency of night shifts had an increased risk of DP (Table S9, Table S10 and Table S11), which aligns with previous findings for fixed night work.[43] In addition to the different types of fixed shifts, there is also a diverse range of shift rotations in policing, which were grouped into one variable (i.e., rotating schedules) in our study. Specific shift rotations and types of fixed shifts may have varying effects on burnout, thus underspecifying these schedules in the current study may limit the interpretation

of our findings. Further research that utilises detailed objective shift work information will allow for a more nuanced approach when it comes to examining interactions between different shift schedules and burnout in police and other emergency services.

In addition to subjective shift information, a further limitation of this study was the use of self-reported sleep characteristics. Although some questions used to record police officers' work and sleep hours have been validated,[20] participants were required to report and recall this information for the prior month. An additional limitation was the cross-sectional design. Future longitudinal studies using objective work and sleep measures are needed to examine the causality within our findings.

The results of this study among police contribute to a growing evidence-base in shift workers that indicates how the number of long shifts and night shifts, mandatory overtime and short sleep and sleepiness raise the risk of burnout. Importantly, we further demonstrate that irregular schedules present a significant risk for burnout. These findings support future research in police that trials reducing the rate of long shifts and night shifts per week in vulnerable officers, and preventing irregular schedules where possible. Although shift work is unavoidable for industries such as law enforcement, optimising work hours in relation to control over overtime, consistency of schedules and reducing duration and frequency of night and long shifts should be explored as a way to lower the high level of burnout among police, leading to improved health for personnel, and enhanced performance for their department and communities whom they serve.

Contribution statement:

SAP, APW, LKB, CSO, JPS, SQ, SWL, CAC and SMWR contributed to the design of the study. LKB, CSO, JPS, SQ, SWL, CAC and SMWR contributed to data collection. SAP, APW, LKB and SMWR conducted the data analysis. SAP, APW, LKB, CSO, JPS, SQ, SWL, CAC and SMWR contributed to the interpretation of the data, and the preparation and refinement of the final manuscript.

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Data sharing statement:

No additional data available.

Ethics approval:

This study was approved by the Ethics Committees of Partners HealthCare (2015P001357/BHW) and Monash University (2736).

Competing interests statement:

SAP, APW, JPS, SQ and CSO report no conflicts of interest. SMWR reports that he has served as a consultant through his institution to Philips Respironics, EdanSafe, National Transport Commission, Vanda Pharmaceuticals, Rail, Bus and Train Union, Tontine Group, Australian Workers' Union, Transport Accident Commission, Meda Consumer Healthcare, New South Wales Department of Education and Communities, and has through his institution received grants from Philips Respironics and Vanda Pharmaceuticals and reimbursements for conference travel expenses from Vanda Pharmaceuticals. SMWR currently serves as a consult to, and is a Program Leader for, the Cooperative Research Centre for Alertness, Safety and Productivity. SMWR institution has received equipment donations or other support from Compumedics, Philips Lighting, Optalert and Tyco Healthcare. SMWR is a former President of the Australasian Sleep Association and is a Director of the Sleep Health Foundation. SMWR has also served as an expert witness and/or consultant to shift work organizations. LKB reports research support from Cephalon, NFL charities, Sysco and San Francisco Bar Pilots. LKB has received consulting/lecture fees or served as a board member for Alertness Solution, Ceridian, Davis Joint Unified School Board, San Jose State University Foundation, Pugot Sound Pilots, Sygma and Torvec. SWL has no conflicts of interests directly related to the research or results reported in this paper. SWL holds a process patent for 'Systems and methods for determining and/or controlling sleep quality', which is assigned to the Brigham and Women's Hospital per Hospital policy. SWL has also served as a paid expert for legal proceedings related to light, sleep and health. SWL is a Program Leader for the CRC for Alertness, Safety and Productivity, Australia. CAC reports grants from Cephalon Inc., grants from Mary Ann & Stanley Snider via Combined Jewish Philanthropies, grants from National Football League Charities, grants from Optum,

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Supplement

Table S1. Multicollinearity statistics for all shift work and sleep predictor variables included in the multiple logistic regression analysis

