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# Hospital Work, Occupational Stress, and Obesity among Female Registered Nurses

by

Julia Buss

DISSERTATION

Submitted in partial satisfaction of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

Nursing

in the

GRADUATE DIVISION

of the

UNIVERSITY OF CALIFORNIA, SAN FRANCISCO

## Dedication

This dissertation is dedicated to my loving husband, David Millett, and to my parents, John Buss, and Mary Sadtler. Their continuous love, support, and encouragement made my dissertation journey possible.

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Hospital Work, Occupational Stress, and Obesity

Among Female Registered Nurses

Julia Buss

## Abstract

### Background

More than one quarter of US working adults are obese. Obesity increases risk for chronic disease and injury. Work-related factors contributing to obesity may be modified to assist in health promotion.

### Objectives

This dissertation examines occupational stress and obesity among hospital-working female registered nurses (RNs). The objectives are to summarize the evidence to-date; to describe shift work, work hours, meal break practices, occupational stress, sleep quality, and obesity among female RNs; to develop and evaluate a conceptual model that occupational stress is associated with adiposity, and mediated by stress-induced eating behaviors.

### Methods

A cross-sectional web survey collected data from members of the Academy of Medical/Surgical Nurses. Occupational stress was measured with the Effort Reward Imbalance (ERI) short form. An ERI >1 indicates high effort and low reward indicative of occupational stress. Sleep quality was measured with the Pittsburgh Sleep Quality Index (PSQI). Scores can range from 0-21, and >5 indicates poor sleep quality. Descriptive statistics summarized the results, and Pearson's correlations tested associations between sleep quality, occupational stress, and body mass index (BMI). The

associations between occupational stress, adiposity, and mediating pathways were assessed using structural equation modeling (SEM).

**Results**

A total of 256 participated. The RNs' mean age was 46 (±11.9) years, the majority were White (76%). Over half (58%) of the RNs worked more than 40 hours per week, and one third (33%) were never able to take a meal break during their shifts. The majority (77%) reported high occupational stress with an ERI>1, poor sleep quality (78%), and over one-third (35%) were obese. Worse sleep quality correlated with higher BMI and higher occupational stress. SEM showed a significant indirect effect of occupational stress on adiposity mediated by eating behaviors ($p$<0.001). The direct effect of occupational stress on adiposity was negative, and non-significant.

**Conclusions**

These findings indicate that RNs are experiencing occupational stress and not getting adequate rest; interventions are needed to reduce occupational stress, improve rest, meal-breaks, and sleep. For individuals with stress-related eating behaviors, occupational stress may increase obesity risk. Interventions to reduce stress-related eating behaviors included in wellness programs need to be evaluated.

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# Chapter 1.

# Introduction

# Chapter 1.

# Introduction

## Obesity

Obesity in the USA continues to be a major threat to public health. It is estimated that more than one third (34.9%) of the US adult population are living with obesity (Ogden, Carroll, Kit, & Flegal, 2014). Additionally, the prevalence of abdominal obesity has increased over the previous decade and is now at 54.9% (Ford, Maynard, & Li, 2014). In the workforce, obesity prevalence among adults is 27.7% (Luckhaupt, Cohen, Li, & Calvert, 2014); it is probably lower than in the US population due to the healthy worker effect where those with disease due to obesity, or those living with severe obesity are less likely to be in employment. The prevalence of obesity and abdominal obesity among the adult population and among workers is of public health concern because of associated increased risk for several chronic diseases (diabetes, cardiovascular disease, and some cancers) (Guh et al., 2009). In the workplace, lost productivity costs due to obesity result from: presenteeism (less ability to be productive while at work), absenteeism, and disability (Hammond & Levine, 2010). The price tag is exorbitant, with lost productivity in the workplace due to obesity estimated to be at least $73.1 billion each year (Finkelstein, DiBonaventura, Burgess, & Hale, 2010).

