

Cardiovascular health, stress and sleep of shift working police officers: A physiological assessment

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“Quis custodiet ipsos custodes?”

(Satires VI, lines 347 – 348) – **Juvenal**

The woods are lovely, dark and deep,
But I have promises to keep,
And miles to go before I sleep,
And miles to go before I sleep.

“Stopping by Woods on a Snowy Evening” – **Robert Frost**

Declaration

Certificate of original authorship.

I certify that the work in this thesis has not been previously submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text. This research was supported by an Australian Government Research Training Program Scholarship.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

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Jaymen Luke Elliott

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List of Figures

Figure 1.1 – Police officer losses for NSW between 2015 and 2016	2
Figure 1.2 – Physiological factors influenced by circadian rhythms	8
Figure 1.3 – Fluctuations in melatonin levels over a 24-hour period	11
Figure 1.4 – The hypothalamic-pituitary-adrenal axis during a stress response.....	17
Figure 1.5 – A conceptual model for coping with police stress.....	20
Figure 3.1 – Participant recruitment map.....	32
Figure 3.2 – Sample distribution of each sub-group	36
Figure 3.3 – Automated BP monitor placement.....	38
Figure 3.4 – Experimental protocol summary flowchart	44
Figure 4.1 – Reported prevalence of CVD in the Australian population.....	131
Figure 5.1 – Frequency distribution of the perception of stress for the total sample (N=255).....	140
Figure 5.2 – Visualisation of the most to least prevalent coping styles in general duties police officers (N=255).....	166
Figure 6.1 – Frequency distribution of the overall sleep quality for the total sample (N=255).....	180
Figure 6.2 – Frequency distribution of sleepiness risk for the total sample (N=255)...	183
Figure 6.3 – Frequency distribution of fatigue severity for the total sample (N=255) .	184
Figure 6.4 – Frequency distribution of subjective sleepiness for the total sample (N=255).....	185

List of Tables

Table 1.1 – A typical twelve hour ‘block’ NSW police roster.....	6
Table 1.2 – Clinical blood pressure classifications for Australian adults.....	23
Table 1.3 – Summary of relevant articles pertaining to shift work and blood pressure .	26
Table 3.1 – Breakdown of reasons for exclusion of police officers.....	35
Table 3.2 – Normative data for Part 2 of the LAQ	40
Table 4.1 – Mean demographic values for the total sample (N=255).....	50
Table 4.2 – Mean cardiac values for the total sample (N=255).....	51
Table 4.3 – Significant partial correlations between independent variables and SBP for the total sample (N=255).....	54
Table 4.4 – Hierarchical multiple regression between pre-shift SBP and significantly correlated variables in the total sample (N=255)	55
Table 4.5 – Hierarchical multiple regression between post-shift SBP and significantly correlated variables in the total sample (N=255)	56
Table 4.6 – Significant partial correlations between independent variables and DBP for the total sample (N=255).....	58
Table 4.7 – Hierarchical multiple regression between pre-shift DBP and significantly correlated variables in the total sample (N=255)	59
Table 4.8 – Hierarchical multiple regression between post-shift DBP and significantly correlated variables in the total sample (N=255)	60
Table 4.9 – Hierarchical multiple regression between DBP reactivity and significantly correlated variables in the total sample (N=255)	61
Table 4.10 – Mean demographic values for male (n=179) and female (n=76) police officers.....	62
Table 4.11 – Mean cardiac values for male (n=179) and female (n=76) police officers	63
Table 4.12 – Significant partial correlations between independent variables and pre-shift SBP for male (n=179) and female (n=76) police officers.....	65
Table 4.13 – Hierarchical multiple regression between pre-shift SBP and significantly correlated variables in male police officers (n=179).....	66
Table 4.14 – Significant partial correlations between independent variables and post-shift SBP for male (n=179) and female (n=76) police officers.....	68
Table 4.15 – Hierarchical multiple regression between post-shift SBP and significantly correlated variables in male police officers (n=179).....	69