Predictor variable	Multicollinearity Statistics	
	Tolerance	Variance Inflation Factor
Emotional Exhaustion		
Night shift frequency	0.932	1.073
Long work shifts	0.884	1.131
Long work weeks	0.860	1.163
Mandatory overtime	0.525	1.904
Voluntary overtime	0.455	2.197
Any overtime	0.352	2.840
Shift rotation	0.977	1.023
Sleep duration	0.947	1.056
Sleepiness	0.982	1.019
Depersonalisation		
Night shift frequency	0.936	1.068
Long work shifts	0.888	1.127
Long work weeks	0.859	1.164
Mandatory overtime	0.528	1.893
Voluntary overtime	0.458	2.181
Any overtime	0.354	2.821
Shift rotation	0.978	1.023
Sleep duration	0.951	1.051
Sleepiness	0.984	1.017
Personal Accomplishment		
Night shift frequency	0.940	1.064
Long work shifts	0.885	1.130
Long work weeks	0.862	1.161
Mandatory overtime	0.532	1.881
Voluntary overtime	0.462	2.165
Any overtime	0.357	2.798
Shift rotation	0.977	1.023
Sleep duration	0.954	1.049
Sleepiness	0.986	1.014
Burnout (High EE+DP)		
Night shift frequency	0.934	1.071
Long work shifts	0.883	1.133
Long work weeks	0.858	1.165
Mandatory overtime	0.527	1.898
Voluntary overtime	0.455	2.198
Any overtime	0.350	2.854
Shift rotation	0.979	1.022
Sleep duration	0.950	1.053
Sleepiness	0.983	1.018

EE, emotional exhaustion; DP, depersonalization.

Table S2. Pearson correlation coefficient between shift work and sleep predictor variables

	Long work shifts	Long work weeks	Mandatory overtime	Voluntary overtime	Any overtime	Shift rotation	Sleep Duration	Sleepiness
Night shift frequency	0.076	0.053	0.155	0.034	0.132	0.026	0.146	0.099
Long work shifts		0.324	0.094	0.106	0.115	-0.027	0.057	0.031
Long work weeks			0.068	0.244	0.195	-0.051	0.056	0.008
Mandatory overtime				-0.033	0.539	0.102	0.101	0.059
Voluntary overtime					0.609	-0.012	0.013	0.006
Any overtime						0.063	0.071	0.021
Shift rotation							0.105	0.011
Sleep duration								0.074

Table S3. High burnout outcomes associated with working at least 1 long shift in the past 4 weeks (n=3140)

Worked >0 Long Shifts in Past 4 Weeks, *n*[†,‡]	Positive result in police with high burnout, No./No. total (%)		Unadjusted		Adjusted[¶]	
			OR (95% CI)	*P* Value	OR (95% CI)	*P* Value
	High EE	Low-moderate EE				
No	69/575 (12.0)	296/1719 (17.2)				
Yes	506/575 (88.0)	1423/1719 (82.8)	1.53 (1.52 - 2.02)	0.003	1.54 (1.51 - 2.06)	0.004
n	2294					
	High DP	Low-moderate DP				
No	151/1027 (14.7)	226/1316 (17.2)				
Yes	876/1027 (85.3)	1090/1316 (82.8)	1.20 (0.96 - 1.51)	0.107	1.12 (0.88 - 1.41)	0.365
n	2343					
	Low PA	Moderate-high PA				
No	167/962 (17.4)	201/1314 (15.3)				
Yes	795/962 (82.6)	1113/1314 (84.7)	0.86 (0.69 - 1.08)	0.187	0.85 (0.67 – 1.08)	0.1.87
n	2276					
	Overall burnout	No overall burnout				
No	51/426 (12.0)	338/1967 (17.2)				
Yes	375/426 (88.0)	1629/1967 (82.8)	1.53 (1.11 - 2.09)	0.009	1.43 (1.04 - 1.98)	0.029
n	2393					

EE, emotional exhaustion; DP, depersonalisation; PA, personal accomplishment; OR, odds ratio; CI, confidence interval; [†]The *n* presented represents the sample for each unadjusted analysis. The *n* for the adjusted analyses are in Supplement 1, Table S4; ‡Some participants did not provide sufficient information from which to determine their long shifts. The *n* presented are from those who answered sufficiently; [¶]Adjusted for age, BMI, gender, marital status, hypertension, cigarette use, caffeine use, alcohol use, second job, primary activity, years as police officers, exercise frequency, and seniority. Variables included in each model are in Supplement 1, Table S4 and model fit is reported in Supplement 1, Table S5.