Obesity is a complex disease and its various causes are associated with environmental, contextual, social, behavioral, and physiological factors. However, obesity can be prevented (Bauer, Briss, Goodman, & Bowman, 2014) and thus it is important to examine all contributors to the disease, including work-related factors which may increase risk for excessive weight gain and obesity. Obesity prevalence varies by

work sector and by occupation. By work sector, public administration (including federal, state, and local government agencies) has the highest obesity prevalence at 36.3%. By occupation, the protective service occupations (e.g. police officers, firefighters, correctional officers) has the highest prevalence of obesity at 40%, and life, physical and social science occupations (e.g. physicists, epidemiologists, biologists) the lowest at 14.2% (Luckhaupt et al., 2014). Among healthcare practitioners (which includes RNs and other healthcare providers) obesity prevalence is estimated to be 22% (Luckhaupt et al., 2014).

The work context of interest for this dissertation is the hospital and the workers under consideration are registered nurses (RNs). The title "nurse" is imprecise and is generally given to a wide variety of health care providers from unlicensed care assistants to Nurse Practitioners. Previous research includes various definitions of "nurse" in sample populations. This dissertation will focus on RNs, but included background research may also include data from additional licensed nurse populations, in which case this is noted.

Obesity prevalence among RNs in particular varies by geographic area and age. It is not clear if there are differences by gender. An analysis of self-reported data from the 2003-2009 Behavioral Risk Factor Surveillance Survey in Washington State, reported the prevalence of obesity in 1,210 male and female RNs at 22.6%, with the highest rate found among those aged 45 to 64 years, reported to be 25.6% (Bonauto, et al., 2014). In 2013, a cross-sectional survey of 169 RNs (95% female) from one Eastern US hospital reported a 31.4% obesity rate (Nahm, Warren, Zhu, An, & Brown, 2012). Despite the variation in

results these reports indicate that obesity prevalence among RNs is high enough to warrant concern and further investigation.

**Occupational Stress**

It is estimated that 30-40% of American workers find their jobs to be stressful (National Institute for Occupational Safety and Health, 2011). Various psychosocial stressors in the work place, (for example: low control, uncertainty in role expectations, negative social interactions, unfair procedural and distributive justice, or job insecurity), affect the well-being of workers (Nieuwenhuijsen, Bruinvels, & Frings-Dresen, 2010). The adverse effects of occupational stress include increased risk for hypertension, metabolic syndrome, and increased mortality from cardiovascular disease (Kivimaki et al., 2002; Landsbergis, Dobson, Koutsouras, & Schnall, 2013; Schmidt et al., 2014). In addition, chronic occupational stress may increase risk for obesity among workers, although the evidence is not conclusive (Solovieva, Lallukka, Virtanen, & Viikari-Juntura, 2013).

Nursing work is highly stressful occupation with a variety of stressors such as shift work and long work hours (Happell et al., 2013). RNs perform diverse roles in various settings, where presumably stressful factors may be variable, and individuals may be more or less resilient to stressors, with different levels of coping skills. The extent to which working situations and characteristics are stressful for all areas of nursing, and the level at which RNs feel themselves affected by occupational stress is not fully described. However, a study among hospital working nurses (including licensed practical nurses as well as RNs) suggested that occupational stress could be a substantial problem as 80% either “agreed” or “strongly agreed” that their jobs were stressful (Zapka, Lemon,

Magner, & Hale, 2009). Furthermore, it is possible that occupational stress may be a risk factor for obesity among RNs, as earlier research findings revealed that occupational stressors such as long work hours and high demand/low control at work (job strain) were associated with weight gain and obesity among RNs (Han, Trinkoff, Storr, & Geiger-Brown, 2011; Overgaard, Gamborg, Gyntelberg, & Heitmann, 2004).

**Work and Personal Health Characteristics**

The organizational characteristics of hospital work may affect the RN's ability to eat a healthy diet, thus promote weight gain, as well as contribute to perception of occupational stress. These organizational characteristics include: shift work, work hours, and meal break practices, and whether healthy food is available to staff in the hospital.