Table 4.16 – Significant partial correlations between independent variables and SBP reactivity for male (n=179) and female (n=76) police officers.....	70
Table 4.17 – Significant partial correlations between independent variables and pre-shift DBP for male (n=179) and female (n=76) police officers	72
Table 4.18 – Hierarchical multiple regression between pre-shift DBP and significantly correlated variables in male police officers (n=179).....	73
Table 4.19 – Significant partial correlations between independent variables and post-shift DBP for male (n=179) and female (n=76) police officers.....	75
Table 4.20 – Hierarchical multiple regression between post-shift DBP and significantly correlated variables in male police officers (n=179).....	76
Table 4.21 – Hierarchical multiple regression between post-shift DBP and significantly correlated variables in female police officers (n=76)	77
Table 4.22 – Significant partial correlations between independent variables and DBP reactivity for male (n=179) and female (n=76) police officers.....	79
Table 4.23 – Hierarchical multiple regression between DBP reactivity and significantly correlated variables in male police officers (n=179).....	80
Table 4.24 – Hierarchical multiple regression between DBP reactivity and significantly correlated variables in female police officers (n=76)	81
Table 4.25 – Mean demographic values for police officers working a day (n=148) or night shift (n=107)	82
Table 4.26 – Mean cardiac values for police officers working a day (n=148) or night shift (n=107).....	83
Table 4.27 – Significant partial correlations between independent variables and pre-shift SBP for police officers working a day (n=148) or night shift (n=107).....	85
Table 4.28 – Hierarchical multiple regression between pre-shift SBP and significantly correlated variables in police officers working a night shift (n=107).....	86
Table 4.29 – Significant partial correlations between independent variables and post-shift SBP for police officers working a day (n=148) or night shift (n=107)	88
Table 4.30 – Hierarchical multiple regression between post-shift SBP and significantly correlated variables in police officers working a night shift (n=107).....	89
Table 4.31 – Significant partial correlations between independent variables and SBP reactivity for police officers working a day (n=148) or night shift (n=107).....	90
Table 4.32 – Significant partial correlations between independent variables and pre-shift DBP for police officers working a day (n=148) or night shift (n=107).....	91
Table 4.33 – Hierarchical multiple regression between pre-shift DBP and significantly correlated variables in police officers working a night shift (n=107).....	92

Table 4.34 – Significant partial correlations between independent variables and post-shift DBP for police officers working a day (n=148) or night shift (n=107).....	93
Table 4.35 – Hierarchical multiple regression between post-shift DBP and significantly correlated variables in police officers working a night shift (n=107).....	94
Table 4.36 – Significant partial correlations between independent variables and DBP reactivity for police officers working a day (n=148) or night shift (n=107).....	95
Table 4.37 – Mean demographic values for probationary constables (n=57), constables (n=99), senior constables (n=53) and sergeants (n=46).....	97
Table 4.38 – Significant differences in demographics variables for probationary constables (n=57), constables (n=99), senior constables (n=53) and sergeants (n=46)..	98
Table 4.39 – Mean cardiac values for probationary constables (n=57), constables (n=99), senior constables (n=53) and sergeants (n=46).....	100
Table 4.40 – Significant differences in cardiac variables for probationary constables (n=57), constables (n=99), senior constables (n=53) and sergeants (n=46)	101
Table 4.41 – Significant partial correlations between independent variables and pre-shift SBP for probationary constables (n=57), constables (n=99), senior constables (n=53) and sergeants (n=46)	103
Table 4.42 – Hierarchical multiple regression between pre-shift SBP and significantly correlated variables in constables (n=99).....	104
Table 4.43 – Significant partial correlations between independent variables and post-shift SBP for probationary constables (n=57), constables (n=99), senior constables (n=53) and sergeants (n=46)	106
Table 4.44 – Hierarchical multiple regression between post-shift SBP and significantly correlated variables in constables (n=99).....	107
Table 4.45 – Significant partial correlations between independent variables and SBP reactivity for probationary constables (n=57), constables (n=99), senior constables (n=53) and sergeants (n=46)	109
Table 4.46 – Hierarchical multiple regression between SBP reactivity and significantly correlated variables in constables (n=99).....	110
Table 4.47 – Significant partial correlations between independent variables and pre-shift DBP for probationary constables (n=57), constables (n=99), senior constables (n=53) and sergeants (n=46)	112
Table 4.48 – Hierarchical multiple regression between pre-shift DBP and significantly correlated variables in constables (n=99).....	113
Table 4.49 – Significant partial correlations between independent variables and post-shift DBP for probationary constables (n=57), constables (n=99), senior constables (n=53) and sergeants (n=46)	115