Table S4. Variables included in models used to examine associations between sleep and sleepiness, shift schedules and burnout outcomes in police regularly working long shifts (≥2 per week), more than 1 long shift in the past 4 weeks

Shift work and sleep characteristics, *n*‡	**Emotional Exhaustion**	**Depersonalisation**	**Personal Accomplishment**	**Burnout (High EE+DP)**
(Extended shift sample) Sleep duration	Gender, seniority	Age, blood pressure, primary activity, seniority	Second job	Age, seniority
n	813	782	691	842
(Extended shift sample) Sleepiness	Gender, seniority	Age, exercise	Cigarette use, second job	Seniority
n	856	904	713	887
>0 Long shifts in past 4 weeks	Gender, Cigarette use, seniority	Age, cigarette use, caffeine use, primary activity, years in law enforcement, seniority	Age, BMI†, blood pressure, caffeine use, exercise	Cigarette use, seniority
n	2230	2250	2134	2330

EE, emotional exhaustion; DP, depersonalization; OT, overtime; BMI, body mass index; †BMI was a continuous variable; ‡The *n* presented represents the sample for the adjusted analyses.

Table S5. Model fit assessment for models used to examine associations between sleep, sleepiness, shift schedules and burnout outcomes in police regularly working long shifts (≥2 per week) and more than 1 long shift in the past 4 weeks

			Block 1 model vs Baseline model			Block 2 model vs Block 1 model		Block 2 model vs Baseline model	
Predictor variable	**Baseline -2 log-likelihood**	**Block 1 -2 log-likelihood**	**χ^2**	***P* Value**	**Block 2 -2 log-likelihood**	**χ^2**	***P* Value**	**χ^2**	***P* Value**
Emotional Exhaustion									
Sleep Duration (Table S8)	955.246	926.646	28.600	<0.001	908.051	18.594	<0.001	47.194	<0.001
Sleepiness (Table S8)	992.275	964.570	27.705	<0.001	947.997	16.573	<0.001	44.278	<0.001
At least 1 long shift (Table S3)	2526.519	2458.661	67.858	<0.001	2449.703	8.959	0.003	76.816	<0.001
Depersonalisation									
Sleep Duration (Table S8)	1074.158	1033.530	40.628	<0.001	1027.265	6.265	0.012	46.894	<0.001
Sleepiness (Table S8)	1232.672	1203.538	29.134	<0.001	1183.564	19.974	<0.001	49.108	<0.001
At least 1 long shift (Table S3)	3094.782	2989.169	105.613	<0.001	2988.346	0.824	0.364	106.437	<0.001
Personal Accomplishment									
Sleep Duration (Table S8)	915.170	910.236	4.934	0.026	910.222	0.014	0.907	4.948	0.084
Sleepiness (Table S8)	957.902	948.042	9.860	0.007	947.864	0.178	0.673	10.038	0.018
At least 1 long shift (Table S3)	2905.861	2845.281	60.580	<0.001	2843.543	1.738	0.187	62.318	<0.001
Overall Burnout									
Sleep Duration (Table S8)	838.781	814.448	24.334	0.001	801.083	13.365	<0.001	37.698	<0.001
Sleepiness (Table S8)	872.535	855.789	16.746	0.010	840.539	15.250	<0.001	31.996	<0.001
At least 1 long shift (Table S3)	2204.559	2163.002	41.557	<0.001	2157.926	5.076	0.024	46.633	<0.001

Table S6. Variables included in the models used to examine associations between shift characteristics, shift schedules, sleep, and burnout outcomes

