An exploration of the associations between work and life stress, and indicators of cardiovascular risk among female shift work and non-shift work hospital employees

By

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Abstract

Objective: To compare psychological work and life stress indicators among female hospital employees in both shift work (SW) and non-shift work (NSW) positions, and determine associations with demographic and vocational factors, and indicators of cardiovascular risk (CVR).

Methods: Female employees from one Southeastern Ontario acute care hospital (n=212) provided fasting blood samples, demographic and work related data, and completed a physical assessment and questionnaires. Work stress was measured with the Job Content Questionnaire and Effort-Reward Balance Index (ERI). Life stress was assessed with the Derogatis Stress Profile. Metabolic Syndrome (MS) was determined based on Interim Societies Joint Guidelines.

Results: SW in comparison to NSW employees reported higher mean scores in: global ERI (.70 (SD .4) vs. .58 (SD.29) $p<.05$), psychological job demands (21.2 (SD 4.8) vs. 19.2 (5.7) $p<.01$), physical job demands (13.8 (SD 2.6) vs. 10.2 (SD 3.8), skill discretion (36.5 (SD 4.4) vs. 34.7 (SD 5.4) $p<.01$), lower decision authority (31.6 (SD 5.8) vs. 33.5 (SD 6.5) $p<.05$), and lower total life stress scores (39.2 (SD 7.3) vs. 42.1 (SD 9.4) $p<.05$). There were no significant differences between SW and NSW group for MS or CVR factors. MS was present among 17% of all employees, 18.5% of SW, and 15.5% of NSW. In logistic regression analysis MS occurrence was associated with chronic SW exposure of 6 or more years (AOR 5.41 (95% CI, 1.84 – 15.87), decisional authority (AOR 1.09 (95% CI, 1.00 – 1.18), skill discretion (AOR 1.13 (95% CI, 1.01 – 1.26), and depression (AOR 1.26 (95% CI 1.08 – 1.46).

Conclusions: Women working in SW positions experience more psychological and physical work stress, and effort-reward imbalance. The interplay between effort and reward aspects of the work environment may significantly contribute to psychological work stress and persist with increasing age among female hospital employees regardless of SW status. Among female hospital employees SW status and psychological stress measures do not appear to have an immediate effect upon CVR, as measured by the MS, but may contribute to its development with prolonged exposure.

Co-Authorship

This thesis represents the work of Justin Tennant in collaboration with his supervisor, Joan Tranmer, and committee members Joan Almost and Linda McGillis-Hall. The cross-sectional study was designed by Joan Tranmer, Kristan Aronson, Ian Janssen, Linda McGillis Hall, Christine Collier and Andrew Day with funding from the Canadian Institutes for Health Research. Justin Tennant was responsible for the conceptualization of this thesis project, along with statistical analyses, interpretation of the results, and writing of the manuscripts with the supervision of Joan Tranmer, and feedback from Joan Almost and Linda McGillis-Hall.

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List of Abbreviations

Shift work……SW

Non-shift work……..NSW

Job Content Questionnaire……..……JCQ

Effort-Reward Imbalance……ERI

Derogatis Stress Profile……..DSP

Cardiovascular disease……..CVD

Cardiovascular risk……....CVR

Cardiometabolic risk……CMR

Metabolic syndrome……MS

Hypothalamic-pituitary-adrenal……HPA

Intima-media thickness……...…IMT

Mean……...M

Standard deviation……...…….SD

Prevalence ratio……PR

Odds ratio……OR

Adjusted odds ratio……AOR

Relative risk……..RR

Confidence interval……CI

Chapter 1

Introduction

1.1 General Introduction

A recent national report (Heart and Stroke Foundation, 2010) raised concern about the growing risk of heart disease in younger and middle-aged adults. The face of heart disease is changing such that young adults are entering adulthood with a number of cardiovascular risk factors and older adults have lived longer with their unhealthy habits and are developing heart disease at an earlier age. Populations recently identified by the Heart and Stroke Foundation as at risk for cardiovascular disease include women entering their adult years and middle-aged adults**.** Given that adults spend a significant amount of time in the workplace, the potential influence of selected work characteristics, such as shift work on cardiovascular risk require careful examination.

Psychological work-related stress is one of three hypothesized pathways linking shift work to increased risk for cardiovascular disease (CVD) (Puttonen, Härmä, & Hublin, 2010). Previous research exploring the associations between shift work and CVD has produced inconsistent findings, predominantly included men and has not addressed important gender perspectives such as those that may exist when considering work-life issues. Furthermore, Canadian census data indicates that the healthcare provider workforce is primarily composed of a female population (78%), and largely employed within the hospital setting (Canadian Institute for Health Information, 2007). Thus the focus of this study is on the determination and comparison of work and life-

related psychological stress in female shift work and non-shift work hospital employees, and the effect of these stress-related pathways on the risk for cardiovascular disease.

1.2 Key definitions

1.2.1 Psychological stress is a cognitive state that results when perceived demands exceed one's available resources (including coping skills) (Lazarus & Folkman, 1984).

1.2.2 Psychological work stress is a disturbed psychological state precipitated by vocational factors such as: organization, work design, management, and context (social and organizational) (Karasek & Theorell, 1990; Siegrist, 1996). In a recent meta-analysis of studies considering a general population of workers both job strain, conceptualized as high demand and low control and effort-reward imbalance were associated with the development of cardiovascular disease, relative risk 1.43 (95% CI 1.15 – 1.84) and 1.58 (95% CI 0.84 – 2.97), respectively (Kivimäki et al., 2006).

1.2.3 Life stress is not exclusive of work stress and refers to a disturbed psychological and/or physiological state precipitated by domestic (home and/or family) factors such as: having dependents, being partnered, and workload (Winwood, Winefield, & Lushington, 2006). In this study I am focusing on various life areas and personal characteristics, including environment, personality, and emotional response, as these have been identified in the Derogatis Stress Profile (DSP) as areas that are associated with life stress (Derogatis, 1995).

1.2.4 Cardiovascular risk (CVR) refers to an individual's risk of developing cardiovascular diseases (CVD) (coronary heart disease (CHD), myocardial infarction (MI) angina pectoris, peripheral vascular disease, cerebrovascular disease, and vascular nephropathies) through factors such as inflammation, elevated blood pressure, blood lipids and blood glucose (Cook, et al., 2012; Fuster & Kelly, 2011). The metabolic syndrome (MS) provides a measure of CVR and is identified through a cluster of cardiometabolic factors associated with an increased risk for CVD; three or more indicators must be present for classification of MS (Alberti et al., 2009). These criteria include: fasting blood sugar value greater than or equal to 5.6mmol/L or treatment for elevated blood glucose, blood pressure greater than or equal to 130mmHg systolic or 85mmHg diastolic or treatment for previously diagnosed hypertension, total triglycerides greater than 1.7mmol/L or receiving treatment, high density lipoprotein less than 1.3mmol/L, or waist circumference greater than or equal to 80 cm (Alberti et al., 2009).

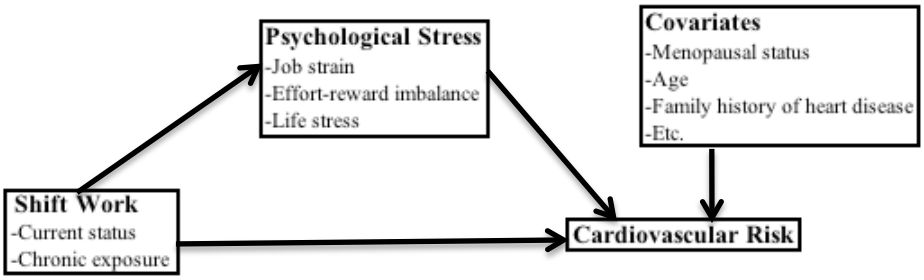
1.2.5 Shift work has no standard definition but generally refers to extended working hours (eight or more consecutively) with scheduling time routinely at changing times of day (morning, afternoon, nights), including a night shift rotation, and is associated with circadian stress or misalignment (altered dietary and sleep schedules) (Puttonen et al., 2010).

1.3 Conceptual framework

Puttonen et al. (2010) hypothesize that shift work is associated with three circadian-related stress pathways that potentially contribute to CVD: 1) psychological stress (work, work-life imbalance, work recovery) 2) behavioural stress (sleep quality and

length, weight gain, smoking, nutrition, physical inactivity), and 3) physiological stress (inflammation, blood coagulation, cardiac autonomic function, hypothalamic-pituitary-adrenal (HPA) axis, blood pressure). The epidemiological evidence supporting the associations between shift work and CVD is inconsistent (Frost, Kolstad, & Bonde, 2009, Hublin et al., 2010; Puttonen et al., 2010); however; mechanistic studies do support the biological plausibility of the proposed pathways (Hamer, Endrighi, Venuraju, Lahiri, & Steptoe, 2012; Brisson et al., 1999). The conceptual framework created by Puttonen et al. (2010) has been simplified to provide an organizing framework for this thesis project (Figure 1). In this thesis I am focusing on the potential psychosocial pathway linking shift work to increased risk for cardiovascular disease, while controlling for unmodifiable risk factors.

Figure 1 – The modified Puttonen et al. (2010) framework linking shift work to CVD.



1.4 Objectives

The overall goal of this thesis project is to compare the differences between work and life stress, and their associations with indicators of cardiovascular risk among shift work and non-shift work female hospital employees. The specific objectives are as follows:

1.4.1 To compare levels of work stress as measured with the Job Content Questionnaire (JCQ) and effort-reward imbalance (ERI) among female shift and non-shift hospital employees**.**

1.4.2 To compare the levels of life stress as measured with the Derogatis Stress Profile (DSP) among female shift work and non-shift work hospital employees**.**

1.4.3 To determine the associations between work stress, and life stress, and shift work exposure on indicators of cardiovascular risk (as measured by the metabolic syndrome (MS)) while controlling for non-modifiable CVR factors (i.e. age, cardiovascular history, and menopausal status).

1.5 Thesis organization and outline

Organization of this thesis will adhere to the Manuscript Form of Theses as specified by the School of Graduate Studies at Queen's University. Chapter 2 provides an outline of the relevant literature reviewed. Chapter 3 is the first manuscript: *A comparative analysis of work and life stress in female shift work and non-shift work hospital employees,* which will be submitted to the peer reviewed journal *Stress and Health*. Chapter 4 is the second manuscript: *A comparative analysis of cardiometabolic risk and associations with work and life stress among female shift work and non-shift work hospital employees,* which will be submitted to the BMJ journal *Heart*. Chapter 5 provides a general discussion of manuscript findings, including summaries, conclusions, strengths, limitations, and implications for policies and future research.

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Chapter 2

Background Literature Review

2.1 Introduction

This chapter provides a narrative summary and critique of the research literature that has explored the potential links between shift work, psychological stress in work and domestic environments and cardiovascular risk (CVR). The goal of this review was to summarize the available evidence and to identify potential gaps in the evidence, to inform the research objectives for this thesis. The OvidSP MEDLINE 1996 to present and the Cumulative Index to Nursing and Allied Health databases were searched with the goal of summarizing the research evidence focusing on: 1) psychological stress and shift work, 2) psychological stress and CVR, and 3) shift work and CVR. Search terms utilized were dependent upon the foci of examination and included: cardiovascular disease, cardiovascular risk, psychological stress, work stress, life stress, personnel staffing scheduling, shift work, work patterns, and shift patterns. Primary literature searches were completed for each focus with the inclusion of the exploded search term "Personnel, Hospital" or "hospital personnel". Secondary literature searches were then completed excluding this population limitation to increase to breadth of literature obtained. All results were limited to humans, all adults, English language, and journal articles. Titles and abstracts were then hand searched for inclusion into full-text review based upon the following inclusion criteria: male or female participants, psychosocial stress measurement, worker population, hospital worker population, shift work, outcome measurement of CVR, and outcome measurement of CVD. Three out of nine inclusion

criteria were required to be met for full-text review. Included articles then underwent full-text review and appraisal to arrive at the final literature base. The overall flow and additional details of the literature review is depicted in Appendix B.

2.2 Cardiovascular Disease

Cardiovascular disease is a prevalent chronic condition. Cardiovascular disease is one of the leading causes of morbidity and death among Canadian men and women, claiming 70 000 Canadian lives per year despite a decrease in cardiovascular related mortality rates over the past 40 years. In 2010, 1.6 million Canadians were living with cardiovascular or cerebrovascular conditions (Health Canada, 2010). While the number of deaths related to CVD are equal for Canadian men and women; the manifestation of CVD occurs later in women's life cycle, with a 4-fold increase for CVD-related death after menopause (Heart and Stroke, 2010).

2.2.1 Cardiovascular risk

There are a number of common and well-accepted modifiable and non-modifiable cardiovascular risk factors. Non-modifiable risk factors for CVD include: family history of early cardiovascular disease, menopausal status and age (Health Canada, 2010). Modifiable risk factors for CVD include: smoking, physical inactivity, dietary habits, obesity, high cholesterol and lipids, high blood pressure, and diabetes (Health Canada, 2010). A number of other factors, such as psychological stress, have been associated with increased risk for CVD, though these factors are often not commonly screened for (Health Canada, 2010). Modifiable CVR factors provide targets for preventative measures against CVD development through reduction in CVR.

As the onset of CVD is latent to risk factor exposure the prediction of future CVD is often measured by the use of CVR algorithms or scores. Common CVR algorithms include the Framingham Risk Score (FRS) and Reynolds Risk Score (RRS). The FRS was developed using a population based sample of 2 856 women and 2 489 men between the ages of 30 and 74 years (Wilson et al., 1998). Using the predictors of age, gender, cholesterol, high-density lipoprotein, smoking status, diabetic status, and high-blood pressure, the FRS provides a 10-year percent risk of a vascular event. The RRS was developed and validated utilizing a sample of 24 558 women aged 45 or older followed for an average of 10.2 years. This algorithm also provides a 10-year percent risk of a vascular event utilizing the predictors of age, systolic blood pressure, high-sensitivity C-reactive protein, total cholesterol, high-density lipoprotein, hemoglobin A1C (if diabetic), smoking status, and family history of early heart disease. Recent findings from the Women's Health Initiative Observational Cohort (comprising 1722 major CVD and a random health sub-cohort of women without any CVD history) indicate that CRP CVD risk models are better predictors of CVR for women (Cook et al., 2012).

More recently, and complementary to the use of algorithm scores, cardiometabolic risk has been classified as the presence or absence of a cluster of risk factors, commonly referred to as the metabolic syndrome (MS). MS is characterized by a specific set of CVR factors (excessive adipose tissue, and abnormalities in blood glucose, blood pressure, and serum lipid profile) and has a known increased risk for CVD and type II diabetes (Leiter et al., 2011). In an effort to harmonize criteria for MS a number of organizations and societies agreed upon the following definition for classification of MS in adult women. MS is present for women if 3 or more of the following indicators are

present: an elevated waist circumference (>80 cm, depending upon country of origin), elevated triglycerides (>1.7mmol/L or treatment for this abnormality), reduced HDL (<1.29mmol/L or treatment for this abnormality), raised blood pressure (≥135mmHg systolic or ≥85mmHg diastolic or treatment for hypertension), or elevated fasting blood sugar (>5.6mmol/L) (Alberti et al., 2009). It is important to note that the FRS and RRS algorithms do not consider the presence of MS. The presence of MS may increase the level of CVR predicted by algorithms two-fold (Leiter et al., 2011). Thus within a female population the FRS, RRS, and MS are prudent outcome measures; however, if an algorithm based outcome is utilized it may be under-predictive of CVR in those meeting MS criteria. This project will determine risk using the MS, as this outcome, in comparison to algorithm based CVR measures, is not limited by participant age and indicates a cluster of factors known to increase CVR (Leiter et al., 2011; Galassi, Reynolds, & He, 2006).

2.3 Shift Work and Cardiovascular Disease

Epidemiological evidence suggests a link between shift work and increased risk for CVD (Vyas et al., 2012; Pimenta et al., 2012, Fujino et al., 2006; Tuchsen et al., 2006; Karlsson et al., 2005; Knutsson, Hallquist, Reuterwall, Theorell, and Åkerstedt, 1999; Knutsson,& Bøggild, 1999). Most recently, Vyas et al. (2012) completed a meta-analysis of 34 studies that included 2 011 935 participants. The purpose of this review was to determine the associations between shift work and major vascular events. The relative risk of vascular events for those employed in shift work (including a night rotation) in comparison to day workers was 1.23 (95% CI=1.15-1.31) for myocardial infarction and 1.05 (95% CI=1.01-1.09) for ischemic stroke (Vyas et al., 2012). For the

Canadian population, the attributable risk of vascular events related to shift work exposure (prevalence of 32.8%) was 7.0% for MI, 7.3% for any coronary event, and 1.6% for ischemic stroke (Vyas et al., 2012). Within the Canadian healthcare setting there is a high prevalence of female shift workers, thus the attributable risk of shift work to vascular events may be substantially higher.

Some studies have explored the associations between acute exposure to shift work patterns and CVD. In a prospective follow-up study (233 689 person years) of male workers from the Japan Collaborative Cohort Study for Cancer Risk (n=17 649) shift workers had an increased risk for death due to ischemic heart disease in comparison to day workers (relative risk [RR] 2.32 (95% CI 1.37 – 3.95), p=0.002) (Fujino et al., 2006). In a longitudinal study of a representative sample of working Danes with a 12 year follow-up Tuchsen et al. (2006) found that individuals who worked irregular hours, defined as working at hours other than common day work, had increased admissions to hospital for circulatory-related diseases (RR 1.31 (95% CI 1.06-1.63)) when compared to those with day work. In their cross-sectional study of 211 participants who worked in public health campuses, Pimenta et al. (2012) reported that night work was independently associated with CVR, defined by FRS, (prevalence ratio [PR] 1.67 (95% CI 1.10-2.54)). These findings support that acute shift work exposure may be related to increased CVD prevalence; however, these studies do not provide female gender specific analyses or specific consideration of the hospital working setting.

The effect of chronic exposure to shift work has also been explored (Haupt et al., 2008; Knutsson et al., 1999; Knuttson & Boggild, 1999; Colditz, Manson, & Hankinson, 1997; Kawachi et al., 1996). In their population based case-control study, Knutsson et al.

