



University
of Victoria

Graduate Studies

Notice of the Final Oral Examination
for the Degree of Master of Science

of

THOMAS W. SERVICE

BSc (University of Victoria, 2015)

**“Physiological and psychological impacts of nighttime call response
in firefighters from volunteer and paid-on-call fire departments”**

School of Exercise Science, Physical and Health Education

Friday, August 23, 2019

10:00 A.M.

Clearihue Building

Room B019

Supervisory Committee:

Dr. Lynneth Stuart-Hill, School of Exercise Science and Physical Health Education,
University of Victoria (Co-Supervisor)

Dr. Jody Gawryluk, Department of Psychology, UVic (Non-Unit Member)

External Examiner:

Dr. Cory Coehoorn, Department of Kinesiology and Health Science, Louisiana State University

Chair of Oral Examination:

Dr. Harald Krebs, School of Music, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

An oft overlooked population in research, firefighters of volunteer and paid-on-call fire departments respond to nighttime calls as a supplement to their normal working hours, making the duties taxing on the autonomic system leading to cardiovascular and endocrine disruptions. These duties also come with a tax burden on the volume and distribution of sleep. The current study was executed in order to gain valuable insight into the impact of nighttime call response in this population and the magnitude and duration of any perturbations. Eight firefighters from Greater Victoria Volunteer and Paid-on-call departments were recruited to wear Equivital EQ02 heart monitors and FitBit Charge 2 devices to record autonomic cardiovascular responses and track sleep between 1900 and 0700. HR MAX was found to significantly increase with a large effect size ($p < 0.0005$) from 97 ± 20 to 157 ± 18 beats per minute in the 15 minutes preceding versus following a call within the time period. LF/HF ratios increased during the first 15-minutes following a call to 4.055 ± 1.316 from 1.911 ± 0.599 pre-call. HF power, RMSSD, and pNN50 all decreased significantly compared to pre-call values ($796.176 \pm 414.296 \text{ ms}^2$ vs $244.119 \pm 153.880 \text{ ms}^2$, $51.940 \pm 7.119 \text{ ms}$ vs $35.072 \pm 2.624 \text{ ms}$, $25.017 \pm 7.034\%$ vs $7.403 \pm 2.411\%$). Further, all HRV measures with the exception of normalized LF and HF were found to be significantly different when waking for and attending a call versus waking on a normal day despite there being no significant differences among any variables when going to bed on nights with and without a call. Total and REM sleep were the most significantly impacted measurables of sleep. Total sleep fell to 261.11 ± 61.11 minutes from 417.13 ± 52.04 minutes while REM absolute and percentage of total sleep dropped from 109.88 ± 28.47 minutes to 51.44 ± 17.92 minutes, and $22.25 \pm 3.73\%$ to $16.33 \pm 3.17\%$ respectively. In response to a call, mean salivary cortisol levels increased from pre-call values by $0.426 \pm 0.202 \text{ } \mu\text{g/dL}$ ($p < .001$) while salivary c-reactive protein levels did not demonstrate significant differences. The results of this study demonstrate the presence of a significant shift in autonomic control from parasympathetic (PSNS) dominance to sympathetic control and PSNS withdrawal which evokes a cortisol-mediated stress response of comparable magnitude to literature standards for normal waking fluxes. Sleep volume, and arguably the most critical stage of sleep, rapid eye movement, are significantly impacted and the links between cognitive performance and both total and overall REM sleep indicate that call response does not just impact the cardiovascular system but may in fact be reducing mental acuity of firefighters. This is important as it has the potential to impact both self and team health and safety, not only during night time call response, but at the firefighters' day jobs which they regularly proceed to the very same morning following a call, evidently with significant deprivation in sleep.