Shift work and sleep characteristics, *n*‡	**Emotional Exhaustion**	**Depersonalisation**	**Personal Accomplishment**	**Burnout (High EE+DP)**
Night shift frequency	Gender, cigarette use, seniority	Age, cigarette use, second job, primary activity, years in law enforcement, seniority	Age, BMI†, cigarette use, caffeine use, exercise	Age, cigarette use, seniority
n	2882	2440	2881	3015
Long work shifts	Gender, cigarette use, exercise, seniority	Age, cigarette use, caffeine use, primary activity, years in law enforcement, seniority	Age, caffeine use, exercise	Gender, cigarette use, seniority
n	2220	2250	2134	2328
Long work weeks	Gender, cigarette use, seniority	Age, cigarette use, second job, primary activity, seniority	Age, BMI†, cigarette use, exercise	Age, cigarette use, seniority
n	2862	2479	2873	2994
Shift schedule	Gender, cigarette use, seniority	Age, cigarette use, second job, primary activity, years in law enforcement, seniority	Age, BMI†, cigarette use, caffeine use, exercise	Age, cigarette use, years in law enforcement, seniority
n	2894	2451	2898	2992
Mandatory OT	Gender, cigarette use, seniority	Age, cigarette use, second job, primary activity, years in law enforcement, seniority	Age, BMI†, cigarette use, primary activity, exercise	Age, cigarette use, seniority
n	2512	2353	2521	2622
Voluntary OT	Gender, cigarette use, seniority	Age, cigarette use, primary activity, seniority	Age, BMI†, cigarette use, primary activity, seniority	Age, cigarette use, seniority
n	2531	2587	2536	2639
Any OT	Gender, cigarette use, seniority	Age, cigarette use, primary activity, years in law enforcement, seniority	Age, cigarette use, exercise	Age, cigarette use, seniority
n	2368	2407	2378	2470
Sleepiness	Gender, cigarette use, exercise, seniority	Age, cigarette use, second job, primary activity, seniority	Age, BMI†, cigarette use, exercise	Age, cigarette use, seniority
n	2772	2375	2667	2921
Sleep duration	Gender, cigarette use, seniority	Age, cigarette use, caffeine use, primary activity, exercise, seniority	Age, BMI†, cigarette use, primary activity, exercise	Age, primary activity, seniority
n	2554	2595	2537	2663

EE, emotional exhaustion; DP, depersonalization; OT, overtime; BMI, body mass index; †BMI was a continuous variable; ‡The *n* presented represents the sample for the adjusted analyses.

Table S7. Model fit assessment for models used to examine associations between shift work characteristics, shift schedules, sleep and burnout outcomes