(1999) demonstrated an association between shift work duration and CVD (myocardial infarction) in a cohort of 2,006 cases and 2,642 referents, including 1,423 women (589 cases and 834 referents). When participants were followed for three years, women with 3 years of shift work exposure in comparison to no shift work exposure had increased risk of a CVD event (odds ratio [OR] 1.3 (95% CI 0.9 – 1.8)). Within their cross-sectional study of 698 current and 238 former shift workers Haupt et al. (2008) reported a significant association between increased shift work exposure, defined by having ever worked in shift and night work, and risk for MI in both unadjusted models and models adjusting for age, sex, and cigarette smoking. The Nurses' Health Study, a population-based cohort that consisted of 121 700 female registered nurses between the ages of 30-55 years found an increased risk of CVD in nurses with a shift work history of six or more years compared with those with no employment history in shift work (RR 1.51 (95% CI 1.12 – 2.03)) (Kawachi et al., 1996).

Conversely, other reviews and studies have not shown an association between shift work and CVD. Frost et al.'s (2009) systematic review of 11 cohort and 5 case-control studies that included primarily male participants (one study utilized women exclusively and two did not restrict the inclusion of women) reported no association between shift work exposure (inconsistently defined as irregular hours sometimes including night work) and CVD, except in the female American nurses subgroup. Relative risks for shift work and ischemic heart disease ranged between 0.6-2.0. The authors concluded that the inconsistent associations were related to difficulty in excluding bias due to outcome measurement quality, exposure classification, and confounder control. Similarly, in a 22-year population-based longitudinal Finnish Twin

Cohort study (1975 and 1981 to 2003), that consisted of same gender twin pairs born prior to 1958 (n=20 142) including 10 303 women, there was no association between shift work (defined as both day and night shifts) and CVD events (defined as CHD mortality, and disability retirement due to CHD) (Hublin et al., 2010). All data were obtained from the Finland Social Insurance Institution and vital statistic data (Hublin et al., 2010). Measures included working time and physical workload questionnaires, socio-demographic and lifestyle covariates (married/cohabitating, social class, education level, smoking status, binge drinking, daily alcohol consumption, hypertension (self-report), BMI, physical activity level, life satisfaction, diurnal type, sleep quality and length). After a follow-up period of 22 years morbidity and mortality outcomes were assessed from vital statistic data. Among women the age-adjusted hazard ratios (HR) for the time of day worked and CHD mortality were non-significant but trended higher among those with shift work exposure when compared to day workers with no shift work exposure. Similarly, in a longitudinal study of participants from the Cardiovascular Risk in Young Finns cohort (n=1 543, 54% women), Puttonen et al. (2009) found that among the women studied there were no associations between shift work and CVD. This is likely related to the age of the women (ranged 24-39 years) at time of follow-up. Additionally, Yadegarfar and McNamee (2008) found in their case-control study that there was no significant dose-response interaction between shift work and ischemic heart disease among male blue-collar shift and non-shift workers (n= 635).

Thus the evidence linking shift work exposure to CVD is inconsistent. Some studies support that both acute and chronic shift work exposure is associated with increased risk for CVD. When no associations are found studies often possess

methodological problems that may affect findings, these include: outcome measurement, time for follow-up and exposure quantification. Additionally, few of these studies examined only women within a healthcare environment. This thesis project provides an analysis of shift work and CVR among female healthcare workers.

2.4 Potential pathways linking shift work to CVD

Puttonen, Härmä, and Hublin, (2010) have proposed that shift work is a circadian-related stressor that contributes to the development of CVD through three interacting pathways: behavioural, physiological and psychosocial. In this thesis I am focusing on the psychosocial pathway, within the context of the other pathways.

2.4.1 Psychological response to shift work

2.4.1.1 Work stress and shift work

Evidence from a number of studies that have included both men and women report that persons who work in shift work positions report more psychological work stress (Golubic et al., 2010; Elovainio, Kuusio, Aalto, Sinervo, & Heponiemi, 2010; Winwood et al., 2006; Alimoglu & Donmez, 2005; Harada et al., 2005; Bøggild, Burr, Tüchsen, & Jeppesen, 2001; Peter, Alfredsson, Knutsson, Siegrist, & Westerholm, 1999; Karasek & Theorell, 1990). Golubic et al. (2010) surveyed 1086 hospital nurses; nurses reported that shift work was a perceived stressor. In a Danish cohort study (n=5 940) shift night shift workers in comparison to day workers had a higher prevalence of work conflicts (adjusted odds ratio [AOR] 5.22 (95 % CI 1.9 – 14.3)), and low decision latitude (AOR 2.21 (95% CI 1.5-3.3)) (Bøggild et al., 2001). Thus, evidence suggests that in settings where shift work is utilized there may be an increased occurrence of work stress.

The hospital setting and a number of environmental characteristics, in addition to shift work, have also been associated with high work stress among workers. The National Survey of the Work and Health of Nurses (NSWHN), a recent national survey of nurses (n=18 676) in Canada reported that 33.2 % of nurses who worked in the hospital setting reported both high levels of job strain and low autonomy (28.5%) (Shields & Wilkins, 2006). Individuals providing care for complex and vulnerable patients (i.e. caring for children and the elderly) may experience more stress (Scott, Hwang, & Rogers, 2006; Hoffman & Scott, 2003). The teaching hospital environment is often more complex because of the acuity of the patients and the number of professionals and learners involved in care. Lu et al. (2007) reported moderate (61%) and moderate to extreme (15%) levels of occupational stress in 2 teaching hospitals. However, findings were not compared to non-teaching hospitals making it difficult to determine whether higher levels of stress exist in both settings. Iskera-golec, Folkard, Marek, and Noworol (1996) conducted a cross-sectional study in Cracovian hospitals comparing measures of health, sleep, job satisfaction, burnout, psychological and social well being among intensive care unit (ICU) nurses who worked either 8- or 12-hour shifts. As measured with the Maslach burnout inventory, ICU nurses on 12-hour shifts reported greater levels of chronic fatigue (mean 26.97, $p<0.01$) and cognitive anxiety (mean 16.16, $p<0.05$) when compared to ICU nurses working 8-hour shifts. Hoffman and Scott (2003), in their study of 208 registered nurses, also found that longer shift lengths, 12-hours compared to 8-hours, were associated with more psychological stress as measured by the Nurses Stress Scale ($t=-2.009$, $p=0.04$). In a cross-sectional study of shift working female nurses aged 20-59 years in southeastern Sweden, Edéll-Gustafsson, Kritz, and Bogren (2002),

reported that nurses who were dissatisfied with working hours reported significantly higher job strain scores (mean 3.2, SD 0.6) than those who reported satisfaction with working hours (mean 2.6, SD 0.6, $p<0.001$). The degree of control with work demands is associated with psychological work stress (Pryce et al., 2006). Workload may also affect the experience of psychological stress (Chung, Wolf, & Shapiro, 2009).

Thus the available evidence suggests that the hospital environment and shift work may be associated with higher levels of psychological work stress that may be related to complex working environments and long working hours. Work characteristics such as irregular working hours, shift length, and the teaching hospital setting may affect the workers' experiences of psychological work stress. Work demands and stress are potentially modifiable, whereas, the need for night work in hospital settings is not. This thesis will focus on the independent and interactive effects of psychological work stress and shift work.

Individuals may respond differently to shift work and work stress. Thorsteinsson and Brown (2009) conducted two cross sectional studies of undergraduate psychology students at an Australian university (study one n=281, 63 males and 218 females; study two n=609, 225 males and 384 females). In these studies the relationship between stressful life events and fatigue was mediated, through social support, dissatisfaction and sleep quality among women, notably different mechanisms than male participants, suggesting that women may respond differently to stressful events.

Individuals who have more work experience (including shift work experience) and are older report less work stress (Purcell, Kutash, & Coob, 2011; West, Ahern, Byrnes, & Kwanten, 2007; Winwood, Winefield, & Lushington, 2006). In a large

teaching hospital in the southern United States stress, as measured with the nurses stress scale (NSS), correlated with age ($r=-0.14$, $p<0.05$) (Purcell et al., 2011). The decrease in psychological stress associated with age and shift work experience may be related to a "healthy shift work" effect, in which persons who are able to manage or tolerate shift work rotations (and may be satisfied with their position) remain longer in the shift work position.

Associations between shift work and psychological work stress are likely influenced by personal attributes such as age, work experience and ability to adapt. This has not been comprehensively explored between shift working and non-shift working women within the hospital setting. The effects of the personal attributes, such as age and shift work experience, upon psychological stress will be explored within this thesis research.

2.4.1.2 Shift work and life stress

Few studies have examined the impact of shift work upon life stress. Stress outside the workplace may occur through non-work related factors, such as domestic work, being partnered (Winwood, et al., 2006), and/or having dependents (Simunic & Gregov, 2012; Chung et, al., 2009; Winwood et al., 2006). Shift work scheduling, particularly among women who continue to undertake the majority of domestic work and have a higher domestic workload, may compound psychological stress (Winwood, et al., 2006). In their narrative review Chung et al. (2009) similarly reports that combined domestic and vocational workload is potentially higher among female shift workers. Conflict between work and family domains is more prevalent among shift workers when compared to day workers (Simunic & Gregov, 2012; Canivet et al., 2010; Barnes-Farell

et al., 2008; Van Amelsvoort, Schouten, & Kok, 2004). Canivet et al., (2010), conducted a large cross-sectional study of Malamö, Sweden residents (n=12 607) to explore the determinants of exhaustion among women though work and family domains. In an age-adjusted model, exhaustion was associated with family-to-work conflict and job strain (OR 6.6 (95% CI 4.7 – 9.4)), and work-to-family conflict and job strain (OR 10.7 (95% CI 7.2 – 16.0)).

While Simunic and Gregov (2012) suggest that the age and number of dependents should be considered when examining the demands of both work and life; the evidence to support this suggestion is not strong or clear. Winwood et al. (2006) in their cross-sectional and correlational study of full-time working female nurses at two main Australian hospitals (n=846) reported no associations between number of dependents, being partnered and psychological stress. Additionally, other studies have shown no association between home characteristics and satisfaction with irregular working hours (Peters et al., 2009) and number of dependents (Kandolin, 1993).

The inconsistent findings may be related to the changing nature of life and work demands as careers and life advance and the capacity of the individual to manage these demands. Furthermore, the effects of non-work related demands and stress may independently or interactively influence these associations with psychological stress. Regardless, shift work and age may affect life stress. This thesis research will consider the number of dependents among other demographic and vocational factors in association with life stress among female shift work and non-shift work hospital employees.

2.4.1.3 Physiological effects of psychological stress

Autonomic activation and the hypothalamic-pituitary-adrenal (HPA) axis are major components of the physiologic stress response. Psychological stress may contribute to CVD development through prolonged and heightened activation of these systems. In their meta-analysis Kivimaki et al. (2006) reported that increased blood pressure levels were associated with increased levels of psychological stress, which is reflective of more recent findings (Gilbert-Ouimet, Brisson, Vezina, Milot, Blanchette, 2012). Cortisol, as the primary glucocorticoid actor of the HPA system, has a variety of physiological effects. In low doses cortisol enhances bodily defensive mechanisms such as the inflammatory response and the immune system response (Munck, Guyre, & Holbrook, 1984). In moderate to high concentrations cortisol depresses defense mechanisms to maintain homeostasis during stressful responses, preventing the over activation of bodily defenses (Munck et al., 1984). These depressive actions of cortisol have been found to reduce immune system response (anti-inflammatory actions) through moderation of mediator secretion including: interferon, prostaglandins, leukotrienes, histamine, serotonin and bradykinin (Munck et al.,1984). Another function of increased cortisol levels involves blood sugar regulation where insulin is decreased and glucagon secretion increased (increased gluconeogensis), resulting in increased blood sugar concentrations (Munck et al., 1984). Considering these mediators, the extensive actions of cortisol can be linked to tissue damage, metabolic disturbance, neuronal disturbance, infections, and fluid loss (Munck et al., 1984).

The physiological imbalances produced by prolonged HPA axis activation is atherogenic to blood vessels (Hamer et al., 2012; Härmä, Krompier, & Vahtera, 2006; Adameova, Abdellatif, & Dhalla, 2009; Everson-Rose & Lewis, 2005). Hamer et al.

(2012) measured HPA axis activation with saliva samples taken prior and following exposure to tasks designed to induce mental stress, and arterial calcification through computed tomography scans from the carina to diaphragm at baseline and three year follow-up. Individuals that had an increased HPA activation to psychological stress had increased arterial calcification (OR 1.27 (95% CI 1.02 – 1.60)). Autonomic activation is considered with the calculation of the MS, and though not directly measured within this project, the prolonged activation of the HPA system in response to psychological stress is a potential pathway contributing to CVD.

2.4.1.4 Psychological stress and CVD development

According to a 2006 meta-analysis of 14 prospective cohort studies age- and gender-adjusted relative risks for CHD were 1.43 (95% CI 1.15 – 1.84) for high job strain (high demand and low decision latitude) and 1.58 (95% CI 0.84 – 2.97) for high ERI (high effort – low reward) (Kivimäki et al., 2006). In the Framingham Offspring Study, a ten year follow up study of CHD identified through MI occurrence, women (n=1 328) with active job strain defined as high demands and high decision latitude had increased risk for CHD (RR 2.8 (95% CI 1.1 – 7.2) compared to women with the typical job strain definition of high demands and low control (Eaker, Sullivan, Kelly-Hayes, D'Agostino, & Benjamin, 2004). In a cross-sectional and review study of male (n=12 241) and female (n=10 245) French workers estimates for attributable fractions (AF) of job strain, as measured by the JCQ, with CVD, as measured by incidence reported within recent literature, were determined (Sultan-Taieb, Lejeune, Drummond, & Niedhammer, 2011). The resulting AF values ranged between 0-15.9% for morbidity and 2.5% for mortality (Sultan-Taïeb et al., 2011). The presence of chronic job strain, measured by the JCQ and

defined as high demand-low reward, was associated with higher proportion of recurrent MI, following and initial MI (hazard ratio [HR] 2.20 (95% CI 1.32 – 3.66) (Aboa-Éboulé et al., 2011). Interestingly, only one study (Orth-Gomer et al., 2000) examined psychological domestic stress as predictor of recurrent CVD; women with a partnered marital stress and cohabitation with a male partner had a 2.9 fold increase in risk for recurrent CVD (95% CI 1.3 – 6.5).

Some studies, however, do not support the associations between psychological stress and CVD (Kivimaki et al., 2011; Bonde et al., 2009; De Bacquer et al., 2005). In a longitudinal study with a mean follow-up period of 11.3 years (n=5 533) Kivimaki et al. (2011) did not find an association between job strain and either coronary heart disease or cardiovascular risk as measured with the Framingham Risk Score. Similarly, Bonde et al. (2009) found no association between psychological factors and ischemic heart disease in their prospective cohort study. De Bacquer et al. (2005) also found that after covariate adjustment job strain was not associated with coronary heart disease within the follow-up period of 3 years.

The associations between psychological job stress and CVR have also been explored. Higher levels of psychological stress have been associated with increased carotid intima-media thickness (IMT) (Hintsa et al., 2008; Wang et al., 2007). In a longitudinal study, Hintsa et al. (2008) followed 494 men from the CVR in Young Finns Study and found that an average increase in carotid IMT in adulthood of 0.59mm (95% CI 0.42 – 0.76) was associated with high job strain in young adulthood. In a three-year follow-up study Wang et al. (2007) found that when both work and domestic stress were present arterial lumens decreased in diameter by 0.20mm (95%CI -0.14 – -0.25).

Interestingly, in a cross-sectional study of 150 male and female office workers there was a negative association between mean IMT and work-related stress ($r = -0.28$, $p<0.01$) (Bugajska et al., 2008). A number of studies support the association between elevated blood pressure and psychological stress (Gilbert-Ouimet et al., 2012; Thurston, Sherwood, Matthews, & Blumenthal, 2011; De Gaudemaris et al., 2011; Markovitz, Matthews, Whooley, Lewis, & Greenlund, 2004; Peter et al., 1999; Brisson et al., 1999). Peter et al. (1999) found, among shift working men (aged 30-55, n= 2 288) employed in the area of Stockholm, Sweden, that effort-reward imbalance was associated with hypertension (OR 2.21 (95% CI 1.10 – 4.42)) and atherogenic lipid profiles (OR 1.34 (95% CI 0.92 – 1.95)) when controlled for age, behavioral factors, and hypertension in the case of lipid profiles. Thurston et al. (2011) and Brisson et al. (1999) explored the effects of psychological stress from both domestic and work domains. Large family responsibilities and high job strain in white-collar working women (n=199) with university degrees were associated with increases in blood pressure levels of 2.7-5.7mmHg systolic and 1.8-4.9mmHg diastolic ($p\leq0.05$), in comparison to women without university degrees (Brisson et al., 1999).

Other studies do not support an association between CVR factors and psychological stress. In a longitudinal study of 709 men from the CVR in Young Finns Study no associations were found when examining carotid IMT and psychological stress (Rosenstrom et al., 2011). Additionally, Guimont et al. (2006) found no effect of job strain upon blood pressure levels in their longitudinal study with a 7.5-year follow-up period of male and female white-collar workers (n=8395).

When both CVD and CVR are considered in association with psychological stress results remain inconsistent, and are likely related to classification of exposure (i.e, job strain), length of follow-up, and outcome assessment. Psychological work stress is commonly measured in relation to demand-control (i.e., job strain) and effort-reward imbalance. Psychological life stress appears to be under explored, though evaluated to some degree with certain demographic factors often included in analyses (e.g. marital status). The evaluation of CVD and CVR outcomes presents challenges, as discrete outcome events occur later in life as disease progression is slow. This thesis will measure cardiometabolic risk identified by the presence of metabolic syndrome, and work and life stress using validated questionnaires in addition to demographic and work-related factors.