Table 4.50 – Hierarchical multiple regression between post-shift DBP and significantly correlated variables in constables (n=99).....	116
Table 4.51 – Hierarchical multiple regression between post-shift DBP and significantly correlated variables in senior constables (n=53).....	117
Table 4.52 – Significant partial correlations between independent variables and DBP reactivity for probationary constables (n=57), constables (n=99), senior constables (n=53) and sergeants (n=46)	119
Table 4.53 – Hierarchical multiple regression between DBP reactivity and significantly correlated variables in probationary constables (n=57)	120
Table 4.54 – Hierarchical multiple regression between DBP reactivity and significantly correlated variables in senior constables (n=53).....	121
Table 4.55 – Summary of significant partial correlations between BP and independent variables for the total sample (N=255)	133
Table 4.56 – Summary of significant partial correlations between BP and independent variables for male (n=179) and female (n=76) police officers	134
Table 4.57 – Summary of significant partial correlations between BP and independent variables for police officers working a day (n=148) or night shift (n=107)	135
Table 4.58 – Summary of significant partial correlations between BP and independent variables for probationary constables (n=57), constables (n=99), senior constables (n=53) and sergeants (n=46)	136
Table 5.1 – Mean perception of stress and coping style prevalence for the total sample (N=255).....	139
Table 5.2 – Significant correlations between independent variables and perception of stress for the total sample (N=255)	142
Table 5.3 – Multiple regression between perception of stress and significantly correlated variables in the total sample (N=255).....	143
Table 5.4 – Mean perception of stress and coping style prevalence for male (n=179) and female (n=76) police officers	145
Table 5.5 – Significant correlations between independent variables and perception of stress for male (n=179) and female (n=76) police officers	147
Table 5.6 – Multiple regression between perception of stress and significantly correlated variables in male police officers (n=179).....	148
Table 5.7 – Multiple regression between perception of stress and significantly correlated variables in female police officers (n=76)	149
Table 5.8 – Mean perception of stress and coping style prevalence for police officers working a day (n=148) or night shift (n=107)	151

Table 5.9 – Significant correlations between independent variables and perception of stress for police officers working a day (n=148) or night shift (n=107).....	153
Table 5.10 – Multiple regression between perception of stress and significantly correlated variables in police officers working a day shift (n=148)	154
Table 5.11 – Mean perception of stress and coping style prevalence for probationary constables (n=57), constables (n=99), senior constables (n=53) and sergeants (n=46)	156
Table 5.12 – Significant differences in stress and coping variables for probationary constables (n=57), constables (n=99), senior constables (n=53) and sergeants (n=46)	157
Table 5.13 – Significant correlations between independent variables and perception of stress for probationary constables (n=57), constables (n=99), senior constables (n=53) and sergeants (n=46)	159
Table 5.14 – Multiple regression between perception of stress and significantly correlated variables in probationary constables (n=57)	160
Table 5.15 – Multiple regression between perception of stress and significantly correlated variables in constables (n=99).....	161
Table 5.16 – Normative data for Part 2 of the Lifestyle Appraisal Questionnaire	163
Table 5.17 – Summary of significant partial correlations between perception of stress and independent variables for the total sample (N=255)	173
Table 5.18 – Summary of significant partial correlations between perception of stress and independent variables for male (n=179) and female (n=76) police officers	174
Table 5.19 – Summary of significant partial correlations between perception of stress and independent variables for police officers working a day (n=148) or night shift (n=107).....	175
Table 5.20 – Summary of significant partial correlations between perception of stress and independent variables for probationary constables (n=57), constables (n=99), senior constables (n=53) and sergeants (n=46).....	176
Table 6.1 – Mean overall sleep quality for the total sample (N=255)	179
Table 6.2 – Mean sleepiness and fatigue scores for the total sample (N=255).....	182
Table 6.3 – Significant correlations between independent variables and sleep factors for the total sample (N=255).....	188
Table 6.4 – Multiple regression between sleepiness risk and significantly correlated variables in the total sample (N=255)	189
Table 6.5 – Multiple regression between fatigue severity and significantly correlated variables in the total sample (N=255)	190
Table 6.6 – Multiple regression between total fatigue impact and significantly correlated variables in the total sample (N=255)	191

