UNIVERSITY OF TECHNOLOGY SYDNEY

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

Jaymen Luke Elliott

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Principal supervisor: Associate Professor Sara Lal (UTS)

Alternate supervisors: Doctor Najah Nassif (UTS)

Professor Phillip Newton (WSU)

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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.

Production Note:
Signature: Signature removed prior to publication.

Date: 13th of December, 2017

Jaymen Luke Elliott

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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.