2.4.2 Physiological response to shift work

Circadian disruption is associated with physiological and metabolic disturbances. These include altered inflammation, blood coagulation, cardiac autonomic function, blood sugar regulation, and HPA function (Puttonen et al., 2010). Biophysiological risk factors altered among shift workers, compared to day workers, in ways that contribute to CVD include: resistin, C-reactive protein, leptin, blood glucose, glucose tolerance, insulin, serum lipid profiles, and cardiac arrhythmogenicity (Burgueno, Gemma, Gianotti, Sookoian, & Pirola, 2010; Thomas & Power, 2010; Scheer et al., 2009; Ghiasvand et al., 2006; Di Lorenzo et al., 2003; Karlsson, Knutsson, & Lindahl, 2001; Van Amelsvoort, Schouten, Maan, Swenne, & Kok, 2001). In a cross-sectional study of male factory workers that compared day workers to rotating shift workers, shift workers displayed elevated levels of resistin 5450 ± 3780pg/mL and 6440 ± 4510pg/mL ($p<0.045$), respectively (Burgueno et al., 2010). When Thomas and Power (2010) prospectively

followed 7839 men and women over 48 and 42 years comparing female and male shift workers CRP was significantly higher among women, mean 0.94, SD 1.13 and mean 0.91, SD 0.95 ($p<0.001$), respectively. Scheer et al. (2009) examined 5 male and 5 female participants in a laboratory setting over 10 days and induced circadian misalignment (eating and sleep approximately 12 hours outside of habitual times) through a recurring 28-hour day and providing isocaloric meals. In response to circadian misalignment participants displayed increased mean arterial pressure (+3%, $p<0.001$), increased insulin (+22%, $p=0.006$), increased glucose (+6%, $p<0.001$), decreased leptin (-17%, $p<0.001$), and reversed cortisol rhythm ($p<0.001$), all of which may have adverse effects upon the cardiovascular system. Among 424 male railroad workers (37% shift workers) Ghiasvand et al. (2006) found increased total and LDL cholesterol levels among shift workers compared to day workers OR 2.11 (95% CI 1.33 – 3.36) and 1.76 (95% CI 1.09 – 2.83), respectively. Van Amelsvoort et al. (2001) prospectively followed shift working participants from an ongoing cohort study for 1 year (n=107 at baseline and 81 at follow-up). According to holter monitor recordings the incidence of premature ventricular contractions was weakly associated with number of shifts worked ($r=0.33$, $p=0.004$). Circadian stress as a result of shift work scheduling has the potential to adversely affect a variety of biophysiological factors that may contribute to CVD development.

Other physiological disturbances precipitated by circadian stress that have been associated with intermediate markers for CVD include altered blood pressure and endothelial function. In a cross-sectional study of male shift and non-shift workers (n=148) conducted by Nazri et al. (2008) hypertension was significantly more prevalent

among shift workers compared to non-shift workers, 22.4% and 4.2% respectively, (AOR 9.1 (95% CI 1.4 – 56.7)). In another prospective cohort study of 5 338 steel plant workers hypertension was more likely to develop among shift workers compared to day workers (OR 1.1 (95% CI 1.01 – 1.97)) (Sakata et al., 2003). Similarly in a cross-sectional study of 319 male chemistry plant workers the systolic blood pressure levels were higher among shift workers compared to day workers ($F=4.10$, $p<0.05$) (Di Lorenzo et al., 2003). As well, shift work may precipitate further increases in blood pressure for those with elevated blood pressure prior to entering a shift work pattern (Vikkunen, Harma, Kauppinen, & Tenkanen, 2007; Oishi et al., 2005). In a longitudinal, 8-year follow-up study of 2 172 middle-aged men from the Helsinki Heart Study shift workers who initially had a systolic blood pressure greater than 140mmHg were at risk for increase in blood pressure over both the short and long term (RR 4.61 and 3.59, $P<0.01$, respectively) (Vikkunen et al., 2007). In a prospective cohort study of Japanese steel working men, those with systolic hypertension (n=2 911) and diastolic hypertension (n=2 941) those in shift work positions displayed an elevated risk of progression to more severe hypertensive levels when compared to day workers (OR 1.28 (95% CI 1.07 – 1.52) and OR 1.23 (95% CI 1.05 – 1.44) for diastolic and systolic pressures respectively) (Oishi et al., 2005). A family history of hypertension may influence people's susceptibility to the adverse effects of shift work. McCubbin et al. (2010) found that those with self-reported family history of hypertension displayed higher diastolic blood pressures during simulated night work than those without self-reported family history of hypertension ($F=4.574$, $p=0.007$). Additionally, Scheer et al. (2009) found that circadian misalignment was associated with higher mean arterial pressures in their study of 10

participants (5 female) over a 10-day laboratory session. However, Sfreddo et al. (2010) explored the associations between shift work and blood pressure status in 493 healthcare workers (88% female, average age = 34.3 years) and found no significant associations between current shift work status and blood pressure.

Changes in endothelial structure and function may precipitate atherosclerotic changes and thereby precipitate vascular diseases. Tarzia et al. (2012) found that flow mediated dilation was significantly lower following night work when compared to day work, 8.02 ± 1.4% and 8.56 ± 1.7% ($p=0.025$), respectively. Lower arterial dilation may increase shear stress placed upon arterial endothelium consequently precipitating atherosclerotic changes. Coronary reserve, the amount of blood available within coronary circulation, was examined using transthoracic Doppler echocardiography in 36 female nurses (Kubo et al., 2011). Compared to day work, coronary reserve was significantly decreased, in the same individual, in response to night work, 4.1 ± 06 and 3.8 ± 0.6 ($p<0.001$), respectively. Decreases in coronary reserve have the potential to adversely affect the cardiac oxygenation that is particularly relevant to individuals among those with existing atherosclerotic changes in coronary vessels.

The physiological effects of circadian stress precipitated by shift work may lead to CVD. Analysis of HPA function requires the collection of biological samples at multiple interval points over an extended time period (days) to provide prudently useful information in regards to circadian stress. Within this thesis project the physiological factors that are being considered in relation to shift work and CVR include: lipid profiles, blood sugar and blood pressure levels, as they contribute to the classification of cardiometabolic risk.

2.4.3 Behavioural response to shift work

Shift work or circadian stress may precipitate behavioural changes that potentially contribute to CVD development. These may include altered dietary, physical activity and smoking habits, and sleep patterns (Puttonen et al., 2010). Dietary intake schedules may be altered among shift workers due to changes in sleep wake cycles (Puttonen et al., 2010). Additionally, Puttonen et al. (2010) reports that for those involved in shift work there is a potential for increased weight gain, which may be secondary to altered sleep schedules. Sleep disturbances associated with shift work rotations (difficulty falling asleep, disturbed sleep, and exhaustion) can decrease an individual's resilience to stress (Chung et al., 2009; Thorsteinsson & Brown, 2009; Edéll-Gustafasson et al., 2002; Iskera-golec et al., 1996). In a longitudinal one-year follow-up study among current smokers the number of cigarettes smoked per day increased significantly in shift workers when compared to day workers (+1.42, p=0.03) (Van Amelsvoort et al., 2004). Thus, individuals may not engage in health promoting life style behaviours, in part, because of shift work schedules and need for recovery and engage in unhealthy behaviors to "cope" with shift work– behaviours that may contribute to CVR.

2.5 Summary and Rationale

CVD is a common, chronic and burdensome illness. A number of non-modifiable and modifiable factors increase the risk for CVD. Generally, evidence supports potential links between shift work, psychological work stress, non-work related stress, and increased risk for CVD. However there is limited evidence about the contribution of the independent and interactive effects of shift work and stress on CVR. The hospital work environment is unique and stressful (for some). When considering the shift work pattern

within the hospital setting and associations with psychological stress there is the potential for enhanced susceptibility for CVD due to a combination of both the work pattern and environment. Women may be particularly susceptible to work-life stress, as women may have demanding domestic workloads, demands that may be more difficult to meet when working in shift work patterns. Most importantly, women experience overt CVD later in life, but are exposed to similar potentially modifiable risk factors during their working years.

The inconsistent findings linking shift work to the development of CVD for women are likely related to a number of factors 1) inconsistent definition and quantification of the exposure "shift work"; 2) inadequate follow-up time for women, as CVD events occur later in life; and 3) poor measurement of the outcomes of interest. There are three potential pathways linking shift work to CVD: physiological, behavioral, and psychosocial. This thesis aims to explore the psychosocial pathway linking shift work and CVR among female hospital employees. Based upon the literature reviewed in this thesis I will consider psychological work and life stress, (work and domestic sources of stress), shift work exposure (acute and chronic), and non-modifiable factors (menopausal status, age, and family history of premature myocardial infarction) in relation to cardiometabolic risk.

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Chapter 3

A comparative analysis of work and life stress in female shift work and non-shift work hospital employees.

3.1 Abstract

Objective: To compare levels of, and factors associated with psychological work and life stress indicators among female hospital employees in both shift work (SW) and non-shift work (NSW) positions.

Methods: Female employees (n=212) from one acute care teaching hospital in Ontario provided demographic and work related data, and completed questionnaires to assess for psychological work stress and life stress.

Results: Female SW in comparison to NSW reported higher effort-reward imbalance (ERI), psychological job demands, and skill discretion, but lower decision authority and total life stress. High job strain was negatively associated with age (adjusted odds ratio [AOR] 0.37 (0.18 – 0.77) and positively associated with ERI (AOR 2.76 (1.10 – 8.97)). High ERI positively associated with age (AOR 3.29 (1.34 – 8.03)) and psychological job demands (AOR 2.88 (1.16 – 7.17)). High life stress was associated with NSW status (AOR 0.19, 95% CI 0.07-0.52) and higher level of education (AOR 0.32 (0.11 – 0.90)).

Conclusions: Women in SW positions experience more psychological job demands and effort-reward imbalance, but less life stress. The interplay between effort and reward aspects of the work environment may significantly contribute to psychological work stress and persist with increasing age among female hospital employees regardless of SW status.

3.2 Introduction

Psychological stress, precipitated by both work and life domains, has been associated with an increased risk for a number of disease processes including cardiovascular disease (Health Canada, 2008; Kivimäki, et al., 2006; Eaker, Sullivan, Kelly-Hayes, D'Agostino, & Benjamin, 2004). Furthermore, a number of studies indicate that persons who work in SW positions report more psychological work stress (Golubic, Milosevic, Knezevic, & Mustajbegovic, 2010; Elovainio, Kuusio, Aalto, Sinervo, & Heponiemi, 2010; Winwood, Winefield, & Lushington, 2006; Alimoglu & Donmez, 2005; Harada et al., 2005; Bøggild, Burr, Tüchsen, & Jeppesen, 2001; Peter, Alfredsson, Knutsson, Siegrist, & Westerholm, 1999; Karasek & Theorell, 1990). Given that SW is a prevalent work pattern in the hospital setting it is not clear whether it is shift work or the work characteristics associated with shift work that contribute to higher levels of psychological job stress. The National Survey of the Work and Health of Nurses (NSWHN), a national survey of nurses (n=18 676) in Canada reported that 33.2% of nurses who worked in the hospital setting, compared to nurses employed in other settings, reported both high levels of job strain and low autonomy (28.5%) (Shields & Wilkins, 2006). There are a number of hospital work environment characteristics that are potentially stressful, including, but not limited to: complexity and vulnerability of patients, length of working hours, multiple care providers, and high levels of bureaucracy (Scott et al., 2006; Hoffman & Scott, 2003). Thus, working in a hospital may be psychologically stressful, but it is not clear if psychological stress is experienced the same or differently by employees in SW and NSW positions.

Feelings of psychological work stress may also be affected by a number of non-work related factors, such as age and work experience. Individuals who have more work

experience (including SW experience) and are older report less work stress (Purcell, Kutash, & Coob, 2011; West, Ahern, Byrnes, & Kwanten, 2007; Winwood et al., 2006). In a large teaching hospital in the southern United States, higher levels of work-related stress, measured via the nurses stress scale (NSS), were negatively correlated with age (NSS: $r=-0.14$, $p<0.05$) (Purcell et al., 2011). However, the strength of this association was weak. Decreasing levels of psychological job stress associated with age and SW experience may be related to a "healthy shift work or worker" effect, in which persons who are able to manage or tolerate SW rotations and/or work (and may be satisfied with their position) remain in positions longer.

Few studies have examined the impact of SW upon life stress. Stress outside the workplace may occur through non-work related factors, such as domestic work, being partnered (Winwood et al., 2006), and/or having dependents (Simunic & Gregov, 2012; Chung et, al., 2009; Winwood et al., 2006). SW scheduling, particularly among women who have a high domestic workload, may compound psychological stress (Winwood, et al., 2006). Additionally, life stress may be precipitated through conflict between work and family domains, which may be more prevalent among shift workers when compared to day workers (Simunic & Gregov, 2012; Canivet et al., 2010; Barnes-Farell et al., 2008; Van Amelsvoort, Schouten, & Kok, 2004). Canivet et al., (2010), conducted a large cross-sectional study of Malamö, Sweden residents (n=12 607) to explore the determinants of exhaustion among women through work and family domains. In an age-adjusted model, exhaustion was associated with family-to-work conflict and job strain (OR = 6.6, 95% CI 4.7-9.4), and work-to-family conflict and job strain. (OR = 10.7,95% CI 7.2-16.0). Simunic and Gregov (2012) suggest that the age and number of dependents

should be considered when examining the demands of both work and life; however, the evidence to support this suggestion is not strong or clear. Winwood et al. (2006) in their cross-sectional and correlational study of full-time working female nurses at two main Australian hospitals (n=846) reported no associations between number of dependents and being partnered and psychological stress. Additionally, other studies have shown no association between home characteristics and satisfaction with irregular working hours (Peters et al., 2009).

The available evidence suggests that the hospital environment and SW may be associated with higher levels of psychological work stress. Associations between SW and psychological work stress are likely influenced by personal attributes such as age, work experience and ability to adapt. Work characteristics such as irregular working hours, shift length, and the complex hospital settings may affect the workers' experiences of psychological work stress. The inconsistency in findings between higher levels of life stress and SW may be related to the changing nature of life and work demands as careers and life advance and the capacity of the individual to manage these demands. Furthermore, the effects of non-work related demands and stress may independently or interactively influence an individual's perception of psychological job stress. Work and life stress are potentially modifiable, whereas, the need for SW in hospital settings is not. Given that psychological stress may contribute to a number of disease processes the potential impact of SW within hospital settings on psychological stress development among female workers requires further investigation. Thus, the overall aim of this study was to explore the differences in psychological work stress and life stress in shift and non-shift female hospital employees, and to determine the influence of individual

attributes, such as age and work experience on potential associations. This served to address the knowledge gap related to life stress occurrence, and further understanding of work stress occurence, among hospital employed women in both SW and NSW positions.

3.3 Methods

To address the study objective a cross-sectional, descriptive research study was conducted with a sub-sample of data obtained from an ongoing cohort study at a university affiliated tertiary care teaching hospital in Ontario, Canada.

The sample consists of 102-shift work and 110-non-shift work female participants (n=212) from the larger ongoing cohort study (Canadian Institute of Health Research grant CIHR MOP 111023) representing the available data at study conception. All women who had two or more years of hospital work experience and were currently employed in the hospital in a full-time or part-time work capacity were eligible to participate. Participant enrollment was not limited to an area of practice and was open to all female employees in the hospital.

3.3.1 Data collection procedure

Female hospital employees were informed about the study using a variety of measures (email notice, unit postings, internal organizational newspaper and intra-net), and invited to participate. Women who were interested in study participation contacted the Project Manager to learn more about the study. If inclusion criteria were met, an intake interview was arranged and consent obtained. Trained personnel obtained SW history and details, and participants completed a questionnaire package containing descriptive items and valid measures of psychological work stress and life stress.

3.3.2 Exposure: Shift work

During the intake interview, participants reported their SW history and current SW status. SW has no standard definition but generally refers to working hours (eight or more consecutively) in a rotational shift pattern, at changing times of day (morning, afternoon, nights), including a night shift rotation. Participants reported: a) if ever worked SW, b) duration of employment in different SW rotations (i.e., permanent night, day and/or rotating mix), c) the typical number of shifts involved in each SW pattern worked, and d) their current SW status. Current SW status was the primary exposure variable.

3.3.3 Variables of interest

3.3.3.1 Work stress

Work stress was measured with the Job Content Questionnaire (JCQ) developed by Karasek et al. (1998) and the Effort Reward Index developed by Siegrist (1996). The JCQ consists of 56-items and includes scales measuring decision latitude (9 items), decision authority (3 items), psychological job demands (5 items), skill discretion (6 items), and physical job demands (5 items). A job strain variable was created based on high psychological demands-low decision latitude, utilizing the median quadrant method. This involves categorizing participants as above or below the median values for psychological job demands and decision latitude, those who are above the median value for psychological job demands and below the median value for decision latitude are considered to have high job strain (Landsbergis, Schnall, Warren, Pickering, & Schwartz, 1994). The effort-reward imbalance (ERI) model is an additional measure of job content that identifies potential antecedents to the experience of psychological job stress (Siegrist,

1996). Within this model intrinsic and extrinsic factors of high effort (i.e. critical coping and obligations) and low reward (i.e. money, esteem, status control) are considered in a reciprocal nature (Siegrist, 1996). The instrument consists of 52-items including descriptive measures, six effort and eleven reward subscales. The formula e/ (r*c) is utilized to determine the degree of imbalance, where e = sum of effort scale, r = sum of reward scale and c defines the correction factor for number of items in the nominator and denominator (6/11). When the ratio is calculated, values close to 0 indicate favorable conditions (relatively low effort and high reward) and values greater than 1 indicate unfavorable conditions (high effort and low reward). JCQ and ERI subscale and scale scores, as well as categories of job strain and effort reward imbalance (i.e., scores greater than 1) were determined along with reliability analyses.

3.3.3.2 Life stress

The Derogatis Stress Profile (DSP) provides a comprehensive stress measure. Based upon interactional stress theory, this 77 self-report item instrument considers the domains of environment (domestic, vocational, and health), personality (time pressure, driven behaviour, attitude posture, relaxation potential, role definition), and emotional response (hostility, anxiety, depression) as precipitators of the stress experience (Derogatis, 1995). These subscales describe the potential areas of life that precipitate psychological stress experience and each consists of 7 items (Derogatis, 1995). Dimension raw scores are calculated and converted to a t-score, which is a standardized scored based upon the original DSP sample. Approximately half of reported items need to be reflected meaning the score is subtracted from four before being calculated and converted into a t-score. Domain and total stress raw scores are obtained by summing

dimension t-scores. These domain and total stress raw scores are then converted into t-scores through a conversion table. T-scores are interpretable based upon the range of responses obtained during instrument development and allow centile assignment of sample scores. The clinical threshold for life stress determined by Derogatis (1995) is a t-score of 60 or greater, or the 84th percentile, determined as the mean plus one standard deviation. Within this study few participants met threshold score of 60. Therefore, a high life stress category was defined as the sample mean plus one standard deviation (t-score > 50), representing approximately the 87th percentile of the sample. Subscale, domain, total life stress, and high life stress scores were determined along with reliability analyses.