Table 6.7 – Mean overall sleep quality for male (n=179) and female (n=76) police officers.....	193
Table 6.8 – Mean sleepiness and fatigue scores for male (n=179) and female (n=76) police officers.....	194
Table 6.9 – Significant correlations between independent variables and sleepiness risk for male (n=179) and female (n=76) police officers.....	196
Table 6.10 – Multiple regression between sleepiness risk and significantly correlated variables in male police officers (n=179).....	197
Table 6.11 – Multiple regression between sleepiness risk and significantly correlated variables in female police officers (n=76)	198
Table 6.12 – Significant correlations between independent variables and fatigue severity for male (n=179) and female (n=76) police officers.....	200
Table 6.13 – Multiple regression between fatigue severity and significantly correlated variables in male police officers (n=179).....	201
Table 6.14 – Multiple regression between fatigue severity and significantly correlated variables in female police officers (n=76)	202
Table 6.15 – Significant correlations between independent variables and total fatigue impact for male (n=179) and female (n=76) police officers.....	204
Table 6.16 – Multiple regression between total fatigue impact and significantly correlated variables in female police officers (n=76)	205
Table 6.17 – Mean overall sleep quality for police officers working a day (n=148) or night shift (n=107)	207
Table 6.18 – Mean sleepiness and fatigue scores for police officers working a day (n=148) or night shift (n=107)	208
Table 6.19 – Significant correlations between independent variables and sleepiness risk for police officers working a day (n=148) or night shift (n=107).....	210
Table 6.20 – Multiple regression between sleepiness risk and significantly correlated variables in police officers working a day shift (n=148)	211
Table 6.21 – Multiple regression between sleepiness risk and significantly correlated variables in police officers working a night shift (n=107).....	212
Table 6.22 – Significant correlations between independent variables and fatigue severity for police officers working a day (n=148) or night shift (n=107).....	214
Table 6.23 – Multiple regression between fatigue severity and significantly correlated variables in police officers working a day shift (n=148)	215
Table 6.24 – Multiple regression between fatigue severity and significantly correlated variables in police officers working a night shift (n=107).....	216

Table 6.25 – Significant correlations between independent variables and total fatigue impact for police officers working a day (n=148) or night shift (n=107).....	218
Table 6.26 – Multiple regression between total fatigue impact and significantly correlated variables in police officers working a day shift (n=148)	219
Table 6.27 – Multiple regression between total fatigue impact and significantly correlated variables in police officers working a night shift (n=107).....	220
Table 6.28 – Mean overall sleep quality for probationary constables (n=57), constables (n=99), senior constables (n=53) and sergeants (n=46).....	222
Table 6.29 – Mean sleepiness and fatigue scores for probationary constables (n=57), constables (n=99), senior constables (n=53) and sergeants (n=46)	224
Table 6.30 – Significant correlations between independent variables and sleepiness risk for probationary constables (n=57), constables (n=99), senior constables (n=53) and sergeants (n=46).....	227
Table 6.31 – Multiple regression between sleepiness risk and significantly correlated variables in probationary constables (n=57)	228
Table 6.32 – Multiple regression between sleepiness risk and significantly correlated variables in constables (n=99).....	229
Table 6.33 – Multiple regression between sleepiness risk and significantly correlated variables in senior constables (n=53).....	230
Table 6.34 – Multiple regression between sleepiness risk and significantly correlated variables in sergeants (n=46)	231
Table 6.35 – Significant correlations between independent variables and fatigue severity for probationary constables (n=57), constables (n=99), senior constables (n=53) and sergeants (n=46).....	234
Table 6.36 – Multiple regression between fatigue severity and significantly correlated variables in probationary constables (n=57)	235
Table 6.37 – Multiple regression between fatigue severity and significantly correlated variables in constables (n=99).....	236
Table 6.38 – Multiple regression between fatigue severity and significantly correlated variables in senior constables (n=53).....	237
Table 6.39 – Multiple regression between fatigue severity and significantly correlated variables in sergeants (n=46)	238
Table 6.40 – Significant correlations between independent variables and total fatigue impact for probationary constables (n=57), constables (n=99), senior constables (n=53) and sergeants (n=46)	241
Table 6.41 – Multiple regression between total fatigue impact and significantly correlated variables in probationary constables (n=57)	242