			Block 1 model vs Baseline model			Block 2 model vs Block 1 model		Block 2 model vs Baseline model	
Predictor variable	**Baseline -2 log-likelihood**	**Block 1 -2 log-likelihood**	**χ^2**	***P* Value**	**Block 2 -2 log-likelihood**	**χ^2**	***P* Value**	**χ^2**	***P* Value**
Emotional Exhaustion									
Night shift frequency	3242.398	3177.483	64.915	<0.001	3176.031	1.451	0.694	66.367	<0.001
Long work shifts per week (≥11 hours)	2518.501	2437.941	80.560	<0.001	2424.368	13.573	0.004	94.133	<0.001
Long work weeks	3224.288	3163.277	61.011	<0.001	3161.114	2.162	0.141	63.173	<0.001
Mandatory overtime	2855.519	2803.785	51.734	<0.001	2792.186	11.599	0.001	63.333	<0.001
Voluntary overtime	2851.474	2803.191	48.282	<0.001	2802.681	0.510	0.475	48.792	<0.001
Any overtime (Mandatory or voluntary)	2695.674	2650.557	45.117	<0.001	2647.720	2.836	0.092	47.953	<0.001
Shift schedule	3264.646	3200.499	64.147	<0.001	3176.911	23.588	<0.001	87.735	<0.001
Sleep duration	2884.430	2829.733	54.696	<0.001	2805.322	24.411	<0.001	79.108	<0.001
Sleepiness	3124.160	3046.472	77.688	<0.001	3009.107	37.365	<0.001	115.053	<0.001
Depersonalisation									
Night shift frequency	3360.466	3252.568	107.898	<0.001	3245.833	6.734	0.081	114.632	<0.001
Long work shifts per week (≥11 hours)	3094.782	2989.169	105.613	<0.001	2984.924	4.245	0.236	109.858	<0.001
Long work weeks	3415.808	3316.551	99.258	<0.001	3316.472	0.078	0.779	99.336	<0.001
Mandatory overtime	3243.362	3134.813	108.549	<0.001	3128.779	6.034	0.014	114.583	<0.001
Voluntary overtime	3568.120	3475.359	92.761	<0.001	3470.640	4.719	0.030	97.480	<0.001
Any overtime (Mandatory or voluntary)	3322.268	3216.873	105.395	<0.001	3202.430	14.443	<0.001	119.838	<0.001
Shift schedule	3376.754	3267.995	108.759	<0.001	3263.216	4.779	0.189	113.538	<0.001
Sleep duration	3579.600	3464.638	114.963	<0.001	3462.581	2.056	0.152	117.019	<0.001
Sleepiness	3273.321	3180.016	93.305	<0.001	3163.182	16.833	<0.001	110.138	<0.001
Personal Accomplishment									
Night shift frequency	3933.344	3862.300	71.044	<0.001	3857.460	4.841	0.184	75.885	<0.001
Long work shifts per week (≥11 hours)	2905.861	2845.281	60.580	<0.001	2841.977	3.304	0.347	63.884	<0.001
Long work weeks	3922.667	3854.019	68.648	<0.001	3848.346	5.674	0.017	74.322	<0.001
Mandatory overtime	3441.816	3381.423	60.393	<0.001	3381.416	0.007	0.935	60.400	<0.001
Voluntary overtime	3459.090	3392.836	66.254	<0.001	3390.823	2.012	0.156	68.266	<0.001
Any overtime (Mandatory or voluntary)	3246.670	3183.680	62.990	<0.001	3183.536	0.144	0.704	63.134	<0.001
Shift schedule	3959.849	3895.533	64.316	<0.001	3881.181	14.352	0.002	78.668	<0.001
Sleep duration	3443.452	3390.407	53.045	<0.001	3384.026	6.380	0.012	59.425	<0.001
Sleepiness	3643.751	3580.752	62.999	<0.001	3577.116	3.505	0.061	66.635	<0.001
Overall Burnout									
Night shift frequency	2828.199	2767.204	60.995	<0.001	2764.317	2.888	0.409	63.883	<0.001
Long work shifts per week (≥11 hours)	2203.759	2156.970	46.789	<0.001	2147.794	9.176	0.027	55.965	<0.001
Long work weeks	2825.977	2768.128	57.849	<0.001	2766.499	1.629	0.202	59.478	<0.001
Mandatory overtime	2522.921	2471.633	51.289	<0.001	2461.084	10.549	0.001	61.837	<0.001
Voluntary overtime	2509.058	2462.021	47.038	<0.001	2462.008	0.013	0.910	47.051	<0.001
Any overtime (Mandatory or voluntary)	2386.497	2342.340	44.158	<0.001	2336.122	6.218	0.013	50.375	<0.001
Shift schedule	2825.181	2759.886	65.295	<0.001	2736.336	23.549	<0.000	88.845	<0.001
Sleep duration	2527.726	2473.363	54.363	<0.001	2458.897	14.466	<0.001	68.829	<0.001
Sleepiness	2748.475	2693.100	55.375	<0.001	266.405	26.694	<0.001	82.070	<0.001

Table S8. High burnout outcomes associated with sleep and sleepiness in police regularly working long work shifts (≥2 long work shifts per week; n=978)

Sleep characteristic, *n*†, ‡	Positive result in police with high burnout, No./No. total (%)		Unadjusted		Adjusted¶	
			OR (95% CI)	*P* Value	OR (95% CI)	*P* Value
	High EE	Low-moderate EE				
Sleep duration						
≥6 hours per night	105/228 (46.1)	398/617 (64.5)				
<6 hours per night	123/228 (53.9)	219/617 (35.5)	2.13 (1.56 - 2.90)	<0.001	2.02 (1.46 - 2.78)	<0.001
n	845					
Sleepiness						
<11 ESS	139/234 (59.4)	502/664 (75.6)				
≥11 ESS	95/234 (40.6)	162/664 (24.4)	2.12 (1.55 - 2.90)	<0.001	1.99 (1.43 - 2.77)	<0.001
n	898					
	High DP	Low-moderate DP				
Sleep duration						
≥6 hours per night	198/371 (53.4)	317/486 (65.2)				
<6 hours per night	169/371 (46.6)	173/487 (34.8)	1.64 (1.24 - 2.16)	<0.001	1.46 (1.09 - 1.97)	0.012
n	857					
Sleepiness						
<11 ESS	244/384 (63.5)	403/523 (77.1)				
≥11 ESS	140/384 (36.5)	120/523 (22.9)	1.93 (1.44 - 2.58)	<0.001	1.97 (1.46 - 2.66)	<0.001
n	907					
	Low PA	Moderate-high PA				
Sleep duration						
≥6 hours per night	188/317 (59.3)	311/516 (60.3)				
<6 hours per night	129/317 (40.7)	205/516 (39.7)	1.04 (0.78 - 1.38)	0.783	1.02 (0.74 - 1.40)	0.907
n	833					
Sleepiness						
<11 ESS	247/353 (70.)	379/527 (71.9)				
≥11 ESS	106/353 (30.0)	148/527 (28.1)	1.01 (0.82 - 1.48)	0.533	1.08 (0.77 - 1.50)	0.673
n	880					
	Overall burnout	No overall burnout				
Sleep duration						
≥6 hours per night	77/169 (45.6)	444/706 (62.9)				
<6 hours per night	92/169 (54.5)	262/706 (37.1)	2.03 (1.44 - 2.84)	<0.001	1.92 (1.35 - 2.72)	<0.001
n	875					
Sleepiness						
<11 ESS	101/175 (57.7)	560/754 (74.3)				
≥11 ESS	74/175 (42.3)	194/754 (25.7)	2.12 (1.50 - 2.98)	<0.001	2.03 (1.43 - 2.89)	<0.001
n	929					