3.3.3.3 Demographic and work-related factors

Potential covariates included both demographic and work-related factors. Demographic measures included age, marital status, highest level of education, and household income. Other work-related factors included position status (e.g. full-time or part-time) and nature of work (e.g. direct vs. non-direct care).

3.3.4 Statistical analysis

All analyses were conducted with the software IBM SPSS Statistics version 21. Continuous variables were compared between SW and NSW with an independent t-test. Significant t-statistics were converted to a Pearson's correlation value (r) to provide a measure of effect size, permitting insight into the magnitude of significant statistical differences. Categorical variables were compared with a chi-square test. Using the dichotomized work and life stress variables as dependent variables we determined the unadjusted odds ratios for the effect of demographic, work and other psychological stress measures on each outcome. For multivariate analysis age and shift work history duration

were dichotomized based upon median values. Additionally, number of children was dichotomized based upon having no children or having children. For psychological stress measures the low stress groups were considered as the referent categories. Multivariate logistic regression models were then constructed by forcing current SW status into the model and using backward selection for demographic, work and psychological stress factors which were included based upon a Wald-statistic level of significance of $p<.10$.

3.3.5 Ethics

Ethical approval for this study was obtained through the Queen's University Health Sciences and Affiliated Teaching Hospitals Research Ethics Board (6007599).

3.4 Results

Sample demographics are presented in Table 1. Women in SW positions in comparison to women in NSW positions were more likely to be: younger and have fewer children. As expected those currently employed in SW, were more likely to be involved in direct patient care than non-direct patient care and had worked in SW longer. There were no significant differences between SW or NSW in regards to annual pre-tax household income, full-time or part-time status, or highest level of education.

Full descriptive test results of the JCQ, ERI, and DSP are presented in Tables 2 and 3, including effect sizes for significant differences. Reliability analyses for these instruments are presented in Table 4. Overall alpha values for instruments ranged from .64 to .90 for JCQ subscales, .65 to .85 for ERI subscales, and .13 to .84 for DSP subscales. The alpha values for the DSP subscales of time pressure, driven behavior, health posture and role definition were low (i.e., < .50), though low alpha levels were

correctable to acceptable alpha levels (>.50) with single specific item removal. In the bivariate analyses there were significant differences between SW and NSW with respect to the mean scores of the JCQ subscales: skill discretion, psychological job demands, decision authority, and physical job demands; but not for the four categories of job strain. There was a significant difference between SW and NSW composite ERI scores only, and not the subscale scores. NSW, in comparison to SW, reported significantly higher DSP scores for: time pressure, driven behaviour, anxiety and depression, and personality mediators (a composite score of time pressure, attitude posture, driven behavior, relaxation potential and role definition) and total stress score (a composite score of all subscales).

Table 5 provides the results of the multivariate logistic regression analyses for each of the psychological stress measures. High job strain was negatively associated with age (AOR 0.37 (0.18 – 0.77)) and positively associated with ERI (AOR 2.76, (1.10 – 6.97)). High ERI was positively associated with age (AOR 3.29 (1.34 – 8.03) and psychological job demands (AOR 2.88,(16-7.17)). Lower levels of life stress were associated with SW (AOR 0.19 (0.07-0.52)) and higher level of completed education (AOR 0.32 (0.11-0.90)).

3.5 Discussion

The key findings of this study are: 1) women in SW positions did not report higher levels of job strain, 2) women in SW positions reported higher effort-reward imbalance, psychological job demands, and physical job demands and lower levels of life stress and 3) different personal (age and highest level of education) and job characteristics (SW status) are associated with different types of stress.

Overall these findings suggest that high job strain, characterized by high demand and low control was not different for those employed in SW or NSW positions, which is contradictory to the reported literature (Golubic et al., 2010; Elovainio, Kuusio, Aalto, Sinervo, & Heponiemi, 2010; Winwood et al., 2006; Alimoglu & Donmez, 2005; Harada et al., 2005; Bøggild, Burr, Tüchsen, & Jeppesen, 2001; Peter, Alfredsson, Knutsson, Siegrist, & Westerholm, 1999; Karasek & Theorell, 1990). Though not significant, there was a higher prevalence of high job strain among those in SW positions compared to NSW position (23.5% vs. 18.2%). Psychological job demands, physical job demands, and ERI were significantly higher among those in SW positions compared to those in NSW positions, which is consistent with literature (Golubic et al., 2010; Elovainio et al., 2010; Winwood et al., 2006; Harada et al., 2005; Bøggild et al., 2001). Decision latitude, a composite score of skill discretion and decision latitude, was not different between groups, though the subscale components were. Women in SW positions reported higher skill discretion, that is the ability to individually use one's skills during work, but lower decision authority or inability to make decisions about work demands. Given that most of the SW provided direct care, this finding is somewhat logical, as women would be able to use a wide variety of skills for direct patient care, but had little authority over decisions in regard to unit or organizational functions.

In multivariate analysis, high job strain was negatively associated with participant age, which reflects previous findings within the literature (Purcell et al., 2011), and positively associated with high ERI, as expected. Age and high job strain were positively associated with high ERI, suggesting that although job strain may decrease with age, as expected through the development of coping mechanisms, ERI, a different psychological

work stress construct persists. The ERI composite score, compared to the demand-control categories of job strain, may be more effective at detecting psychological work stress factors relevant to female hospital employees as this composite score displayed a significant between group difference within this sample. However, subscale analysis from both demand-control and effort-reward models provide insight into the similarities and differences in psychological job characteristics of SW and NSW.

Interestingly, we found that women employed in SW positions reported less life stress experiences compared to those in NSW positions, which is also contradictory to recent literature (Simunic & Gregov, 2012; Canivet et al., 2010; Barnes-Farell et al., 2008; Winwood, et al., 2006; Van Amelsvoort et al., 2004). This may be reflective of the characteristics of SW and NSW groups. Those employed in SW positions were more likely to be younger and have fewer children potentially reducing life demands and total life stress occurrence; however, there were no significant associations between age and number of children and life stress. The lack association of high total life stress with personal factors is contradictory to recent literature reviewed (Simunic & Gregov, 2012; Chung et al., 2009; Winwood et al., 2006) where factors such as number of children and marital status were identified as potentially impacting total life stress. However, among female hospital employees the ability to cope with life stress was enhanced with higher education, as evidenced by a negative association with life stress occurrence. Employment within rotational SW schedules may aid workers in meeting life demands through work schedule flexibility and/or extended periods of non-working time between shifts. Significant differences in total life stress subscales indicate that time pressure, driven behavior, anxiety, and depression were scored higher by those employed in NSW

positions. However, DSP subscale scores composing the personality domain need to be interpreted with caution due to low alpha levels. Regardless, 14% of the sample reported high levels of life stress, suggesting that the ability to integrate work and life demands is a challenge for female employees.

Based on the findings of this study, aspects of psychological work and life stress occur, and are experienced differently between those employed in SW and NSW positions. Those in SW positions are more likely to be exposed to higher ERI, psychological and physical work demands, yet seem to have the resources to balance these work demands with life demands. Whereas, women in NSW positions reported higher decision authority (i.e., control) but higher overall life stress. Chronic exposure to psychological stress, regardless of origin, contributes to disease development, notably the development of cardiovascular disease (Sultan-Taieb, Lejeune, Drummond, & Niedhammer, 2011; Health Canada, 2010; Health Canada, 2008; Kivimäki, et al., 2006; Eaker, Sullivan, Kelly-Hayes, D'Agostino, & Benjamin, 2004). From an occupational health perspective, work related factors that contribute to chronic stress need to identified and, ideally, managed.

This study possesses several strengths and limitations. One of the strengths of this study is the use of validated psychometrically tested measures of job and life stress. Psychological work stress measures generally displayed acceptable alpha levels, suggesting detection of latent constructs. However, alpha levels for some subscales included in the total life stress instrument were low, potentially indicating that these subscales were not detecting a latent construct within this sample, a limitation to this study. The single-site research design also limits the generalizability of findings to other

hospital environments, as we were not able to control for potential site-specific factors. While our sample was large enough to determine moderate associations in regression analysis with the consideration of up to 10 variables, we may have lacked the power to detect weaker associations. As well, as previously discussed, the perception of stress is also influenced by other individual and system factors (i.e. ability to cope and organizational culture), which we did not measure. Finally, the cross-sectional research design limits the ability to determine the temporality of findings.

In conclusion, women working in SW positions experience more psychological and physical work stress, and effort-reward imbalance. The interplay between effort and reward aspects of the work environment may significantly contribute to psychological work stress and persist with increasing age among female hospital employees regardless of SW status.

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3.7 Competing Interests

No competing interests are possessed by any author within this study.

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Table 1

Sample characteristics.

	All Workers (N=212)	**Shift workers (n=102)**	**Non-shift workers (n=110)**	***p***
Characteristic	**n (%)**	**n (%)**	**n (%)**	
Age (yrs) – **M (SD)**	42.46 (10.8)	39.51 (11.1)	45.20 (9.7)	.000
Number of yrs in shift work – **M(SD)**	11.04 (10.58)	13.05 (10.28)	9.18 (10.6)	.007
Marital status				.064
Single	68 (32.1)	39 (38.2)	29 (26.4)	
Partnered	144 (67.9)	63 (61.8)	81 (73.6)	
Pre-tax household income (Canadian Dollars)				.106
< 50 000	22 (10.4)	7 (6.9)	15 (13.6)	
≥ 50 000	190 (52.8)	95 (93.1)	95 (86.4)	
Number of children				.002
0	71 (33.5)	45 (44.1)	26 (23.6)	
≥1	151 (66.5)	57 (55.9)	84 (76.4)	
Highest level of education				.103
Secondary/ Post-secondary (diploma)	127 (60.2)	55 (54.5)	72 (65.5)	
Post-secondary degree (Undergraduate/Graduate)	85 (39.8)	47 (45.5)	38 (34.5)	
Shift Work Exposure				.010
Less than 6 years	92 (43.3)	35 (34.3)	57 (51.8)	
Greater than six years	120 (56.6)	67 (65.7)	53 (48.2)	
Work status				.907
Full-time	176 (83.0)	85 (48.3)	91 (51.7)	
Part-time	36 (17.0)	17 (47.2)	19 (52.8)	
Patient Care				.000
Direct	157 (74.1)	97 (95.1)	60 (54.5)	
Non-direct	55 (25.9)	5 (4.9)	50 (55.4)	

Note: Continuous variables compared via independent t-test. Categorical variables compared via Chi-square.

Table 2

Job content questionnaire (JCQ) and effort reward imbalance (ERI) subscale and composite score comparisons between SW and NSW.

	All workers (N=212)	**Shift workers (n=102)**	**Non-shift workers (n=110)**	***p***	***r***
	M (SD)	**M (SD)**	**M (SD)**		
JCQ					
Skill discretion	35.6 (5.0)	36.5 (4.4)	34.7 (5.4)	.006	.19
Psychological job demands	20.2 (5.3)	21.2 (4.8)	19.2 (5.7)	.008	.18
Decision authority	32.6 (6.2)	31.6 (5.8)	33.5 (6.5)	.027	.15
Decision latitude	68.1 (9.2)	68.1 (8.0)	68.2 (10.2)	.994	
Physical job demands	11.9 (3.7)	13.8 (2.6)	10.2 (3.8)	.000	.49
High Job Strain[1]				.337	
Present – **n (%)**	44 (20.8)	24 (23.5)	20 (18.2)		
Not present – **n (%)**	168 (79.2)	78 (76.5)	90 (81.8)		
Active Job Strain[2]				.898	
Present – **n (%)**	47 (22.2)	23 (22.5)	24 (21.8)		
Not present – **n (%)**	165 (77.8)	79 (77.5)	86 (78.2)		
Passive Job Strain[3]				.128	
Present – **n (%)**	31 (14.6)	11 (10.8)	20 (18.2)		
Not present – **n (%)**	181 (85.4)	91 (89.2)	90 (81.8)		
Low Job Strain[4]				.646	
Present – **n (%)**	38 (17.9)	17 (16.7)	21 (19.1)		
Not Present – **n (%)**	174 (82.1)	85 (83.3)	89 (80.9)		
ERI					
Extrinsic effort	5.7 (3.9)	6.1 (4.2)	5.3 (3.7)	.137	
Esteem reward	3.9 (2.4)	3.9 (2.2)	4.0 (2.7)	.765	
Monetary gratification	2.0 (0.9)	1.8 (0.8)	2.2 (1.0)	.100	
Status control	9.6 (2.2)	9.6 (2.1)	9.7 (2.3)	.573	
Reward	15.6 (4.2)	15.5 (3.7)	15.9 (4.6)	.302	
Total ERI	0.6 (0.4)	0.7 (0.4)	0.6 (0.3)	.014	.17
High ERI				.105	
Present – **n (%)**	29 (13.7)	18 (17.6)	11 (10)		
Not present – **n (%)**	183 (86.3)	84 (82.4)	99 (90)		

Note: Continuous variables compared via independent t-test. Categorical variables compared via Chi-square. r = Pearson's correlational value based upon t-statistic and degrees of freedom. [1]Low decision latitude and high psychological job demands. [2]High decision latitude and high psychological job demands. [3]Low psychological job demands and low decision latitude. [4]Low psychological job demands and high decision latitude.

Table 3

Derogatis stress profile (DSP) subscale and composite score comparisons between SW and NSW.

	All workers (N=212)	**Shift workers (n=102)**	**Non-shift workers (n=110)**	***p***	***r***
	M (SD)	**M (SD)**	**M (SD)**		
DSP					
Time pressure	46.5 (8.2)	44.6 (7.5)	48.2 (8.6)	.002	.22
Driven behaviour	44.3 (8.1)	43.1 (6.9)	45.3 (9.0)	.042	.14
Attitude posture	37.6 (7.2)	36.8 (6.4)	38.2 (7.8)	.152	
Relaxation potential	46.8 (7.4)	46.1 (7.2)	47.5 (7.6)	.164	
Role definition	47.7 (8.5)	47.0 (8.2)	48.3 (8.7)	.266	
Vocational satisfaction	48.6 (7.8)	48.0 (6.7)	49.2 (8.7)	.268	
Domestic satisfaction	46.5 (9.2)	45.8 (8.2)	47.2 (10.0)	.300	
Health posture	48.4 (9.3)	47.4 (8.9)	49.2 (9.5)	.157	
Hostility	44.8 (9.5)	44.2 (8.6)	45.4 (10.2)	.378	
Anxiety	45.7 (8.4)	44.5 (7.9)	46.8 (8.8)	.041	.14
Depression	50.6 (9.2)	49.2 (8.6)	51.9 (9.6)	.033	.14
Personality mediators	36.7 (4.8)	36.2 (5.0)	37.2 (4.7)	.040	.10
Environmental events	44.9 (7.7)	44.0 (6.5)	45.7 (8.6)	.110	
Emotional response	45.8 (9.0)	44.5 (8.0)	47.0 (9.7)	.135	
Total stress score	40.7 (8.6)	39.2 (7.3)	42.1 (9.4)	.013	.17
High total life stress				.000	
Present – **n (%)**	30 (14.2)	5 (4.9)	25 (22.7)		
Not present – **n (%)**	182 (85.8)	97 (95.1)	85 (77.3)		

Note: Continuous variables compared via independent t-test. Categorical variables compared via Chi-square. r = Pearson's correlational value based upon t-statistic and degrees of freedom. DSP T-score values of 30, 40, 50, and 60 respectively represent the 2nd, 16th, 50th, and 84th percentiles of original sample t-score values.

Table 4

Internal consistency of psychometric instruments.

Job Content Questionnaire		
Scale	**Number of items (Cronbach's Alpha)**	**Comparison[1]**
Skill discretion	6 items (α=.71)	.71
Decision authority	3 items (α= .65)	.72
Decision latitude	9 items (α=.74)	.80
Psychological job demands	9 items (α= .77)	.62
Physical job demands	5 items (α= .90)	
Effort Reward Imbalance[2]		
Extrinsic Effort	6 items (α= .85)	
Esteem reward	5 items (α= .85)	
Status control	5 items (α= .65)	
ERI	17 items (α= .75)	
Derogatis Stress Profile[3]		
Time pressure	7 items (α= .36)	
Driven behaviour	7 items (α= .36)	
Attitude posture	7 items (α= .13)	
Relaxation potential	7 items (α= .51)	
Role definition	7 items (α= .45)	
Vocational satisfaction	7 items (α= .71)	
Domestic satisfaction	7 items (α= .72)	
Health posture	7 items (α= .57)	
Hostility	7 items (α= .64)	
Anxiety	7 items (α= .77)	
Depression	7 items (α= .71)	
Personality mediators	35 items (α= .70)	
Environmental events	21 items (α= .75)	
Emotional response	21 items (α= .84)	
Total stress score	77 items (α= .88)	

Note: [1]Internal consistency found by Karasek et al., (1998) for women, in a variety of occupations, from the United States. [2]Internal consistency found by Siegrist, Peter, Cremer, and Seidel (1997) ranged from .76 to .69 in a sample of healthy middle-aged men.[3]Internal consistency found by Derogatis (1984) ranged from .79 to .93 for 867 individuals employed in positions ranging from frontline to CEO among 12 commercial companies.

Table 5

Logistic regression results for factors affecting high job strain, high effort reward imbalance (ERI), and high total life stress.