Table 6.42 – Multiple regression between total fatigue impact and significantly correlated variables in constables (n=99).....	243
Table 6.43 – Multiple regression between total fatigue impact and significantly correlated variables in senior constables (n=53).....	244
Table 6.44 – Multiple regression between total fatigue impact and significantly correlated variables in sergeants (n=46)	245
Table 6.45 – Summary of significant partial correlations between sleepiness, fatigue and independent variables for the total sample (N=255).....	254
Table 6.46 – Summary of significant partial correlations between sleepiness, fatigue and independent variables for male (n=179) and female (n=76) police officers.....	255
Table 6.47 – Summary of significant partial correlations between sleepiness, fatigue and independent variables for police officers working a day (n=148) or night shift (n=107)	256
Table 6.48 – Summary of significant partial correlations between sleepiness, fatigue and independent variables for probationary constables (n=57), constables (n=99), senior constables (n=53) and sergeants (n=46).....	257

Table of Contents

Declaration.....	ii
Acknowledgments	iii
List of Figures.....	iv
List of Tables.....	v
Table of Contents.....	xiii
List of Abbreviations	xvi
List of publications and presentations	xviii
List of publications:	xviii
List of conference presentations:	xviii
Abstract.....	xix
Chapter 1 Introduction.....	1
1.1 Police Officers	4
1.2 Shift Work	7
1.2.1 Circadian Rhythms.....	7
1.2.2 Sleep & Fatigue.....	10
1.2.3 Shift Design	13
1.3 Stress & Cortisol.....	16
1.3.1 Police & Occupational Stress.....	19
1.3.2 Coping.....	19
1.4 Blood Pressure & Shift Work	22
Chapter 2 Basis for Research.....	28
2.1 Research Questions.....	29
2.2 Hypotheses.....	29
2.3 Aims.....	30
Chapter 3 Methodology	31
3.1 Participant Recruitment	31

3.2 Ethics Approval & Informed Consent	33
3.3 Selection Criteria	33
3.4 Research Protocol	37
3.4.1 Blood Pressure Measurement.....	37
3.4.2 Questionnaire Battery	39
3.4.3 Experimental Protocol Summary	43
3.5 Data Processing	45
3.5.1 Blood Pressure & WHR Data	45
3.5.2 Questionnaire Data.....	45
3.6 Statistical Analysis.....	46
3.6.1 Power Analysis	46
3.6.2 t-tests (Dependant & Independent)	46
3.6.3 Analysis of Variance (ANOVA).....	47
3.6.4 Multivariate Analysis of Covariance (MANCOVA)	47
3.6.5 Tukey’s Honestly Significant Difference (HSD) Post-hoc Analysis.....	47
3.6.6 Pearson’s correlation (Bivariate & Partial).....	48
3.6.7 Multiple Regression Analysis	48
Chapter 4 Blood Pressure and Shift Work.....	49
4.1 Results: Blood Pressure and Shift Work.....	49
4.1.1 Results: Blood Pressure and Shift Work (total sample).....	49
4.1.2 Results: Blood Pressure and Shift work (sex comparison)	62
4.1.3 Results: Blood Pressure and Shift work (shift comparison)	82
4.1.4 Results: Blood Pressure and Shift work (rank comparison)	96
4.2 Discussion: Blood Pressure and Shift Work.....	122
4.2.1 Blood Pressure and Shift Work (total sample).....	122
4.2.2 Blood Pressure and Shift Work (comparisons).....	128
4.3 Conclusion: Blood Pressure and Shift Work	132
Chapter 5 Stress, Coping and Shift Work.....	137

