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.

1

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

2

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, Cigarette 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

Predictor variable	Baseline -2 log-likelihood	Block 1 -2 log-likelihood	Block 1 model vs Baseline model		Block 2 -2 log-likelihood	Block 2 model vs Block 1 model		Block 2 model vs Baseline model	
			χ^2	*P* Value		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

5

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, $n^{\ddagger}$	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, 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, BMI†, caffeine use, blood pressure, 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†, 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†, 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	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, BMI†, 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, blood pressure, 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†, years in law enforcement, 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.

6

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

Predictor variable	Baseline -2 log-likelihood	Block 1 -2 log-likelihood	Block 1 model vs Baseline model		Block 2 -2 log-likelihood	Block 2 model vs Block 1 model		Block 2 model vs Baseline model	
			χ^2	*P* Value		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, $n^{\dagger,\ddagger}$	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.

9

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

Burnout Outcome	Baseline -2 log-likelihood	Block 1 -2 log-likelihood	Block 1 model vs Baseline model		Block 2 -2 log-likelihood	Block 2 model vs Block 1 model		Block 2 model vs Baseline model	
			χ^2	*P* Value		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