	High Job Strain						High ERI						High Total Life Stress					
	OR	95% CI		AOR	95% CI		OR	95% CI		AOR	95% CI		OR	95% CI		AOR	95% CI	
Factor		LL	UL		LL	UL		LL	UL		LL	UL		LL	UL		LL	UL
Age (years)																		
<45	Ref.			Ref.			Ref.			Ref.			Ref			—	—	—
≥45	0.43*	0.21	0.86	0.37**	0.18	0.77	2.45*	1.06	5.67	3.29**	1.34	8.03	0.98	0.45	2.12	—	—	—
Number of children																		
None	Ref.			—	—	—	Ref.			—	—	—	Ref.			—	—	—
≥1	0.67	0.34	1.32	—	—	—	1.14	0.49	2.65	—	—	—	1.78	0.73	4.38	—	—	—
Household income[1]																		
<50 000	Ref.			—	—	—	Ref.			—	—	—	Ref.			—	—	—
≥50 000	1.20	0.38	3.75	—	—	—	0.68	0.23	2.18	—	—	—	0.71	0.22	2.28	—	—	—
Marital status																		
Single	Ref.			—	—	—	Ref.			—	—	—	Ref.			—	—	—
Partnered	1.16	0.56	2.39	—	—	—	0.74	0.33	1.70	—	—	—	2.07	0.80	5.32	—	—	—
Highest level of education																		
Secondary/post-secondary	Ref.			—	—	—	Ref.			—	—	—	Ref.			Ref.		
Undergraduate/graduate	0.94	0.48	1.86	—	—	—	0.91	0.41	2.04	—	—	—	0.26**	0.10	0.71	0.32*	0.11	0.90
Shift work status																		
Non-shift worker	Ref.			Ref.			Ref.			Ref.			Ref.			Ref.		
Shift worker	1.39	0.71	2.70	1.45	0.69	3.04	1.93	0.86	4.31	2.14	0.93	4.92	0.18**	0.06	0.48	0.19**	0.07	0.52
Shift work duration (years)																		
<7.5	Ref.			—	—	—	Ref.			—	—	—	Ref.			—	—	—
≥7.5	0.71	0.36	1.38	—	—	—	2.10	0.93	4.76	—	—	—	1.00	0.46	2.17	—	—	—
Work status																		
Part-time	Ref.			—	—	—	Ref.			—	—	—	Ref.			—	—	—
Full-time	0.90	0.38	2.14	—	—	—	0.98	0.35	2.76	—	—	—	0.79	0.30	2.10	—	—	—
High job strain	—	—	—	—	—	—	2.31	0.98	5.41	2.88*	1.16	7.17	2.18	0.93	5.07	2.27	0.90	5.73
High ERI	2.31	0.98	5.41	2.76*	1.10	6.97	—	—	—	—	—	—	1.32	0.46	3.77	—	—	—
High total life stress	2.18	0.93	5.07	2.50	0.98	6.39	1.32	0.46	3.77	—	—	—	—	—	—	—	—	—

Note. Dependent variables high job strain, high ERI (defined as ERI > 1), and high total life stress (defined as t-score > 50) OR = odds ratio; AOR = adjusted odds ratio; CI = confidence interval; LL = lower limit; UL = upper limit. [1]Pre-tax household income (thousands), Canadian dollars. Cox and Snell R^2 for adjusted models of job strain, ERI, and total life stress, respectively, = .07 (p=0.004), .06 (p=0.004), .11 (p=0.000). $^{*}p<0.05$. $^{**}p<0.01$. $^{***}p<0.001$.

Chapter 4

A comparative analysis of the associations between work and life stress and cardiometabolic risk among female shift work and non-shift work hospital employees.

4.1 Abstract

Objective: To determine and compare the associations between work and life stress with indicators of cardiometabolic risk (CMR) as measured with the Metabolic Syndrome (MS) in female shift workers (SW) and non-shift workers (NSW).

Methods: Consenting female hospital employees (n=212) underwent anthropometric measurement, provided fasting blood samples, demographic and work related data, and completed questionnaires with validated measures of psychological job and life stress. Psychological work stress was measured with the Job Content Questionnaire (JCQ) and the Effort-Reward Balance Index (ERI). Life stress was assessed with the Derogatis Stress Profile (DSP). The primary outcome of interest was the MS, providing an indicator of increased relative risk of cardiovascular disease (CVD) and mortality.

Results: There were no significant differences between SW and NSW for any CMR factors or MS. Female SW in comparison to NSW reported significantly higher mean scores in: global ERI (0.70 (SD 0.4) vs. 0.58 (SD 0.3) $p<.05$), psychological job demands (21.2 (SD 4.8) vs. 19.2 (5.7) $p<.01$), and lower decision authority (31.6 (SD 5.8) vs. 33.5 (SD 6.5) $p<.05$). MS was present among 17% of all employees, 18.5% of SW, and 15.5% of NSW. In logistic regression analysis MS was associated with chronic SW exposure of 6 or more years (AOR 5.41 (1.84 – 15.87), decisional authority (AOR 1.09 (1.00 – 1.18), skill discretion (AOR 1.13 (1.01 – 1.26), and depression (AOR 1.26 (1.08 – 1.46).

Conclusions: Chronic exposure to the SW environment (six years or greater) may increase risk for cardiovascular disease. Given that SW experienced more indicators of psychological job stress, findings provide support for the hypothesis that a prolonged exposure to both SW and SW-related stress could contribute to future CVD.

4.2 Introduction

Epidemiological evidence suggests a link between acute and chronic SW exposure and increased risk for CVD (Vyas et al., 2012; Pimenta, Kac, Souza, Ferreira, & Silqueira, 2011; Fujino et al., 2006; Tuchsen, Hannerz, & Burr, 2006; Karlsson, Alfredsson, Knutsson, Andersson, & Toren, 2005; Knutsson, Hallquist, Reuterwall, Theorell, and Åkerstedt, 1999; Knutsson,& Bøggild, 1999). Most recently, Vyas et al. (2012) completed a meta-analysis of 34 studies that included 2 011 935 participants. The relative risk of vascular events for those employed in SW (including a night rotation) in comparison to day workers was 1.23 (95% CI=1.15-1.31) for myocardial infarction and 1.05 (95% CI=1.01-1.09) for ischemic stroke (Vyas et al., 2012). For the Canadian population, the attributable risk of vascular events related to SW exposure (prevalence of 32.8%) was 7.0% for MI, 7.3% for any coronary event, and 1.6% for ischemic stroke (Vyas et al., 2012). Conversely, other reviews and studies have not shown an association between SW and CVD (Frost, Kolstad, & Bonde, 2009; Hublin et al., 2010; Puttonen et al., 2009). Frost, Kolstad, and Bonde's (2009) systematic review of 11 cohort and 5 case-control studies that included primarily male participants (one study utilized women exclusively and two did not restrict the inclusion of women) reported no association between SW exposure (inconsistently defined as irregular hours sometimes including night work) and CVD, except in the female American nurses subgroup. The variation in study results may be attributed to variation in exposure and outcome assessment. This is often the case when examining cardiovascular events in women, as cardiovascular events occur later in women's lives, in comparison to men.

One of the hypothesized pathways linking shift work to increased risk for CVD is the effect of circadian-related psychological work stress. Psychological work stress is

associated with increased risk for CVD (Sultan-Taïeb, Lejeune, Drummond, & Niedhammer, 2011; Aboa-Éboulé et al., 2007; Kivimäki et al., 2006; Eaker, Sullivan, Kelly-Hayes, D'Agostino, & Benjamin, 2004); however, in some studies these findings were not confirmed (Kivimaki et al., 2011; Bonde et al., 2009; De Bacquer et al., 2005). According to a 2006 meta-analysis of 14 prospective cohort studies age- and gender-adjusted relative risks (RR) for CHD were 1.43 (1.15-1.84 (CI 95%)) for high job strain (high demand and low decision latitude) and 1.58 (0.84-2.97 (CI 95%)) for high ERI (high effort – low reward) (Kivimäki, et al., 2006). Interestingly, only one study (Orth-Gomer et al., 2000) examined psychological domestic stress as predictor of recurrent CVD and found that married women cohabitating with a male partner had a 2.9 fold increase in risk for recurrent CVD (95% CI 1.3-6.5). In a longitudinal study with a mean follow-up period of 11.3 years (n=5 533) Kivimaki et al. (2011) did not find an association between job strain and either coronary heart disease or cardiovascular risk as measured with the Framingham Risk Score.

The associations between other sources of psychological stress and indicators of CVR have also been explored, but findings are inconsistent. In a three-year follow-up study Wang et al. (2007) found that elevated levels of both work and domestic stress were associated with a decreased arterial lumen diameter of 0.20mm (95%CI -0.14 - -0.25). A number of studies support the association between elevated blood pressure and psychological stress (Gilbert Ouimet et al., 2012; Thurston, Sherwood, Matthews, & Blumenthal, 2011; De Gaudemaris et al., 2011; Markovitz, Matthews, Whooley, Lewis, Greenlund, 2004; Peter, Alfredsson, Knutsson, Siegrist, & Westerholm, 1999; Brisson et al., 1999). Thurston et al. (2011) and Brisson et al. (1999) explored the effects of

psychological stress from both domestic and work domains. Large family responsibilities and high job strain in white-collar working women (n=199) with university degrees were associated with increases in blood pressure levels of 2.7-5.7mmHg systolic and 1.8-4.9mmHg diastolic ($p<0.05$), in comparison to women without university degrees (Brisson et al., 1999). Other studies do not support an association between CVR factors and psychological stress. In a longitudinal study of 709 men from the CVR in Young Finns Study no associations were found when examining carotid intima-media thickness (IMT) and psychological stress (Rosenstrom et al., 2011). Additionally, Guimont et al. (2006) found no effect of job strain upon blood pressure levels in their longitudinal study with a 7.5-year follow-up period of male and female white-collar workers (n=8395).

In Canadian hospitals, there is a high prevalence of female shift workers, thus the attributable risk of SW to vascular events may be substantially higher. Psychological work and domestic stress have been previously examined in relation to CVR; however, few of these studies have examined only female hospital employees who may experience work and life stress differently. We were not able to find a study that examined psychological life stress in association with CMR and SW within a sample of solely female hospital employees. Thus the objective of this study was to determine the associations between SW and CMR among female hospital employees while considering psychological work and life stress and controlling for other potential covariates. This served to address the knowledge gap related to life stress, and further understanding of work stress, and associations with CMR among hospital employed women in both SW and NSW positions.

4.3 Methods

To address the study objective a cross-sectional, descriptive research study was conducted with a sub-sample of data obtained from an ongoing cohort study at large university affiliated tertiary care teaching hospital in Ontario, Canada.

The sample consists of 102-shift work and 110-non-shift work female participants (n=212) from the larger ongoing cohort study (Canadian Institute of Health Research grant CIHR MOP 111023) representing the available data at study conception. All women who had two or more years of hospital work experience and were currently employed in the hospital in a full-time or part-time work capacity were eligible to participate. Participant enrollment was not limited to an area of practice and was open to all female employees in the hospital.

4.3.1 Data collection procedure

Female hospital employees were informed about the study using a variety of measures (email notice, unit postings, internal organizational newspaper and intra-net), and invited to participate. Women who were interested in study participation contacted the Project Manager to learn more about the study. If inclusion criteria were met, an intake interview was arranged and consent obtained. Trained personnel obtained SW history and details, completed anthropometric measures and blood pressure assessment using the BP Tru, and participants completed a questionnaire package containing valid measures of psychological job stress and life stress. As well, participants provided a fasting sample of blood that was analyzed in the hospital lab, according to standard procedures.

4.3.2 Exposure: Shift work

During the intake interview, participants reported their SW history and current SW status. SW has no standard definition but generally refers to working hours (eight or more consecutively) in a rotational shift pattern, at changing times of day (morning, afternoon, nights), including a night shift rotation. Participants reported: a) if ever worked SW, b) duration of employment in different SW rotations (i.e., permanent night, day and/or rotating mix), c) the typical number of shifts involved in each SW pattern worked, and d) their current SW status. Current SW status was the primary exposure variable.

4.3.3 Outcome: Cardiometabolic risk

Cardiometabolic risk was assessed via the Metabolic Syndrome (MS) defined utilizing the criteria outlined by Alberti et al. (2009). The criteria indicate a cluster of cardiometabolic factors associated with an increased risk for CVD; three or more indicators must be present for classification of MS. These criteria include: fasting blood sugar value greater than or equal to 5.6mmol/L or treatment for elevated blood glucose, blood pressure greater than or equal to 130mmHg systolic or 85 mmHg diastolic or treatment for previously diagnosed hypertension, total triglycerides greater than 1.7mmol/L or receiving treatment, high density lipoprotein less than 1.3mmol/L, or waist circumference greater than or equal to 80 cm. According to a recent meta-analysis, among women the presence of MS increases the relative risk of CVD by 2.10 (1.79-2.45) and is an important indicator of CVD incidence and mortality (Galassi, Reynolds, & He, 2006).

4.3.4 Variables of interest

4.3.4.1 Work stress.

Work stress was measured with the Job Content Questionnaire (JCQ) developed by Karasek et al. (1998) and the Effort Reward Index developed by Siegrist (1996). The JCQ consists of 56-items and scales measuring decision latitude, decision authority, psychological job demands, skill discretion, and physical job demands. Most scales are nationally standardized, allowing comparability by sex and occupation code. A job strain variable was created based on high psychological demands-low decision latitude, utilizing the median quadrant method (Landsbergis, Schnall, Warren, Pickering, & Schwartz, 1994). The effort-reward imbalance (ERI) model is an additional measure of job content that identifies potential antecedents to the experience of psychological job stress (Siegrist, 1996). Within this model intrinsic and extrinsic factors of high effort (i.e. critical coping and obligations) and low reward (i.e. money, esteem, status control) are considered in a reciprocal nature (Siegrist, 1996). The instrument consists of 52-items including descriptive measures, six effort and eleven reward subscales. The formula e/(r*c) is utilized to determine the degree of imbalance, where e = sum of effort scale, r = sum of reward scale and c defines the correction factor for number of items in the nominator and denominator (6/11). When the ratio is calculated, values close to 0 indicate favorable conditions (relatively low effort and high reward) and values greater than 1 indicate unfavorable conditions (high effort and low reward). JCQ and ERI subscale and scale scores, as well as categories of job strain and effort reward imbalance (i.e., scores greater than 1) were determined.

4.3.4.2 Life stress.

The Derogatis Stress Profile (DSP) provides a comprehensive stress measure. Based upon interactional stress theory, this 77 self-report item instrument considers the

domains of environment (domestic, vocational, and health), personality (time pressure, driven behaviour, attitude posture, relaxation potential, role definition), and emotional response (hostility, anxiety, depression) as precipitators of the stress experience (Derogatis, 1995). These subscales describe the potential areas of life that precipitate psychological stress experience (Derogatis, 1995). Dimension raw scores are calculated and converted to a t-score, which is a standardized scored based upon the original DSP sample. Approximately half of reported items need to be reflected meaning the score is subtracted from four before being calculated and converted into a t-score. Domain and total stress raw scores are obtained by summing dimension t-scores. These domain and total stress raw scores are then converted into t-scores through a conversion table. T-scores are interpretable based upon the range of responses obtained during instrument development and allow centile assignment of sample scores. The clinical threshold for life stress determined by Derogatis (1995) is a t-score of 60 or greater, or the 84th percentile, determined as the mean plus one standard deviation. Within this sample few participants met threshold score of 60. Therefore, a high life stress category was defined as the sample mean plus one standard deviation (t-score > 50), representing approximately the 87th percentile of the sample. Subscale, domain, total life stress, and high life stress scores were determined.

4.3.4.3 Other cardiovascular risk factors

Other traditional cardiovascular risk factors were considered as descriptors and potential covariates within multivariate models. These factors included: age, low-density lipoprotein (LDL), family history of heart disease, smoking status and menopausal status. Family history of heart disease was considered present if a participant responded “yes” to

the question “Did either of your parents have a heart attack before the age of 60?”. Smoking status was dichotomized based upon being either a smoker or non-smoker through answers to the self-report item “Do you currently smoke?”. Menopausal status was dichotomized based upon being either pre- or post-menopausal based upon responses the self report item “Has your natural menstrual cycle ceased?”.

4.3.5 Statistical analysis

All analyses were conducted with the software IBM SPSS Statistics version 21. Sample characteristics, CVR factors, MS, job and life stress scores were determined and compared between SW and NSW. Continuous variables were compared with independent t-tests; categorical variables with the Chi-square test. Significant t-statistics for psychological stress factors were converted to a Pearson’s correlation value (r) to provide a measure of effect size, permitting insight into the magnitude of significant statistical differences. In multivariate analysis MS was dichotomized as being present or not and utilized as the primary outcome variable in the logistic regression model. The model was then constructed by forcing current SW or NSW status, SW exposure duration, and psychological stress measures found to be significantly different between SW and NSW groups into the model. Backwards methodology with the inclusion criteria of a Wald-statistic level of significance of $p<.10$ was utilized for all other factors.

4.3.6 Ethics

Ethical approval for this study was obtained through the Queen’s University Health Sciences and Affiliated Teaching Hospitals Research Ethics Board (6007599).

4.4 Results

Sample characteristics are presented in Table 1. The mean age of those employed in SW was significantly lower than that those employed in NSW positions. Employees in SW positions were more likely to be single and have less children. As expected those currently employed in SW, were more likely to be involved in direct patient care than non-direct patient care and had worked in SW longer. There were no significant differences between groups regarding annual pre-tax household income, level of education, full-time or part-time status, smoking status, or menopausal status. There were no significant differences between those employed in SW and NSW positions for any MS criteria or CVD risk factors (Table 2).

Descriptive test results including effect sizes for significant differences are presented in Tables 3 and 4. There were no significant differences between SW and NSW groups for high job strain or high ERI, but there were significant differences among some subscale scores. Those in SW positions scored significantly higher in psychological job demands, skill discretion, and physical job demands, while those in NSW positions scored significantly higher in decision authority. Additionally, there was a significant difference in composite ERI between SW and NSW groups as ERI was significantly higher among those employed in SW, though the magnitude of this difference is negligible. NSW reported significantly higher overall DSP scores and scored significantly higher among some subscales, these included: time pressure, driven behaviour, anxiety, depression, and the composite subscale "personality mediators". All significant differences for psychometric factors represented small effects, except for the JCQ subscale physical job demands, which demonstrated a moderate effect. Logistic

regression results for factors affecting MS are featured in Table 5. Higher levels of skill discretion and decision authority, and higher levels of feelings of depression along with SW exposure of six or more were significantly associated with the presence of MS.

4.5 Discussion

In this sample there were no significant differences in CVR as measured by the MS between SW and NSW. Higher levels of skill discretion and of decision authority were weakly associated with increased risk for MS. Importantly, women who worked in a shift work rotation for 6 years or more were approximately 5 times more likely to have MS. Our results are consistent with studies in which current SW status had no association with CVR (Hublin et al., 2010; Frost et al., 2009; Yadegarfar & McNamee, 2008), and where chronic SW exposure was associated with increased CVR (Haupt et al., 2008; Knutsson et al., 1999; Knuttson & Boggild, 1999; Colditz, Manson, & Hankinson, 1997; Kawachi et al., 1996).