Shift work means working outside of regular work hours, at night, in the evening, or rotating from day to night. Hospital-based nurses often work outside regular hours; even those on day shift may begin work earlier than most regular work start times, and when working 12 hour shifts, they finish work later. Shift work increases risk for various health problems, and increases risk for obesity (Ramin et al., 2014).

Shift work may also adversely influence sleep; it is estimated that 65% of hospital RNs work 12 hour shifts (Stimpfel, Sloane, & Aiken, 2012), and they are vulnerable to poor sleep quality (Geiger-Brown, Trinkoff, & Rogers, 2011; Lee & Lipscomb, 2003). As poor sleep quality is associated with obesity, this might additionally contribute to shift working RNs risk for excessive weight gain (Beccuti & Pannain, 2011; Gangwisch, Malaspina, Boden-Albala, & Heymsfield, 2005). In addition, psychological stress predicts poor sleep quality (Akerstedt et al., 2012) and thereby further increases risk for weight gain. Moreover, short sleep is also a physiological stressor (McEwen, 2006).

Therefore, for shift working RNs exposed to occupational stress and poor quality sleep there may be a convergence of risk factors for weight gain.

**Purpose and Aims**

The overall purpose of this dissertation project is to examine occupational stress and obesity among US hospital-based shift working female RNs. The study has three specific aims:

Aim 1. To summarize the evidence from previous research for associations between occupational stress, weight gain, or obesity, or stress-related eating behaviors among licensed nurses.

Aim 2. To identify the work organizational factors (work schedules, work hours, and meal break practices), as well as describe personal health characteristics (sleep quality, occupational stress levels, and physical activity habits among RNs), which may be associated with obesity.

Aim 3. To evaluate a conceptual model that posits occupational stress is associated with adiposity (body fatness), and that the relationship is mediated by stress-related eating behaviors and/or food cravings.

## Significance

An assessment of work organizational and personal health characteristics among hospital-based shift working RNs will provide a preliminary depiction of issues that may affect RNs' wellbeing and risk for obesity. Furthermore, this assessment will assist in identifying important hypotheses for future research into examining occupational environmental, organizational, and contextual factors that may either be detrimental or be supportive of RNs' health and in the prevention of obesity. A better understanding of the

context of hospital work, the extent to which RNs take inadequate meal breaks, work long hours, get poor quality sleep, and experience occupational stress may also motivate hospital, state, or federal policies to better protect RNs' wellbeing and to ensure that they receive adequate rest and healthy food while at work.

Some individuals, particularly those at higher BMI, or with high cortisol reactivity, are "stress-eaters" i.e. they increase their consumption of high fat and sugary foods during a period of psychological stress (Epel, Lapidus, McEwen, & Brownell, 2001; Lattimore & Caswell, 2004). This "stress-eating" serves as a coping strategy, a way to cope with stress-related negative emotion (e.g. anger or sadness), and may even dampen the physiological stress response (Tomiyama, Dallman, & Epel, 2011). Thus, an examination of the association between occupational stress and adiposity, and possible mediation via stress-induced eating behaviors will help elucidate the behavioral pathways between occupational stress exposure and body fatness. A hypothetical conceptual model of the possible associations outlines the concepts and posited relationships (Figure 1). If stress-induced eating behaviors are significant mediators between occupational stress and adiposity then this research project will support the strategy of incorporating stress-coping skills into workplace wellness, or weight reduction interventions.

A future research focus on the effectiveness of interventions that include learning to self-regulate emotion, and to reduce unhealthy eating in response to negative emotion, may assist in promotion of a healthful diet among RNs and indeed all categories of workers with emotional eating traits whose jobs may expose them to high levels of occupational stress. Additionally, such interventions may assist individuals in learning

useful strategies for generally coping with occupational and other exposures to psychological stress.