5.1 Results: Stress, Coping and Shift Work.....	137
5.1.1 Results: Stress, Coping and Shift Work (total sample).....	137
5.1.2 Results: Stress, Coping and Shift Work (sex comparison)	144
5.1.3 Results: Stress, Coping and Shift Work (shift comparison)	150
5.1.4 Results: Stress, Coping and Shift Work (rank comparison)	155
5.2 Discussion: Stress, Coping and Shift Work.....	162
5.2.1 Stress, Coping and Shift Work (total sample).....	162
5.2.2 Stress, Coping and Shift Work (comparisons).....	168
5.3 Conclusion: Stress, Coping and Shift Work	172
Chapter 6 Sleep and Shift Work	177
6.1 Results: Sleep and Shift Work	177
6.1.1 Results: Sleep and Shift Work (total sample)	177
6.1.2 Results: Sleep and Shift Work (sex comparison).....	192
6.1.3 Results: Sleep and Shift Work (shift comparison).....	206
6.1.4 Results: Sleep and Shift Work (rank comparison).....	221
6.2 Discussion: Sleep and Shift Work	246
6.2.1 Sleep and Shift Work (total sample).....	246
6.2.2 Sleep and Shift Work (comparisons)	250
6.3 Conclusion: Sleep and Shift Work.....	253
Chapter 7 Limitations, Conclusions and Future Directions.....	258
7.1 Limitations	258
7.2 Conclusions & Future Directions	259
Chapter 8 Appendices.....	262
8.1 Consent Form.....	262
8.2 Introductory Questionnaire.....	263
Chapter 9 References.....	265

List of Abbreviations

ANOVA = Analysis of Variance

BMI = Body Mass Index

BP = Blood Pressure

C = Constable

CFS = Chronic Fatigue Syndrome

CIS20 = Checklist of Individual Strength

CVD = Cardiovascular Disease

DBP = Diastolic Blood Pressure

ESS = Epworth Sleepiness Scale

FSS = Fatigue Severity Scale

HPA = Hypothalamic-Pituitary-Adrenal (Axis)

HREC = Human Research Ethics Committee

HSD = Honestly Significant Difference

LAC = Local Area Command

LAQ = Lifestyle Appraisal Questionnaire

MANCOVA = Multivariate Analysis of Covariance

mmHg = Millimetres Mercury

n/c = No Change

NSW = New South Wales

PC = Probationary Constable

PSQI = Pittsburgh Sleep Quality Index

PTSD = Post-Traumatic Stress Disorder

SBP = Systolic Blood Pressure

SC = Senior Constable

SCN=Suprachiasmatic Nucleus

SD = Standard Deviation

Sgt = Sergeant

SNS = Sympathetic Nervous System

SOS = Survey of Shiftworkers

TTW = Total Travel to Work (Time)

UTS = University of Technology Sydney

WCQR = Ways of Coping Questionnaire (Revised)

WHR = Waist-Hip Ratio

> = Greater than

≥ = Greater than or equal to

< = Less than

≤ = Less than or equal to

List of publications and presentations

List of publications:

Elliott, J.L. & Lal, S. (2016) Blood pressure, sleep quality and fatigue in shift working police officers: Effects of a twelve hour roster system on cardiovascular and sleep health. *International Journal of Environmental Research and Public Health*, **13** (2), 1-8.

Singh, S., **Elliott, J.L.**, Wyndham, J. & Lal, S. (2016) Associations between lifestyle risk factors, coping and cardiovascular health in police officers. *PLoS One* (Pending)

Lees, T., **Elliott, J.L.**, Gunning, S., Newton, P., Rai, T. & Lal, S. (2017) A review of current evidence about mental disorders and psychological and other wellbeing programs in the law enforcement workplace. *Safety & Health at Work* (Presented in Court; Pending)

List of conference presentations:

Elliott, J.L. & Lal, S. Blood pressure and fatigue links to shift work in police officers of NSW. *Oral Presentation: 29th Combined Health Science Conference* (November 2012 – Sydney, Australia).