The overall prevalence of MS in this sample (17%) is slightly lower than the nationally reported prevalence of MS among Canadian women (20%) (Statistics Canada, 2013). This lower prevalence may be due to a younger age range within this study compared to national reports. While there was no significant difference between SW and NSW groups the occurrence of MS the prevalence of MS was higher among SW (18.5%) compared to NSW (15.5%), an interesting trend. Other studies from this center, in larger samples, have demonstrated that current shift work status is associated with approximately twice the risk of having metabolic syndrome (Lajoie, 2013; Kirk, 2009).

The finding that increased SW exposure, notably six or more years, was significantly associated with MS reflects findings from the Nurse's Health Study (Kawachi et al., 1996). The mechanisms underlying the associations between chronic SW exposure and CVD development are multifactorial. This pathway linking chronic SW to cardiovascular disease is likely related, to some degree, through psychological work stress. Shift work is associated with work stress, which would suggest that prolonged exposure to psychological job stress along with rotational work is contributing to CVR (Haupt et al., 2008; Knutsson et al., 1999; Knuttson & Boggild, 1999; Colditz, Manson, & Hankinson, 1997; Kawachi et al., 1996).

Aspects of psychological job stress were found to be higher among those employed in SW compared to NSW. High job strain was higher among SW compared to NSW, though this difference was not significant. Components of the high job strain variable (psychological job demands, skill discretion, and decision authority) and the physical job demands subscale were found to be significantly different between SW and NSW groups; SW scored higher on all subscales except for decision authority. As well, SW scored significantly higher than NSW in the total score for ERI, though the magnitude of this difference is negligible. When these variables were explored in association with MS only skill discretion and decision authority displayed significant positive associations, in both unadjusted and adjusted models. High job strain (high demand, low control) was not different between work groups or associated with indicators of CVR. Within the hospital setting, there may be high work demands and a mix of high and low control. One may have control over individual practice but no control over patient flow and needs, or organizational demands. SW reported higher

scores on skill discretion (i.e., ability to use one's skill and knowledge in practice) but lower decisional authority, which supports this hypothesis. Moreover, shift work was characterized as more psychologically and physically demanding for SW. If we are exploring the impact of psychological job stress characteristics and within the context of complex workplaces perhaps subscale components of the JCQ better capture associations psychological work stress, in comparison to well-known composite job strain variables.

Interestingly, female NSW scored significantly higher among life stress measures but only the depression subscale was significantly associated with MS occurrence. Women in the NSW group were slightly older and had more children. Thus these demands, in combination with a regular work hours may have created life demands. A shift work schedule allows for more blocks of time off, which may provide an opportunity to manage life demands. The associations between depressive feelings and MS are consistent with the literature (Van der Kooy et al., 2007; Rugulies, 2002) and worrisome. Women who experience depression are at greater risk of CVD; and women with CVD are more likely to experience depression – creating a cycle (van Melle et al., 2004).

Our study has limitations, which may have influenced our ability to determine a true association between current SW status and CVR. The etiology of CVD and therefore CVR is multifactorial. This study explored one potential pathway leading to increased CVR and CVD leaving a large amount of variability amongst the outcome unaccounted for. The single-site research design limits the generalizability of findings to other hospital environments and the inability to control for potential site-specific factors. Sample size, though sufficient to detect moderate associations in regression analysis with the

consideration of up to 10 variables, may have been too small to detect a weaker effect of SW status upon CVR. This is especially so given the lower prevalence of MS among the sample. The use of the MS as an outcome measurement of CVR compared to prospectively following participants to observe hard CVD events, is less favorable though substantially more feasible. The use of CVR algorithms such as the Reynolds Risk Score or Framingham Risk Score better predict absolute CVR though these algorithms are more restrictive of participants based upon their current age.

This study possesses several strengths. The use of a well-validated CVR measure such as the MS permits insight into potential CVR among female hospital employees. This study sample was largely homogenous with regards to CVR factors limiting the potential confounding effects of such factors. An additional strength is the use of well-developed and validated psychometric instruments.

Our findings, in this sample of female hospital employees, indicated that chronic exposure to shift work is associated with increased prevalence of cardiometabolic risk indicators. Selected psychological job characteristics, such as low decision authority and high skill discretion, common in shift workers may be contributing to this risk, especially if experienced for a number of years. The work environment can influence health. While shift work and non-shift work are necessary work patterns, it would seem that reduction in stress-related characteristics of these work patterns may positively influence worker health.

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4.7 Competing Interests

No competing interests are possessed by any author within this study.

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Table 1

Demographic and work characteristics of SW and NSW

	All Workers (N=212)	Shift workers (n=102)	Non-shift workers (n=110)	*p*
Characteristic	**n (%)**	**n (%)**	**n (%)**	
Age (years) – **M (SD)**	42.46 (10.8)	39.51 (11.1)	45.20 (9.7)	.000
Number of years in shift work – **M (SD)**	11.04 (10.58)	13.05 (10.28)	9.18 (10.56)	.007
Marital status				.064
Single	68 (18.9)	39 (38.2)	29 (26.4)	
Partnered	144 (67.9)	63 (61.8)	81 (73.6)	
Pre-tax household income (Canadian Dollars)				.106
< 50 000	22 (10.4)	7 (6.9)	15 (13.6)	
≥ 50 000	190 (52.8)	95 (93.1)	95 (86.4)	
Number of children				.002
0	71 (33.5)	45 (44.1)	26 (23.6)	
≥1	151 (66.5)	57 (55.9)	84 (76.4)	
Highest level of education				.103
Secondary/ Post-secondary (diploma)	127 (60.2)	55 (54.5)	72 (65.5)	
Post-secondary degree (Undergraduate/Graduate)	85 (39.8)	47 (45.5)	38 (34.5)	
Shift work duration				.010
Less than 6 years	92 (43.3)	35 (34.3)	57 (51.8)	
Greater than six years	120 (56.6)	67 (65.7)	53 (48.2)	
Work status				.907
Full-time	176 (83.0)	85 (48.3)	91 (51.7)	
Part-time	36 (17.0)	17 (47.2)	19 (52.8)	
Patient Care				.000
Direct	157 (74.1)	97 (95.1)	60 (54.5)	
Non-direct	55 (25.9)	5 (4.9)	50 (55.4)	

Note: Continuous variables compared via independent t-test. Categorical variables compared via Chi-square.

Table 2

Comparison of cardiovascular disease risk factors and metabolic syndrome (MS) between SW and NSW.

Characteristic	All workers (N=212) n (%)	Shift workers (n=102) n (%)	Non-shift workers (n=110) n (%)	*p*
Smoking status				.131
Smoker	19 (9.0)	6 (5.9)	13 (11.8)	
Non-smoker	193 (91.0)	96 (94.1)	97 (88.2)	
Family history of MI[1]				.848
Yes	28 (13.2)	13 (12.7)	15 (13.6)	
No	184 (86.8)	89 (87.3)	95 (86.4)	
Menopausal status				.424
Pre-menopausal	144 (67.9)	72 (70.6)	72 (65.5)	
Post-menopausal	68 (32.1)	30 (29.4)	38 (34.5)	
Biophysiological factors	**M (SD)**	**M (SD)**	**M (SD)**	
Waist circumference (cm)	85.5 (14.6)	82.5 (15.2)	85.5 (14.2)	.978
BMI	27.3 (6.0)	27.5 (6.0)	27.2 (6.0)	.654
Systolic blood pressure (mmHg)	112.5 (14.1)	112.8 (13.6)	112.2 (14.6)	.720
Diastolic blood pressure (mmHg)	71.9 (8.6)	72.5 (8.0)	71.4 (9.1)	.359
Total Cholesterol	4.8 (1.0)	4.7 (0.9)	4.9 (1.0)	.116
High-density lipoprotein	1.6 (0.4)	1.6 (0.4)	1.6 (1.0)	.914
Low-density lipoprotein	2.8 (0.8)	2.7 (0.8)	2.9 (0.7)	.260
Total Triglycerides	1.0 (0.9)	1.1 (1.0)	1.0 (0.8)	.399
Metabolic syndrome criteria				
Waist circumference ≥ 80cm	133 (62.7)	63 (61.8)	70 (63.6)	.788
Fasting blood glucose ≥ 5.6mmol/L	27 (12.7)	15 (14.7)	12 (10.9)	.407
Elevated total triglycerides ≥ 1.7mmol/L	26 (12.3)	14 (13.7)	12 (10.9)	.532
Low high-density lipoprotein < 1.3mmol/L	49 (23.1)	28 (27.5)	21 (19.1)	.149
Elevated systolic and or diastolic blood pressure ≥130/85mmHg	36 (17.0)	15 (14.7)	21 (19.1)	.396
Metabolic syndrome present	36 (17.0)	19 (18.5)	17 (15.5)	.539

Note: Continuous variables compared via independent t-test. Categorical variables compared via Chi-square. [1]Defined as either parent having a myocardial infarction (MI) prior to the age of 60 years.

Table 3

Job content questionnaire (JCQ) and effort reward imbalance (ERI) subscale and composite score comparisons between SW and NSW.

	All workers (N=212)	**Shift workers (n=102)**	**Non-shift workers (n=110)**	***p***	***r***
	M (SD)	**M (SD)**	**M (SD)**		
JCQ					
Skill discretion	35.6 (5.0)	36.5 (4.4)	34.7 (5.4)	.006	.19
Psychological job demands	20.2 (5.3)	21.2 (4.8)	19.2 (5.7)	.008	.18
Decision authority	32.6 (6.2)	31.6 (5.8)	33.5 (6.5)	.027	.15
Decision latitude	68.1 (9.2)	68.1 (8.0)	68.1 (10.2)	.994	
Physical job demands	11.9 (3.7)	13.8 (2.6)	10.2 (3.8)	.000	.49
High Job Strain[1]				.	
Present – **n (%)**	44 (20.8)	24 (23.5)	20 (18.2)	.337	
Not present – **n (%)**	168 (79.2)	78 (76.5)	90 (81.8)		
ERI					
Extrinsic effort	5.7 (3.9)	6.1 (4.2)	5.3 (3.7)	.137	
Esteem Reward	3.9 (2.4)	3.9 (2.2)	4.0 (2.7)	.765	
Monetary gratification	2.0 (0.9)	1.8 (0.8)	2.2 (1.0)	.100	
Status Control	9.6 (2.2)	9.6 (2.1)	9.7 (2.3)	.573	
Reward	15.6 (4.2)	15.5 (3.7)	15.9 (4.6)	.302	
Total ERI	0.6 (0.4)	0.7 (0.4)	0.6 (0.3)	.014	.17
High ERI					
Present – **n (%)**	29 (13.7)	18 (17.6)	11 (10)	.105	
Not present – **n (%)**	183 (86.3)	84 (82.4)	99 (90)		

Note: Continuous variables compared via independent t-test. Categorical variables compared via Chi-square. r = Pearson's correlational value based upon t-statistic and degrees of freedom. [1]Low decision latitude and high psychological job demands. [2]High decision latitude and high psychological job demands. [3]Low psychological job demands and low decision latitude. [4]Low psychological job demands and high decision latitude.

Table 4

Derogatis stress profile (DSP) subscale and composite score comparisons between SW and NSW.

	All workers (N=212)	**Shift workers (n=102)**	**Non-shift workers (n=110)**	***p***	***r***
	M (SD)	**M (SD)**	**M (SD)**		
DSP					
Time pressure	46.5 (8.2)	44.6 (7.5)	48.2 (8.6)	.002	.22
Driven behaviour	44.3 (8.1)	43.1 (6.9)	45.3 (9.0)	.042	.14
Attitude posture	37.6 (7.2)	36.8 (6.4)	38.2 (7.8)	.152	
Relaxation potential	46.8 (7.4)	46.1 (7.2)	47.5 (7.6)	.164	
Role definition	47.7 (8.5)	47.0 (8.2)	48.3 (8.7)	.266	
Vocational satisfaction	48.6 (7.8)	48.0 (6.7)	49.2 (8.7)	.268	
Domestic satisfaction	46.5 (9.2)	45.8 (8.2)	47.2 (10.0)	.300	
Health posture	48.4 (9.3)	47.4 (8.9)	49.2 (9.5)	.157	
Hostility	44.8 (9.5)	44.2 (8.6)	45.4 (10.2)	.378	
Anxiety	45.7 (8.4)	44.5 (7.9)	46.8 (8.8)	.041	.14
Depression	50.6 (9.2)	49.2 (8.6)	51.9 (9.6)	.033	.14
Personality mediators	36.7 (4.8)	36.2 (5.0)	37.2 (4.7)	.040	.10
Environmental events	44.9 (7.7)	44.0 (6.5)	45.7 (8.6)	.110	
Emotional response	45.8 (9.0)	44.5 (8.0)	47.0 (9.7)	.135	
Total stress score	40.7 (8.6)	39.2 (7.3)	42.1 (9.4)	.013	.17
High total life stress				.000	
Present – **n (%)**	30 (14.2)	5 (4.9)	25 (22.7)		
Not present – **n (%)**	182 (85.8)	97 (95.1)	85 (77.3)		

Note: Continuous variables compared via independent t-test. Categorical variables compared via Chi-square. r = Pearson's correlational value based upon t-statistic and degrees of freedom. DSP T-score values of 30, 40, 50, and 60 respectively represent the 2nd, 16th, 50th, and 84th percentiles of original sample t-score values.

Table 5

Adjusted odds ratio for factors affecting the presence of Metabolic Syndrome (MS).

	MS					
	OR	95% CI		AOR	95% CI	
Factor					LL	UL
Shift work status						
Non-shift worker	1	—	—	1	—	—
Shift worker	1.25	0.61	2.57	1.00	0.37	2.70
Shift work duration						
Less than 6 years	1	—	—	1	—	—
Greater than 6 years	4.78**	1.90	12.05	5.41**	1.84	15.87
JCQ						
Psychological job demands	0.98	0.91	1.05	0.96	0.87	1.06
Skill Discretion	1.09*	1.01	1.18	1.13*	1.01	1.26
Decision authority	1.06	1.00	1.12	1.09*	1.00	1.18
Physical job demands	1.02	0.92	1.12	1.06	0.92	1.22
ERI						
Total ERI	1.05	0.39	2.88	1.04	0.33	3.35
DSP						
Time pressure	0.95	0.85	1.06	0.87	0.75	1.01
Driven behaviour	0.97	0.88	1.08	0.90	0.78	1.04
Anxiety	0.97	0.90	1.05	0.96	0.86	1.09
Depression	1.07	0.98	1.17	1.26**	1.08	1.46

Note. Dependent variable MS present. Model adjusted for age, smoking status, menopausal status, and family history of heart disease. AOR = adjusted odds ratio; CI = confidence interval; LL = lower limit; UL = upper limit. Cox and Snell $R^2 = 0.197$ (p=0.000). $^{*}p<0.05$. $^{**}p<0.01$. $^{***}p<0.001$.

Chapter 5

General Discussion

5.1 Summary of findings

The overall goal of this thesis project was to compare the differences between work and life stress, and their associations with indicators of cardiovascular risk (CVR) among shift and non-shift female hospital employees. Shift work status was the primary exposure of interest and represented by workers who regularly worked at different times of day including night rotations. Work stress was assessed via the Job Content Questionnaire and the Effort-Reward Imbalance Index, and life stress assessed via the Derogatis Stress Profile (DSP). The primary outcome of CVR was measured using the criteria for Metabolic Syndrome, a cluster of cardiometabolic CVR factors.

5.1.1 Psychological stress among female hospital employees

The first manuscript described the differences in work and life stress among female shift work and non-shift work hospital employees, and associations with occupational and demographic factors; therefore, addressing the thesis objectives: to compare levels of work stress as measured with the Job Content Questionnaire (JCQ) and effort-reward imbalance (ERI) among female shift and non-shift hospital employees; and to compare the levels of life stress as measured with the Derogatis Stress Profile (DSP) among female shift and non-shift hospital employees. For women employed in the hospital setting, high job strain, categorized as high demands and low control, was not higher among those in shift work positions, which was contradictory to reports within recent literature (Golubic, Milosevic, Knezevic, & Mustajbegovic, 2010; Elovainio,

Kuusio, Aalto, Sinervo, & Heponiemi, 2010; Winwood, Winefield, & Lushington, 2006; Alimoglu & Donmez, 2005; Harada et al., 2005; Bøggild, Burr, Tüchsen, & Jeppesen, 2001; Peter, Alfredsson, Knutsson, Siegrist, & Westerholm, 1999; Karasek & Theorell, 1990). Job strain was experienced differently for shift and non-shift employees; shift workers reported higher skill discretion and and non shift workers reported lower decision authority, and when these 2 subscales were combined to create a job strain variable, there was no difference between groups. Women in shift work positions reported significantly higher psychological and physical job demands. Within multivariate analyses job strain occurrence was negatively associated with participant age and positively associated with high ERI. ERI was significantly higher among shift workers group; however, there was no significant between group difference based upon the high ERI variable (ERI greater than 1) or for any ERI subscale. Within multivariate analyses high ERI was positively associated with age and job strain. Suggesting that regardless of SW status job strain may be influenced by increased age (time to cope and increased experience), while effort and reward aspects of the work environment may persist and continue to be a source of psychological stress despite increasing age.

Interestingly, life stress was significantly higher among hospital-employed women in non-shift work positions, also contradictory to reported literature (Simunic & Gregov, 2012; Canivet et al., 2010; Barnes-Farell et al., 2008; Winwood, et al., 2006; Van Amelsvoort, Schouten, & Kok, 2004). The subscales time pressure, driven behaviour, anxiety, and depression were all significantly higher among those in non-shift work positions. Within multivariate analyses total life stress was negatively associated with a shift worker status and a higher level of education, suggesting that aspects of the

shift work environment may aid in meeting life demands, as well as life demands may be managed better by those with a higher level of education. It is important to note that the low alpha values of the personality components of the DSP; results must be interpreted with caution. Further exploration of the contribution of these latent constructs to stress among female hospital workers is required.