**Presentation of the dissertation**

This dissertation is presented in 5 chapters. Chapter 1 includes the background and significance of the problem and introduces the dissertation aims. Chapter 2 is an integrative review of research to 2014, examining the association between occupational stress and weight gain or obesity among licensed nurses (all licensed nurses are included due to limited research specifically in RN populations). Chapter 3 is a descriptive study including work organization (shift work, work hours, meal breaks) and personal health characteristics (occupational stress, sleep quality, smoking, physical activity) that may affect healthy eating and weight status, and contribute to obesity. Chapter 4 tests a theoretical model of occupational stress and adiposity and possible mediating paths through stress-induced eating behaviors and food cravings. Chapter 5 provides a summary of the research findings, conclusion, and implications and recommendations for policy, and future research. Three publications (or publishable manuscripts) are generated from Chapters 2, 3, and 4.

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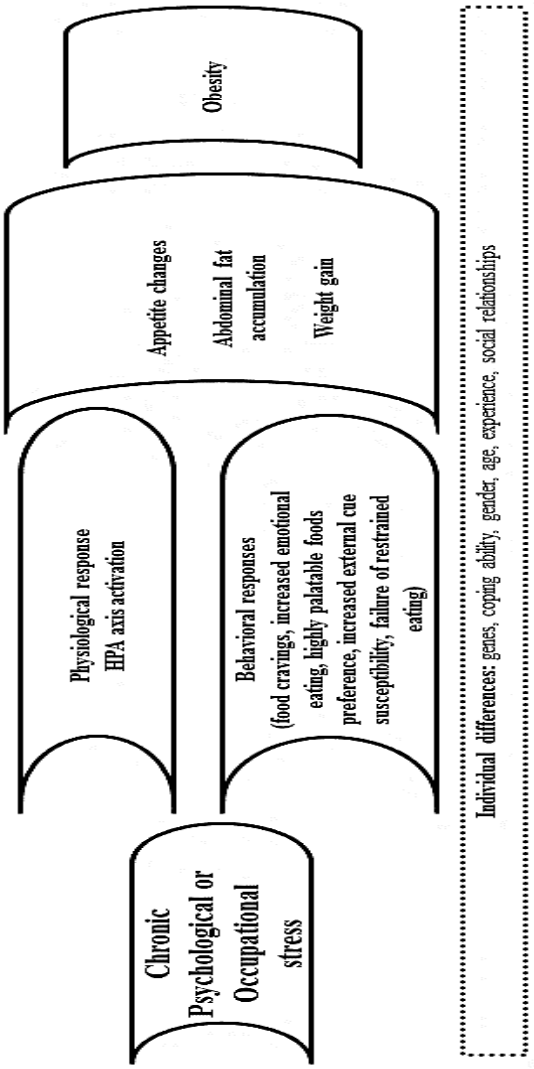
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**Figure 1.**

*Conceptual model for occupational stress and obesity*



# Chapter 2

## Occupational Stress and Weight gain, Obesity, or Stress-related Eating Behaviors among Licensed Nurses: An Integrative Review

# Chapter 2

## Occupational Stress and Weight gain, Obesity, or Stress-related Eating Behaviors among Licensed Nurses: An Integrative Review


## Abstract

**Background.** There are many potential stressors in nursing work. Occupational stress has been identified as a risk factor contributing to weight gain and obesity among non-nursing worker populations, but little is known about the effect of occupational stress on weight gain, obesity, or stress-related eating behaviors among licensed nurses.

**Aims**. This integrative review summarized the evidence for associations between occupational stress, weight gain, or obesity, or stress-related eating behaviors among licensed nurses.

**Methods.** Studies were identified from keyword searches in electronic databases: MEDLINE, PsycINFO, and the Cumulative Index to Nursing and Allied Health Literature (CINHAL). Only peer-reviewed studies quantitative and qualitative studies published in the English language between January 2004 and December 2014 were included. The sample populations in relevant publications included licensed nurses. An integrative approach for data synthesis was used, guided by Whittemore and Knafl's (2005) methodology.