Elliott, J.L., Lees, T., Nassif, N. & Lal, S. Cardiovascular measures and sleep health associations with shift work in police officers: a physiological assessment. *Oral Presentation: 31st Combined Health Science Conference* (November 2014 – Sydney, Australia).

Singh, S. **Elliott, J.L.**, Wyndham, J. & Lal, S. Heart rate variability association to stress and coping ability in police officers. *Oral Presentation: 31st Combined Health Science Conference* (November 2014 – Sydney, Australia).

Kalatzis, D., **Elliott, J.L.** & Lal, S. Investigating blood glucose levels and fatigue in NSW police officers: Implications for metabolic disorders. *Oral Presentation: 32nd Combined Health Science Conference* (November 2015 – Sydney, Australia).

Elliott, J.L., Lees, T., Nassif, N. & Lal, S. Poor sleep quality and fatigue in shift working police officers: Effects of a 12 hour roster system on cardiovascular and sleep health. *Oral Presentation: 9th International Conference on Managing Fatigue* (March 2015 – Perth, Australia)

Elliott, J.L., Lees, T., Nassif, N. & Lal, S. Stress and the New South Wales Police Force: The prevalence of various coping mechanisms. *Oral Presentation: 2nd Interuniversity Neuroscience & Mental Health Conference* (September 2015 – Sydney, Australia)

Abstract

Police officers have been reported to experience a high incidence of chronic health issues (Kales et al., 2009; Hartley et al., 2011), which present prematurely in an otherwise healthy population (Bonneau & Brown, 1995; Barron, 2010). Shift work has also been associated with an increased prevalence of cardiovascular, stress and sleep disorders (Åkerstedt & Wright, 2009; Pan et al., 2011; Jermendy et al., 2012; Zimberg et al., 2012; Hamta et al., 2017), attributed primarily to its propensity for circadian rhythm dysfunction (Shen et al., 2006; Gamble et al., 2011). However, contention exists as to whether shift work has a direct effect upon blood pressure (BP) regulation (Hublin et al., 2010; Sfreddo et al., 2010; Ohlander et al., 2015). The present study explores the associations between shift work and the stress, sleep and cardiovascular health of general duties police officers, as well as comparing within subgroups based on sex, shift and occupational rank.

Recruited participants were added to an existing database (Elliott & Lal, 2016) (n=100) to produce a total sample of N=255 general duties police officers. Endorsed by the New South Wales (NSW) Police Force and Police Association of NSW, observations were made across nine Local Area Commands in a cross-sectional model. The experimental protocol involved BP measurements, taken before and after their regular twelve hour shift, in combination with a comprehensive questionnaire battery. Participants completed the following tools, including the Lifestyle Appraisal Questionnaire (Craig et al., 1996), Epworth Sleepiness Scale (Johns, 1991), Pittsburgh Sleep Quality Index (Buysse et al., 1989), Checklist of Individual Strength (Vercoulen et al., 1994), Fatigue Severity Scale (Krupp et al., 1989), Ways of Coping Questionnaire (Folkman et al., 1986) and Survey of Shiftworkers (Folkard et al., 1995).

Systolic BP was found to significantly increase ($p < 0.05$) after shift work for the total sample, female officers, senior constables and police working a day shift, although these changes were relatively small. A substantial number of significant associations were also identified with BP, even after accounting for the covariates of age, sex, waist-hip ratio and lifestyle risk factors. Subjects' perception of stress was within normal ranges for the majority, likely due to the significant associations found with preferable coping style prevalence. By comparison, poor sleep quality and severe fatigue was found to

predominate within the sample, almost irrespective of sex, shift or occupational rank. Finally, many significant differences were also found amongst police officers when compared between the aforementioned subgroups.

Based on these initial findings, further insight has been made into the detrimental effects shift work may have upon the cardiovascular and sleep health of individuals. Future research must incorporate more physiological measurements, as well as assess the efficacy of suggested interventional programmes which seek to ameliorate fatigue and bolster coping mechanisms. Not only would this reduce potential accidents and associated costs for the NSW Police Force, but most importantly also improve the occupational health and safety of the global shift working community at large.