5.1.2 Shift work, psychological stress and CVR

The second manuscript determined the associations between psychological stress (work and life) and CVR, among female shift and non-shift hospital employees, addressing the third thesis objective to determine the associations between work stress, and life stress, and rotational category on indicators of cardiovascular risk (as measured by the Metabolic Syndrome (MS)) while controlling for potential confounders (i.e. age, cardiovascular history, and menopausal status). Findings from this manuscript indicate that CVR is not significantly different between shift work and non-shift work groups, though the prevalence of MS is higher among the SW group. Those with six or more years of shift work exposure were approximately five times more likely to have MS. These results are consistent with studies in which current SW status had no association with CVR (Hublin et al., 2010; Frost et al., 2009; Yadegarfar & McNamee, 2008), and where chronic SW exposure was associated with increased CVR (Haupt et al., 2008; Knutsson et al., 1999; Knuttson & Bøggild, 1999; Colditz, Manson, & Hankinson, 1997; Kawachi et al., 1996). Metabolic syndrome was also significantly associated with the psychological work stress factors of decision authority and skill discretion, and the psychological life stress factor depression. These findings suggest that chronic exposure to shift work is associated with increased prevalence of cardiometabolic risk indicators.

Selected psychological job characteristics, such as low decision authority (and increased psychological and physical demands) experienced by shift workers may be contributing to this risk, especially if experienced for a number of years.

5.2 Strengths and limitations

This thesis possesses several strengths. Psychometric instruments utilized to assess psychological were well developed and validated tools. This thesis contributes to an apparent gap in the literature regarding total life stress, patterns and potential implications, among Canadian female hospital employees. This thesis utilized a well-known and validated CVR measure. This study also provides a timely examination of CVR in working age women, a population recently identified as high risk.

Despite strengths this thesis possesses several limitations. Participants joined this study on a voluntary basis. Furthermore, the timeline of the parent study was 10 days and required the completion of other activities aside from psychological stress questionnaires. If sample bias exists, then psychological stress may be underrepresented within the thesis. Sample size, though large enough to detect moderate associations, may have been too small to detect potential associations between variables of interest. The single hospital site utilized for this study limits the generalizability of findings to other hospital sites and to outside the hospital sector. The cross-sectional nature of this thesis limits the ability to determine the temporality of any findings and to prospectively analyze the potential interactions between shift work, psychological stress, and CVR. The use of the MS to assess CVR, though validated and reliable, is less effective that observing hard CVD events. The etiology of CVD is multifactorial and this thesis has examined one potential pathway. Therefore, the lack of consideration of potential behavioral (e.g. dietary habits

and physical activity) and physiological CVR factors (e.g. HPA axis and autonomic activation) are additional limitations of this project.

5.3 Implications

Psychological life and work stress may be experienced differently among female hospital employees depending upon work pattern. Shift work patterns among female hospital workers may increase the risk of work stress and decrease risk of life stress. Those in non-shift work positions may be less likely to experience work stress but more likely to experience life stress. The factors contributing to differing psychological stress experiences among female hospital employees remain unclear. It is apparent that depending upon work pattern (i.e. shift work versus non-shift work) different psychological stress experiences are more likely. Thus different approaches may be required to provide tailored interventions promoting psychological health among the hospital worker group.

Women working in the hospital setting with six or more years of SW exposure may have a higher level of CVR. This finding is consistent with previous research from the Nurses Health Study that requires further exploration and consideration. Given that CVD is a chronic disease that develops during working years CVR screening for middle-aged women exposed to the SW environment may be prudent. As well, further research is needed to better understand the nature of the SW environment and factors precipitating this increased CVR, especially among working women.

This thesis research indicates several considerations for future research regarding the potential influences of shift work and psychological stress, and CVR among female hospital employees. For example, physiological measures of stress (i.e., cortisol

production patterns) and consideration of modifiable behaviours (i.e., exercise) that may influence the associations between stress and CVR could be considered. A larger multi-site study could allow for this consideration of behavioural and physiological factors potentially impacting CVR. Additionally, the consideration and comparison of other potential CVR measures such as the Reynolds Risk Score or the Framingham Risk Score could identify the CVR related mortality. Alternatively, it is favorable, though methodologically difficult, to prospectively follow women to accurately quantify and measure their work experience and cardiovascular disease events.

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Appendix A Ethics Approval

QUEEN'S UNIVERSITY HEALTH SCIENCES & AFFILIATED TEACHING HOSPITALS RESEARCH ETHICS BOARD-DELEGATED REVIEW
December 17, 2012

Mr. Justin Tennant
School of Nursing
Queen's University

Dear Mr. Tennant
Study Title: NURS-295-12 A comparative analysis of work stress, life stress, and indicators of cardiovascular risk in female hospital shift and non-shift employees.
File # 6007599
Co-Investigators: Dr. J. Tranmer

I am writing to acknowledge receipt of your recent ethics submission. We have examined the Protocol, Derogatis Stress Profile, Effect Reward Balance Index, Job Content Questionnaire, Recruitment Poster and Consent Form for your project (as stated above) and consider it to be ethically acceptable. This approval is valid for one year from the date of the Chair's signature below. This approval will be reported to the Research Ethics Board. Please attend carefully to the following listing of ethics requirements you must fulfill over the course of your study:

Reporting of Amendments: If there are any changes to your study (e.g. consent, protocol, study procedures, etc.), you must submit an amendment to the Research Ethics Board for approval. Please use event form: HSREB Multi-Use Amendment/Full Board Renewal Form associated with your post review file # **6007599** in your Researcher Portal (https://eservices.queensu.ca/romeo_researcher/)

Reporting of Serious Adverse Events: Any unexpected serious adverse event occurring locally must be reported within 2 working days or earlier if required by the study sponsor. All other serious adverse events must be reported within 15 days after becoming aware of the information. Serious Adverse Event forms are located with your post-review file **6007599** in your Researcher Portal (https://eservices.queensu.ca/romeo_researcher/)

Reporting of Complaints: Any complaints made by participants or persons acting on behalf of participants must be reported to the Research Ethics Board within 7 days of becoming aware of the complaint. Note: All documents supplied to participants must have the contact information for the Research Ethics Board.

Annual Renewal: Prior to the expiration of your approval (which is one year from the date of the Chair's signature below), you will be reminded to submit your renewal form along with any new changes or amendments you wish to make to your study. If there have been no major changes to your protocol, your approval may be renewed for another year.

Yours sincerely,

Albert J. Clark.

Chair, Research Ethics Board
December 17, 2012

Investigators please note that if your trial is registered by the sponsor, you must take responsibility to ensure that the registration information is accurate and complete

QUEEN'S UNIVERSITY HEALTH SCIENCES AND AFFILIATED TEACHING HOSPITALS RESEARCH ETHICS BOARD ANNUAL RENEWAL

Queen's University, in accordance with the "Tri-Council Policy Statement 2, 2010" prepared by the Interagency Advisory Panel on Research Ethics for the Canadian Institutes of Health Research, Natural Sciences and Engineering Research Council of Canada and Social Sciences and Humanities Research Council of Canada requires that research projects involving human participants be reviewed annually to determine their acceptability on ethical grounds.

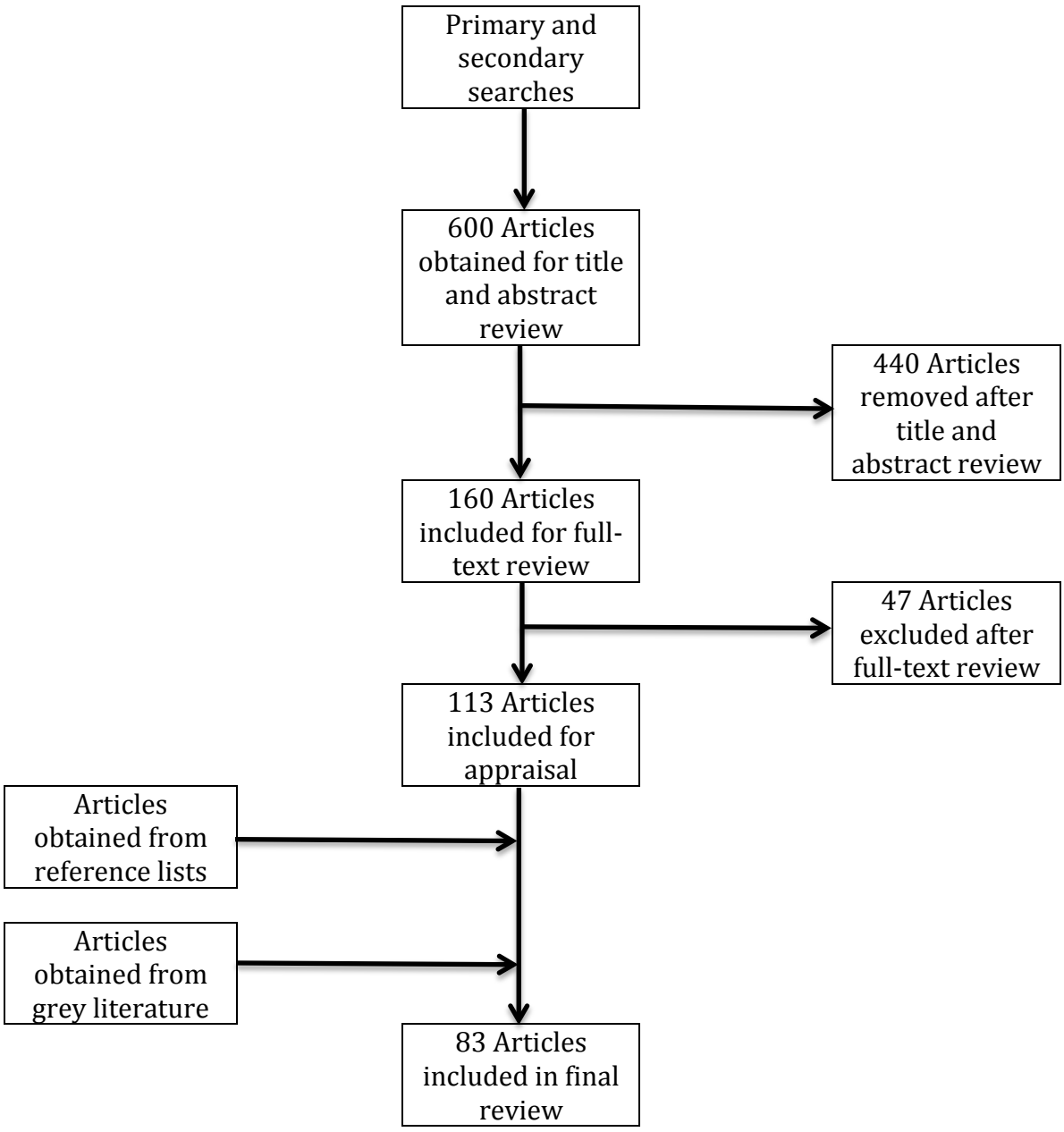
A Research Ethics Board composed of:

Dr. A.F. Clark, Emeritus Professor, Department of Biomedical and Molecular Sciences, Queen's University (Chair)
Dr. H. Abdollah, Professor, Department of Medicine, Queen's University
Dr. C. Cline, Assistant Professor, Department of Medicine, Director, Office of Bioethics, Queen's University, Clinical Ethicist, Kingston General Hospital
Dr. R. Brison, Professor, Department of Emergency Medicine, Queen's University
Dr. M. Evans, Community Member
Ms. J. Hudacin, Community Member
Dr. B. Kisilevsky, Professor, School of Nursing, Departments of Psychology and Obstetrics and Gynaecology, Queens's University
Mr. D. McNaughton, Community Member
Ms. P. Newman, Pharmacist, Clinical Care Specialist and Clinical Lead, Quality and Safety, Pharmacy Services, Kingston General Hospital
Ms. S. Rohland, Privacy Officer, ICES-Queen's Health Services Research Facility, Research Associate, Division of Cancer Care and Epidemiology, Queen's Cancer Research Institute
Dr. A. Singh, Professor, Department of Psychiatry, Queen's University
Dr. J. Walia, Assistant Professor and Clinical Geneticist, Department of Paediatrics, Queen's University and Kingston General Hospital
Ms. K. Weisbaum, LL.B. and Adjunct Instructor, Department of Family Medicine (Bioethics)

has reviewed the request for renewal of Research Ethics Board approval for the project **A comparative analysis of work stress, life stress, and indicators of cardiovascular risk in female hospital shift and non-shift employees** as proposed by **Mr. Justin Tennant** of the **School of Nursing,** at **Queen's University** . The approval is renewed for one year, effective **December 17, 2013.** If there are any further amendments or changes to the protocol affecting the participants in this study, it is the responsibility of the principal investigator to notify the Research Ethics Board. Any unexpected serious adverse event occurring locally must be reported within 2 working days or earlier if required by the study sponsor. All other adverse events must be reported within 15 days after becoming aware of the information.

Albert F. Clark.
_____Date: November 19, 2013
Chair, Health Sciences Research Ethics Board
Renewal 1[X] Renewal 2 [ ] Extension [ ] **Code# NURS-295-12 Romeo file# 6007599**

Appendix B Literature Review Methodology



Review of articles was prioritized based upon an evidence hierarchy with systematic review and meta-analyses receiving review first followed by consensus statements, randomized control trials, prospective cohort, cohort, and cross-sectional studies. Bibliographies were then hand searched along with grey literature to arrive at the final literature base.

Appendix C Job Content Questionnaire

****REGARDING YOUR CURRENT POSITION, PLEASE CHECK THE BOX IN THE MOST APPROPRIATE CATEGORY FOR THE STATEMENTS LISTED IN TABLES 1-8****

TABLE 1.

	Strongly Disagree	Disagree	Agree	Strongly Agree
a. My job requires that I learn new things.				
b. My job involves a lot of repetitive work.				
c. My job requires me to be creative.				
d. My job requires a high level of skill.				
e. I get to do a variety of different things in my job.				
f. I have an opportunity to develop my own special abilities.				

TABLE 2.

	Strongly Disagree	Disagree	Agree	Strongly Agree
a. My job allows me to make a lot of decisions on my own.				
b. On my job I have very little freedom to decide how I do my work.				
c. I have a lot to say about what happens on my job.				
d. I have a significant influence over decisions in my work group or unit.				
e. My work group or unit makes decisions democratically.				
f. I have at least some chance that my ideas will be considered about company policy (e.g., hiring, firing, wage levels, plants closing, new machinery, etc.).				
g. My union or employee association is influential in affecting company policy.				

h. Have influence over the policies of the union or employee association.				

13. How many people are in your work group or unit?
    a. I work alone
    b. 2-5 people
    c. 6-10 people
    d. 10-20 people
    e. >20 people

14. I supervise people as a part of my job.
    a. No
    b. Yes, 1-4 people
    c. Yes, 5-10 people
    d. Yes, 11-20 people
    e. Yes, more than 20 people

15. I am a member of a union or employee association.
    a.Yes
    b. No

TABLE 3.

	Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**
a. My job requires working very fast.				
b. My job requires working very hard.				
c. I am not asked to do an excessive amount of work.				
d. I have enough time to get the job done.				
e. I am free from conflicting demands that others make.				
f. My job requires long periods of intense concentration on the task.				
g. My tasks are often interrupted before they can be completed, requiring attention at a later time.				
h. My job is very hectic.				

i. Waiting on work from other people or departments often slows me down on the job.				

TABLE 4.

	Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**
a. My job requires lots of physical effort.				
b. I am often required to move or lift very heavy loads on my job.				
c. My work requires rapid and continuous physical activity.				
d. I am often required to work for long periods with my body in physically awkward positions.				
e. I am required to work for long periods with my head or arms in physically awkward positions.				

TABLE 5.

	Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**
a. My job security is good.				
b. My prospects for career development and promotions are good.				
c. In five years my skills will still be valuable.				

16. How steady is your work? (check one ONLY)
    a. Regular and steady
    b. Seasonal
    c. Frequent layoffs
    d. Both seasonal and frequent layoffs
    e. Other: _____

17. During the past year, how often were you in a situation where you faced job loss or layoff?

a. Never
b. Faced the possibility once
c. Faced the possibility more than once
d. Constantly
e. Laid off

18. Sometimes people permanently lose jobs they want to keep. How likely is it that during the next couple of years you will lose your present job with your employer?

a. Not likely at all
b. Not too likely
c. Somewhat likely
d. Very likely

19. In the ext 12 months, do you plan to leave your current position?

a. Yes
b. No

TABLE 6.

	Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**
a. My supervisor is concerned about the welfare of those under him/her.				
b. My supervisor pays attention to what I am saying.				
c. I am exposed to hostility or conflict from my supervisor.				
d. My supervisor is helpful in getting the job done.				
e. My supervisor is successful in getting people to work together.				

TABLE 7.

	Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**
a. People I work with are competent in doing their jobs.				
b. People I work with take a personal interest in me.				
c. I am exposed to hostility or conflict from the people I work with.				
d. People I work with are friendly.				

e. The people I work with encourage each other to work together.				
f. People I work with are helpful in getting the job done.				

TABLE 8.

	Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**
a. I often have to arrive early or stay late to get my work done.				
b. I often have to work through my breaks to complete my assigned workload.				
c. It often seems like I have too much work for one person to do.				
d. I have too much to do, to do everything well.				

20. If you are planning on leaving, why are you planning to leave? (circle all that apply)

a. Retirement
b. Career advancement
c. Career change
d. More time with family
e. Health problems
f. Physical demands of your position
g. Too much responsibility
h. Inability to provide safe, competent care
i. Burnout
j. Poor salary
k. Workload
l. Management practices
m. Conflict with management
n. Lack of respect
o. Other: _____

21. Do you have another paid position outside of your current position?
    a. Yes
    b. No

22. Is this other position full-time or part-time?
    a. Full-time
    b. Part-time

Appendix D Effort-Reward Imbalance Index

Job Status

We kindly ask you to answer the following questions and statements about your current working conditions. By doing so you contribute to a better scientific understanding of associations between modern working life and health.

1. What is your current occupation/job title? _____

2. What is your position at work?

   a. Manager
   b. Supervisor
   c. Employee, non-manual
   d. Employee, manual
   e. Self-employed

3. How many years have you worked in your current position? _____

4. Apart from your main employment, do you have any other jobs?

   ☐ Yes
   ☐ No

5. In total, how many hours a week to do you spend working for pay? _____ hours

6. Are you scheduled on shift work?

   ☐ Yes
   ☐ No

If you AGREE for the following questions please also indicate how much you are generally distressed by this situation

(1 = I am not at all distressed; 2 = I am somewhat distressed; 3 = I am distressed; 4 = I am very distressed).