**Results.** Seven studies were identified as relevant to the research question. Requirements of the job, nurses' control over their work, and coping and social support at work were possible factors contributing to weight gain, obesity, and unhealthy stress-related eating behaviors among licensed nurses.

**Conclusions.** It is possible that occupational stress is a modifiable risk factor for weight gain, obesity, and unhealthy stress-related eating behaviors among licensed nurses. To promote a healthy nursing workforce it may be necessary to adjust the requirements of the job by changing the workload, modifying shift schedules, promoting supportive work environments, and assisting licensed nurses to learn coping skills to mitigate occupational stress.

## Background

Licensed nurses are professionals whose work exposes them to various stressors, ranging from coping with death and dying, to lack of social support from colleagues or supervisors (McVicar, 2003). Nurses' work characteristics, such as shift-work, or lack of meal breaks, or limited rest areas to take breaks are also perceived as stressors (Happell et al., 2013). The extent to which licensed nurses, which includes registered nurses (RNs) and vocational or practical nurses (LVNs and LPNs), are experiencing occupational stress, or whether RNs' experience of occupational stress is different from LVNs or LPNs is not known. In 2004, one quarter of participants in the Nurses' Health Study were reported to experience job strain (Schernhammer et al., 2004), and more recently, in a sample of 194 licensed nurses from six hospitals in Massachusetts, 80% of participants agreed or strongly agreed their jobs were stressful (Zapka, Lemon, Magner, & Hale, 2009). In both these studies the sample populations included all licensed nurses and did not stratify by type of license. By comparison to the general population of US workers, in a national survey of adults (from various work-sectors), approximately 31% reported feeling stressed at work (American Psychological Association, 2014).

Occupational (work-related) stress can have serious effects on cardiovascular health (Landsbergis, Dobson, Koutsouras, & Schnall, 2013; Schmidt et al., 2014), and it is associated with increased absenteeism from work (Trybou et al., 2014). There is evidence that occupational stress is also associated with weight gain and obesity (defined as a body mass index (BMI) >30kg/$m^2$) (Brunner, Chandola, & Marmot, 2007). The degree to which licensed nurses in the US are living with obesity is not fully delineated, but it may be similar to that found among working adults (across all work

sectors) in the US, where more than a quarter are living with obesity (Luckhaupt, Cohen, Li, & Calvert, 2014). Among a group of health professionals such as licensed nurses, presumably knowledgeable about risk factors for chronic disease, it seems reasonable to posit that obesity prevalence would be lower than among other groups of workers. However, obesity prevalence among licensed nurses is similar to that found in other working populations, ranging from 22% to 27% (Bonauto et al., 2014; Zitkus, 2011). An analysis of self-reported data from the 2003-2009 Behavioral Risk Factor Surveillance Survey in Washington State, reported 22.6% obesity in 1,210 RNs (Bonauto, Lu, & Fan, 2014). A self-report survey in 2007 with randomly selected RNs from 6 states reported that 23.9% of the respondents were obese, and 54% overweight or obese (Miller, Alpert, & Cross, 2008). In a sample of 721 RNs in New York State, 27% of the participants were obese (Zitkus, 2011). The prevalence of obesity among LVNs and/or LPNs is not yet described.

Allostasis is a conceptual framework that describes the physiological and behavioral responses to stress (McEwen, 2000). It provides a theoretical basis for a possible association between occupational stress and obesity. In the allostasis model, when there is repeated acute activation, or chronic activation of the allostatic response to stressors, (perhaps as a result of repeated acute, or persistent occupational stressors at work) allostatic load (AL) ensues; under AL the cumulative effect of responding to stressors can lead to maladaptive changes that result in increased risk for obesity (Karatsoreos & McEwen, 2010). In particular, physiological changes from repeated or chronic activation of the hypothalamic pituitary adrenal (HPA) axis, and subsequent exposure to circulating cortisol levels result in fat accumulation particularly as

abdominal fat (Rosmond, Dallman, & Bjorntorp, 1998). AL can also manifest as changes in appetite, or stress-related eating; for example, increased snacking, and food preferences for high fat and sweet foods, and these stress-related changes in appetite and eating behaviors may increase risk for weight gain for some individuals (Rosmond, Dallman, & Bjorntorp, 1998; Tomiyama, Dallman, & Epel, 2011).