EE, emotional exhaustion; DP, depersonalisation; PA, personal accomplishment; ESS, Epworth Sleepiness Scale; OR, odds ratio; CI, confidence interval; †The *n* presented represents the sample for each unadjusted analysis. The *n* for the adjusted analyses are in Supplement 1, Table S4; ‡Some participants did not provide sufficient information from which to determine their sleep duration and sleepiness. The *n* presented are from those who answered sufficiently; ¶Adjusted for age, BMI, gender, marital status, hypertension, cigarette use, caffeine use, alcohol use, second job, primary activity, years as police officers, exercise frequency, and seniority. Variables included in each model are in Supplement 1, Table S4, and model fit is reported in Supplement 1, Table S5.

Table S9. High burnout outcomes associated with night shift frequency in police working fixed shifts (n=1822)

Night shift frequency, *n*[†,‡]	Positive result in police with high burnout, No./No. total (%)		Unadjusted		Adjusted[¶]	
			OR (95% CI)	*P* Value	OR (95% CI)	*P* Value
	High EE	Low-moderate EE				
Never/nearly never	170/378 (45.0)	614/1357 (45.2)				
1-4 per month	63/378 (16.7)	245/1357 (18.1)	0.93 (0.67 - 1.29)	0.656	0.90 (0.65 - 1.26)	0.550
1-4 per week	44/378 (11.6)	180/1357 (13.3)	0.88 (0.61 - 1.28)	0.510	0.92 (0.63 - 1.35)	0.666
Nearly every day	101/378 (26.7)	318/1357 (23.4)	1.15 (0.87 - 1.52)	0.338	1.17 (0.87 - 1.57)	0.290
n	1735					
	High DP	Low-moderate DP				
Never/nearly never	279/733 (38.1)	518/1033 (50.1)				
1-4 per month	138/733 (18.8)	176/1033 (17.0)	1.46 (1.12 - 1.90)	0.006	1.33 (1.00 - 1.78)	0.051
1-4 per week	97/733 (13.2)	134/1033 (13.0)	1.34 (1.00 - 1.81)	0.053	1.19 (0.86 - 1.65)	0.301
Nearly every day	219/733 (29.9)	205/1033 (19.8)	1.98 (1.56 - 2.52)	<0.001	1.65 (1.27 - 2.16)	<0.001
n	1766					
	Low PA	Moderate-high PA				
Never/nearly never	301/688 (43.8)	465/1024 (45.4)				
1-4 per month	124/688 (18.0)	178/1024 (17.4)	1.08 (0.82 - 1.41)	0.596	1.05 (0.80 - 1.38)	0.728
1-4 per week	79/688 (11.5)	146/1024 (14.3)	0.84 (0.61 - 1.14)	0.257	0.77 (0.56 - 1.06)	0.113
Nearly every day	184/688 (26.7)	235/1024 (22.9)	1.21 (0.95 - 1.54)	0.122	1.10 (0.86 - 1.41)	0.465
n	1712					
	Overall burnout	No overall burnout				
Never/nearly never	115/275 (41.8)	700/1530 (45.8)				
1-4 per month	52/275 (18.9)	265/1530 (17.3)	1.19 (0.84 - 1.71)	0.329	1.13 (0.78 - 1.62)	0.528
1-4 per week	34/275 (12.4)	204/1530 (13.3)	1.01 (0.67 - 1.53)	0.946	1.03 (0.68 - 1.56)	0.891
Nearly every day	74/275 (26.9)	361/1530 (23.6)	1.25 (0.91 - 1.72)	0.173	1.25 (0.90 - 1.73)	0.186
n	1805					