7. I have constant time pressure due to a heavy work load.

	Agree _____		Disagree _____
1 _____	2 _____	3 _____	4 _____
Not at all distressed	Somewhat distressed	Distressed	Very distressed

8. I have many interruptions and disturbances in my job.

Agree _____ Disagree _____

1 _____	2 _____	3 _____	4 _____
Not at all distressed	Somewhat distressed	Distressed	Very distressed

9. I have a lot of responsibility in my job.

Agree _____ Disagree _____

1 _____	2 _____	3 _____	4 _____
Not at all distressed	Somewhat distressed	Distressed	Very distressed

10. I am often pressured to work overtime.

Agree _____ Disagree _____

1 _____	2 _____	3 _____	4 _____
Not at all distressed	Somewhat distressed	Distressed	Very distressed

11. My job is physically demanding.

Agree _____ Disagree _____

1 _____	2 _____	3 _____	4 _____
Not at all distressed	Somewhat distressed	Distressed	Very distressed

12. Over the past years, my job has become more and more demanding,

Agree _____ Disagree _____

1 _____	2 _____	3 _____	4 _____
Not at all distressed	Somewhat distressed	Distressed	Very distressed

If you <u>DISAGREE</u> for the following questions please also indicate how much you are generally distressed by this situation

(1 = I am not at all distressed; 2 = I am somewhat distressed; 3 = I am distressed; 4 = I am very distressed).

13. I receive the respect I deserve from my superiors.

Agree _____ Disagree _____

1 _____	2 _____	3 _____	4 _____
Not at all distressed	Somewhat distressed	Distressed	Very distressed

14. I receive the respect I deserve from my colleagues.

Agree _____ Disagree _____

1 _____	2 _____	3 _____	4 _____
Not at all distressed	Somewhat distressed	Distressed	Very distressed

15. I experience adequate support in difficult situations.

Agree _____ Disagree _____

1 _____	2 _____	3 _____	4 _____
Not at all distressed	Somewhat distressed	Distressed	Very distressed

If you <u>AGREE</u> for the following questions please also indicate how much you are generally distressed by this situation

(1 = I am not at all distressed; 2 = I am somewhat distressed; 3 = I am distressed; 4 = I am very distressed).

16. I am treated unfairly at work.

Agree _____ Disagree _____

1 _____	2 _____	3 _____	4 _____
Not at all distressed	Somewhat distressed	Distressed	Very distressed

17. I have experienced or I expect to experience an undesirable change in my work situation.

Agree _____ Disagree _____

1 _____	2 _____	3 _____	4 _____
Not at all distressed	Somewhat distressed	Distressed	Very distressed

18. My job promotion prospects are poor.

Agree _____ Disagree _____

1 _____	2 _____	3 _____	4 _____
Not at all distressed	Somewhat distressed	Distressed	Very distressed

19. My job security is poor

Agree _____ Disagree _____

1 _____	2 _____	3 _____	4 _____
Not at all distressed	Somewhat distressed	Distressed	Very distressed

If you <u>DISAGREE</u> for the following questions please also indicate how much you are generally distressed by this situation

(1 = I am not at all distressed; 2 = I am somewhat distressed; 3 = I am distressed; 4 = I am very distressed).

20. My current occupational position adequately reflects my education and training.

Agree _____ Disagree _____

1 _____	2 _____	3 _____	4 _____
Not at all distressed	Somewhat distressed	Distressed	Very distressed

21. Considering all my efforts and achievements, I receive the respect and prestige I deserve at work.

Agree _____ Disagree _____

1 _____	2 _____	3 _____	4 _____
Not at all distressed	Somewhat distressed	Distressed	Very distressed

22. Considering all my efforts and achievements, my work prospects are adequate.

Agree _____ Disagree _____

1 _____ 2 _____ 3 _____ 4 _____
Not at all distressed Somewhat distressed Distressed Very distressed

23. Considering all my efforts and achievements, my salary/income is adequate.

Agree _____ Disagree _____

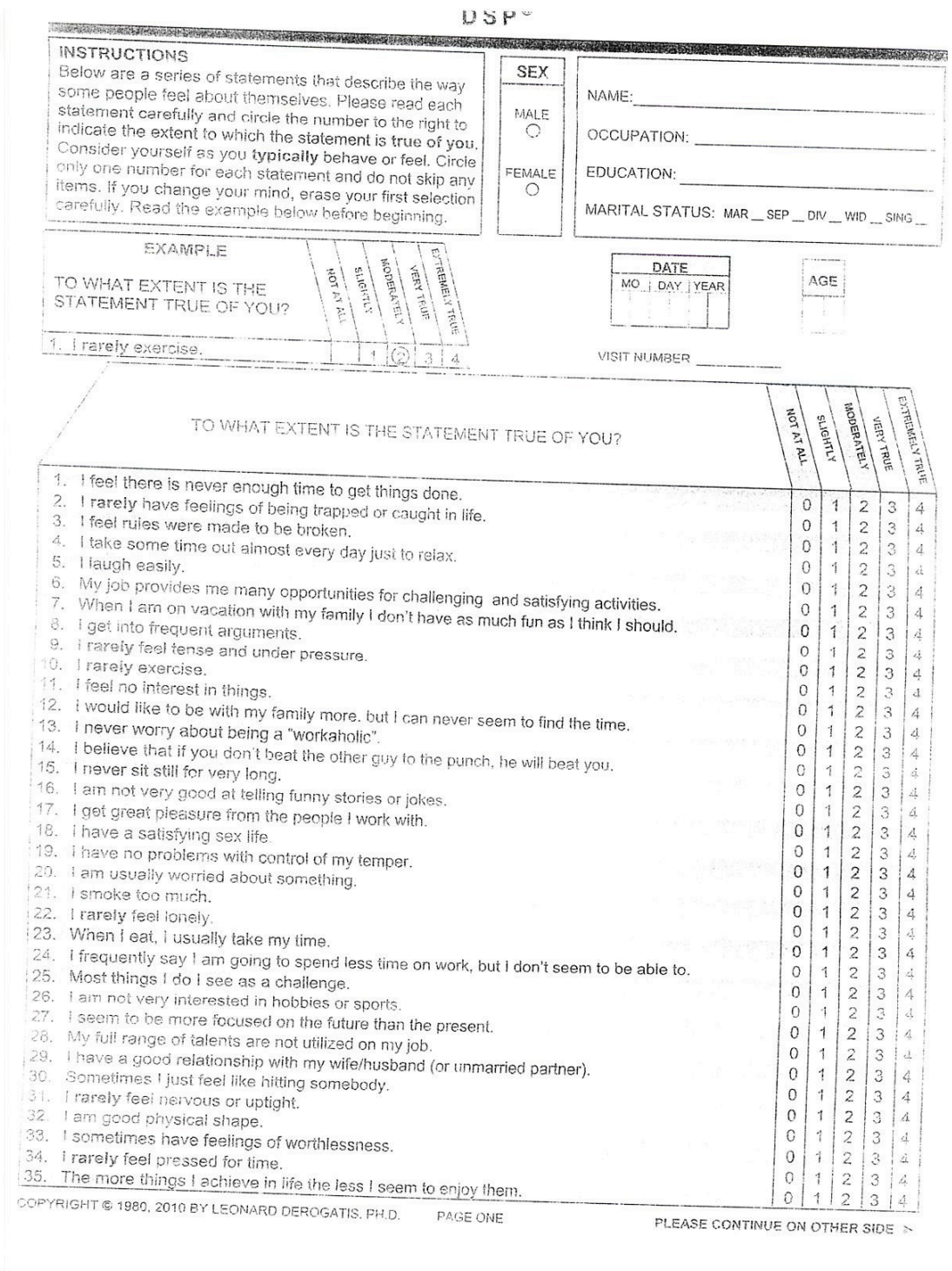
1 _____ 2 _____ 3 _____ 4 _____
Not at all distressed Somewhat distressed Distressed Very distressed

Please indicate to what extent (1 = strongly disagree; 2 = disagree; 3 = agree; 4 = strongly agree) you personally agree or disagree with these statements.

24. I usually take criticism very seriously.	1 ____ 2 ____ 3 ____ 4 ____
25. I am fueled by ambition.	1 ____ 2 ____ 3 ____ 4 ____
26. Even the slightest interruption bothers me.	1 ____ 2 ____ 3 ____ 4 ____
27. If something needs to be done right I'd better do it myself.	1 ____ 2 ____ 3 ____ 4 ____
28. I enjoy proving certain people wrong	1 ____ 2 ____ 3 ____ 4 ____
29. Always being a little better or faster than others is sort of a game to me.	1 ____ 2 ____ 3 ____ 4 ____
30. I can get very upset when someone keeps me from what I'm supposed to be doing.	1 ____ 2 ____ 3 ____ 4 ____
31. I can get very upset with others more often than I should.	1 ____ 2 ____ 3 ____ 4 ____
32. I get easily overwhelmed by time pressures at work.	1 ____ 2 ____ 3 ____ 4 ____
33. I start thinking about work problems as soon as I get up in the morning.	1 ____ 2 ____ 3 ____ 4 ____
34. I get angry with myself when I can't completely resolve a problem at work.	1 ____ 2 ____ 3 ____ 4 ____
35. I don't let others do my work.	1 ____ 2 ____ 3 ____ 4 ____

36. I get especially frustrated when my work is not properly appreciated.	1 ____ 2 ____ 3 ____ 4 ____
37. I can get furious if someone doesn't understand me the first time.	1 ____ 2 ____ 3 ____ 4 ____
38. When I get home, I can easily relax and forget all about work.	1 ____ 2 ____ 3 ____ 4 ____
39. People close to me say I sacrifice too much for my job.	1 ____ 2 ____ 3 ____ 4 ____
40. I only feel successful when I perform better than I expected.	1 ____ 2 ____ 3 ____ 4 ____
41. Other people have confidence in my ability to handle difficult tasks.	1 ____ 2 ____ 3 ____ 4 ____
42. I do everything possible to be in control.	1 ____ 2 ____ 3 ____ 4 ____
43. My family or private life comes first, then work.	1 ____ 2 ____ 3 ____ 4 ____
44. I get furious when anybody questions my competence.	1 ____ 2 ____ 3 ____ 4 ____
45. I don't usually get annoyed when my work routine is interrupted.	1 ____ 2 ____ 3 ____ 4 ____
46. I always want more than I can get.	1 ____ 2 ____ 3 ____ 4 ____
47. Work is usually still on my mind when I go to bed.	1 ____ 2 ____ 3 ____ 4 ____
48. The slightest compliment really boosts my confidence.	1 ____ 2 ____ 3 ____ 4 ____
49. I don't feel angry when others do better than me.	1 ____ 2 ____ 3 ____ 4 ____
50. Every once in a while, I like it when others keep me from working.	1 ____ 2 ____ 3 ____ 4 ____
51. I am always mentally prepared to do what needs to be done next.	1 ____ 2 ____ 3 ____ 4 ____
52. If I put off something that needs to be done today, I'll have trouble sleeping at night.	1 ____ 2 ____ 3 ____ 4 ____

Appendix E Derogatis Stress Profile



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INSTRUCTIONS
Below are a series of statements that describe the way some people feel about themselves. Please read each statement carefully and circle the number to the right to indicate the extent to which the statement is true of you. Consider yourself as you **typically** behave or feel. Circle only one number for each statement and do not skip any items. If you change your mind, erase your first selection carefully. Read the example below before beginning.

SEX
MALE ○
FEMALE ○

NAME: _____
OCCUPATION: _____
EDUCATION: _____
MARITAL STATUS: MAR __ SEP __ DIV __ WID __ SING __

DATE
MO | DAY | YEAR

AGE

VISIT NUMBER _____

EXAMPLE	NOT AT ALL	SLIGHTLY	MODERATELY	VERY TRUE	EXTREMELY TRUE
TO WHAT EXTENT IS THE STATEMENT TRUE OF YOU?					
1. I rarely exercise.	0	1	(2)	3	4

TO WHAT EXTENT IS THE STATEMENT TRUE OF YOU?	NOT AT ALL	SLIGHTLY	MODERATELY	VERY TRUE	EXTREMELY TRUE
1. I feel there is never enough time to get things done.	0	1	2	3	4
2. I rarely have feelings of being trapped or caught in life.	0	1	2	3	4
3. I feel rules were made to be broken.	0	1	2	3	4
4. I take some time out almost every day just to relax.	0	1	2	3	4
5. I laugh easily.	0	1	2	3	4
6. My job provides me many opportunities for challenging and satisfying activities.	0	1	2	3	4
7. When I am on vacation with my family I don't have as much fun as I think I should.	0	1	2	3	4
8. I get into frequent arguments.	0	1	2	3	4
9. I rarely feel tense and under pressure.	0	1	2	3	4
10. I rarely exercise.	0	1	2	3	4
11. I feel no interest in things.	0	1	2	3	4
12. I would like to be with my family more, but I can never seem to find the time.	0	1	2	3	4
13. I never worry about being a "workaholic".	0	1	2	3	4
14. I believe that if you don't beat the other guy to the punch, he will beat you.	0	1	2	3	4
15. I never sit still for very long.	0	1	2	3	4
16. I am not very good at telling funny stories or jokes.	0	1	2	3	4
17. I get great pleasure from the people I work with.	0	1	2	3	4
18. I have a satisfying sex life.	0	1	2	3	4
19. I have no problems with control of my temper.	0	1	2	3	4
20. I am usually worried about something.	0	1	2	3	4
21. I smoke too much.	0	1	2	3	4
22. I rarely feel lonely.	0	1	2	3	4
23. When I eat, I usually take my time.	0	1	2	3	4
24. I frequently say I am going to spend less time on work, but I don't seem to be able to.	0	1	2	3	4
25. Most things I do I see as a challenge.	0	1	2	3	4
26. I am not very interested in hobbies or sports.	0	1	2	3	4
27. I seem to be more focused on the future than the present.	0	1	2	3	4
28. My full range of talents are not utilized on my job.	0	1	2	3	4
29. I have a good relationship with my wife/husband (or unmarried partner).	0	1	2	3	4
30. Sometimes I just feel like hitting somebody.	0	1	2	3	4
31. I rarely feel nervous or uptight.	0	1	2	3	4
32. I am good physical shape.	0	1	2	3	4
33. I sometimes have feelings of worthlessness.	0	1	2	3	4
34. I rarely feel pressed for time.	0	1	2	3	4
35. The more things I achieve in life the less I seem to enjoy them.	0	1	2	3	4

PAGE ONE
PLEASE CONTINUE ON OTHER SIDE >

TO WHAT EXTENT IS THE STATEMENT TRUE OF YOU?	NOT AT ALL	SLIGHTLY	MODERATELY	VERY TRUE	EXTREMELY TRUE
36. I tend to be impatient.	0	1	2	3	4
37. I sometimes just "tune out" of work and get involved in other things.	0	1	2	3	4
38. Sex is an important part of life for me.	0	1	2	3	4
39. I am frequently frustrated in my work.	0	1	2	3	4
40. Interacting with my family and friends is a great source of enjoyment for me.	0	1	2	3	4
41. I rarely have angry thoughts about people.	0	1	2	3	4
42. When I know I have something unpleasant to do I worry about it for a long time.	0	1	2	3	4
43. I don't take antacids for heartburn or gas.	0	1	2	3	4
44. I usually have plenty of energy.	0	1	2	3	4
45. I enjoy being under pressure and doing a good job on many projects at the same time.	0	1	2	3	4
46. I really look forward to my vacations.	0	1	2	3	4
47. I make a serious effort to achieve a balance between work and fun.	0	1	2	3	4
48. It is not difficult for me to unwind after work.	0	1	2	3	4
49. I really believe it is lonely at the top.	0	1	2	3	4
50. Doing my job gives me a good feeling about myself.	0	1	2	3	4
51. I have a good balance between family activities and work activities.	0	1	2	3	4
52. I get easily annoyed or irritated.	0	1	2	3	4
53. I frequently have the feeling that something bad is going to happen to me.	0	1	2	3	4
54. I believe having good health is more important than anything.	0	1	2	3	4
55. Sometimes I feel hopeless about the future.	0	1	2	3	4
56. When I am driving the car, I almost never rush through traffic.	0	1	2	3	4
57. Every day I must get something tangible accomplished or I don't feel good about myself.	0	1	2	3	4
58. I feel the most important thing in life is that you achieve something with it.	0	1	2	3	4
59. The idea of meditation or relaxation training has not had much appeal for me.	0	1	2	3	4
60. I believe you can get a lot of help from others in getting the job done in life.	0	1	2	3	4
61. There are significant parts of my job that are frankly dull and boring.	0	1	2	3	4
62. I don't interact much with friends or neighbors.	0	1	2	3	4
63. I rarely clench my fists during conversation.	0	1	2	3	4
64. I rarely let things get me anxious or tense because I know they always get worked out somehow.	0	1	2	3	4
65. I am very careful about my diet.	0	1	2	3	4
66. I sometimes have thoughts of ending my life.	0	1	2	3	4
67. When I have an appointment I rarely arrive late or at the last minute.	0	1	2	3	4
68. Once I get started on a project, I don't like to stop until I am finished.	0	1	2	3	4
69. I believe competition builds character and is good for you.	0	1	2	3	4
70. I have trouble relaxing.	0	1	2	3	4
71. I believe life is a struggle and you don't get anything for free out of it.	0	1	2	3	4
72. When I wake up in the morning, I really look forward to going to work.	0	1	2	3	4
73. I really enjoy going to parties and meeting people.	0	1	2	3	4
74. If someone expresses a stupid idea, I rarely publicly disagree.	0	1	2	3	4
75. Sometimes I feel tense and anxious for no apparent reason.	0	1	2	3	4
76. I take tranquilizers to relax or sleep.	0	1	2	3	4
77. I rarely blame myself unduly for things that go wrong.	0	1	2	3	4

Please indicate what you believe your current level of stress to be by placing an "X" on the line below.

Totally Free of Stress ●——————————● Extremely Highly Stressed

Also, please assign a number from 0 to 100 where 0 is Totally Free of Stress and 100 is Extremely Highly Stressed in the space provided. _____