Obesity is recognized as a disease, and is associated with chronic diseases such as cardiovascular disease, type 2 diabetes, some cancers, osteoarthritis, and depression (Dixon, 2010). Moreover, once an individual is living with obesity it becomes extremely difficult to lose weight, and if weight is lost, to maintain weight loss (Ochner, Barrios, Lee, & Pi-Sunyer, 2013). Thus, to focus attention on prevention is vitally important. If occupational stress contributes to obesity among licensed nurses, then there is the possibility to modify this risk factor and thereby reduce risk for obesity. There is a paucity of research into the associations between occupational stress and obesity or stress-related eating among licensed nurses. Therefore, an integrative review methodology will allow for the inclusion of qualitative and quantitative research to reach a wide sampling frame, and to summarize the evidence (Whittemore & Knafl, 2005).

The aim of this integrative review is to synthesize the evidence from diverse methodologies for associations between occupational stress and weight gain, obesity, or stress-related eating behaviors among licensed nurses.

## Methods

The procedure for this integrative review follows Whittemore and Knafl's (2005) methodology to evaluate, analyze, summarize, synthesize, and present the findings from research with diverse methodologies.

## Criteria for Inclusion

**Population**. Nursing is a broad job category that can include licensed and non-licensed personnel with differing educational and social economic status (SES) across job titles. It is not known if differences in nursing practice and/or socio-economic status between RNs and LVNs or LPNs results in divergent experiences of occupational stress. There is a lack of research into such differences. Therefore, in this review, the study populations in relevant publications included all licensed nurses.

**Exposure and outcomes**. Studies that examined or described associations between occupational stress as a risk factor, predictor, or mediating variable and obesity, or weight gain, and stress-related eating behaviors as outcome variables were included.

**Type of study.** The literature search was limited to quantative and qualitative research studies reported in the English language, in peer reviewed journals, published between January 2004 and December 2014. Studies were limited to the prior 10-year period in order to include an occupational content and context relevant to currently practicing licensed nurses. International studies in the English language that examined associations between occupational stress and weight gain, or obesity, or stress-related eating among non-US licensed nurses were included due to the paucity of literature on this topic. Literature review and discussion studies, abstracts, dissertations, and unpublished studies were excluded from this review.

## Search Methods

Databases searched included: MEDLINE, PsycINFO, and the Cumulative Index to Nursing and Allied Health Literature (CINHAL). The literature was searched using the following keywords: "work stress" or "job involvement" or "job support" or

"occupational stress" or “effort reward imbalance” or "job strain" or “job stress” or “skill discretion” “decision latitude” or “job insecurity” or “supervisor support” or “co-worker support” and "body weight change" or "eating behaviors" or “stress-related eating” or “appetite” or "overweight" or "obesity" or "weight gain" or "weight loss" or "body mass index" and "nurses" or "nursing staff" or “registered nurses.”

The reference lists of potential studies were examined for studies that qualified for inclusion.

**Search Outcomes**

The search identified 38 potentially relevant studies. From these studies, seven studies were considered relevant to the question of whether occupational stress is associated with obesity, weight gain, or stress-related eating behaviors.

As summarized in Figure 1, searches in MEDLINE produced 24 studies. CINHAL and PsycINFO searches each produced seven studies. From these 38 studies, two were duplicates.