EE, emotional exhaustion; DP, depersonalisation; PA, personal accomplishment; OR, odds ratio; CI, confidence interval; [†]The *n* presented represents the sample for each unadjusted analysis. The *n* for the adjusted analyses are in Supplement 1, Table S10; ‡Some participants did not provide sufficient information from which to determine their night shifts. The *n* presented are from those who answered sufficiently; [¶]Adjusted for age, BMI, gender, marital status, hypertension, cigarette use, caffeine use, alcohol use, second job, primary activity, years as police officers, exercise frequency, and seniority. Variables included in each model are in Supplement 1, Table S10 and model fit is reported in Supplement 1, Table S11.

Table S10. Variables included in models used to examine associations between night shift frequency in police working fixed shifts

Shift work and sleep characteristics, *n*‡	**Emotional Exhaustion**	**Depersonalisation**	**Personal Accomplishment**	**Burnout (High EE+DP)**
Night shift frequency	Gender, cigarette use, seniority	Age, caffeine use, second job	Age, BMI†, exercise	Gender, seniority
n	1683	1494	1688	1753

EE, emotional exhaustion; DP, depersonalisation.

Table S11. Model fit assessment for associations between night shift frequency and burnout in police working fixed shifts

			Block 1 model vs Baseline model			**Block 2 model vs Block 1 model**		**Block 2 model vs Baseline model**	
Burnout Outcome	**Baseline -2 log-likelihood**	**Block 1 -2 log-likelihood**	**χ^2**	***P* Value**	**Block 2 -2 log-likelihood**	**χ^2**	***P* Value**	**χ^2**	***P* Value**
Emotional Exhaustion	1765.283	1725.032	40.251	<0.001	1722.576	2.456	0.483	42.707	<0.001
Depersonalization	2043.728	2003.702	40.026	<0.001	1989.114	14.588	0.002	54.614	<0.001
Personal Accomplishment	2274.339	2247.300	27.039	<0.001	2242.950	4.349	0.226	31.388	0.001
Overall Burnout	1509.658	1488.810	20.847	0.004	1.486.948	1.862	0.602	22.709	0.012

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Reported on Page No.
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	Page 1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	Page 3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Pages 5-6
Objectives	3	State specific objectives, including any prespecified hypotheses	Page 6, 9
Methods			
Study design	4	Present key elements of study design early in the paper	Pages 6-8 with additional details presented in Ref#3
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Pages 6-8 with additional details presented in Ref# 3
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	Pages 6-7 with additional details presented in Ref# 3
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Pages 7-8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Pages 7-8
Bias	9	Describe any efforts to address potential sources of bias	Pages 6-7
Study size	10	Explain how the study size was arrived at	Pages 6-7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Pages 7-9
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	Pages 8-9
		(*b*) Describe any methods used to examine subgroups and interactions	Page 7, 8, 13, 24, 25
		(*c*) Explain how missing data were addressed	Pages 11-12, reported in Table 1; Pages 15-16, reported in Table 2; Page 18, reported in Table 3; Page 20, reported in Table 4.

		(*d*) If applicable, describe analytical methods taking account of sampling strategy	N/A
		(*e*) Describe any sensitivity analyses	N/A
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Pages 6-7
		(b) Give reasons for non-participation at each stage	Pages 6-7
		(c) Consider use of a flow diagram	Not included
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Pages 10-12, Reported in Table 1
		(b) Indicate number of participants with missing data for each variable of interest	Pages 10-12, Reported in Table 1
Outcome data	15*	Report numbers of outcome events or summary measures	Pages 10-12, Reported in Table 1
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Pages 13-20, and reported in tables 2-4
		(*b*) Report category boundaries when continuous variables were categorized	Pages 13-20, and reported in tables 2-4
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Supplement 1, Pages 1-10
Discussion			
Key results	18	Summarise key results with reference to study objectives	Page 21
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Page 25-26
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Pages 21-26
Generalisability	21	Discuss the generalisability (external validity) of the study results	Pages 21-26
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Page 27

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at

http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.