The remaining 36 studies’ titles and abstract contents were screened for the inclusion criteria. From the initial screening 28 studies were excluded: 12 studies were excluded because it was not clear that the sample population included licensed nurses (the sample populations were either student nurses, or non-licensed nurses’ aides or caregivers); 16 were excluded as they did not measure occupational stress, or did not analyze or describe any association between occupational stress and weight change, or obesity, or stress-related eating behaviors.

Two studies that met inclusion criteria were identified from a hand search of the reference lists of already identified studies. From the remaining 10 studies, three were

excluded based on full-text review as the stress defined and measured was not occupational stress. A total of seven studies met the inclusion criteria and were included in the qualitative synthesis.

**Quality Appraisal**

The seven chosen studies for qualitative synthesis were evaluated for methodological quality and for their relevance to the aim of the review (see Table 1). The studies were separated according to methodological approach: quantitative or qualitative. The methodological limitations were assessed based on each study's research question, aims, objectives, methods and measurement, appropriate analysis of data, presentation of results, and interpretation of results. The approaches used to measure and evaluate occupational stress, weight change, obesity, and stress-related eating behaviors were identified. These approaches and study limitations are presented in Table 1.

The studies' aims were examined for relevance to the question of whether there was evidence for an association between occupational stress, weight gain, obesity, or stress-related eating behaviors. The sample characteristics were reviewed, sample size reported, and if available, the percentage of participating RNs was noted. Selection bias can occur in cohort studies from loss to follow-up, and in cross-sectional studies from a low response rate where there may be important differences between responders and non-responders. In the only cohort study included in this review selection bias was unlikely as 14% were lost to follow up after 6 years (Overgaard, Gamborg, Gyntelberg, & Heitmann, 2004). In the five cross-sectional studies, selection bias was possible, but unlikely; response rates ranged from 47% to 80% (King, Vidourek, & Schwiebert, 2009;

Wong, Wong, Wong, & Lee, 2010; Han, Trinkoff, Storr, & Geiger-Brown, 2011; Han et al., 2012; Smith, Fritschi, Reid, & Mustard, 2013).

If specific to a geographic area, or to a limited accessible population of licensed nurses, then results from the study samples are probably not generalizable to wider nursing populations. There is poor generalizability of the included studies' results to wider nursing populations as four of the seven studies are from outside the US (Overgaard et al., 2004; Persson & Martensson, 2006; Wong et al., 2010; Smith et al., 2013), and those within the US were limited to samples from either one or two states (King et al., 2009; Han et al., 2011; Han et al., 2012).

External conditions combined with the individual's appraisal of stressors and their ability to cope, may result in stress (Lazarus, 2012). Occupational stress is work-related stress, but it is a phenomenon that remains elusive, defined by a variety of concepts and models. The National Institute of Occupational Safety and Health (2011) uses the words "job stress" to define the phenomenon, which is the "harmful physical and emotional responses that occur when the requirements of the job do not match the capabilities, resources, or needs of the worker." Another widely used conceptualization of occupational stress is known as job strain, which is the experience of high demands with low control over work (Karasek et al., 1998). There are several factors that contribute to job strain including: physical demands of the job; psychological demands; skill discretion; decision latitude; job insecurity; supervisor support; and co-worker support (Landsbergis, Schnall, Warren, Pickering, & Schwartz, 1994). Another extensively used approach to defining occupational stress is the effort reward imbalance model (ERI), where high effort and low reward from work elicits negative emotions and

thus the experience of occupational stress, and those individuals with an overachieving and unrealistic overcommitment to work are particularly vulnerable to ERI (Siegrist, 1996).

Occupational stress can be measured with validated psychometric instruments, or by researcher developed derivatives of such instruments, or study specific measurements, or by simply asking about "job stress." Four of the quantative studies that measured occupational stress derived the measurement from the job strain model of high demand and low control (Overgaard et al., 2004; Han et al., 2011; Han et al. 2012; Smith et al., 2013), and one study also derived measurement from the job strain and ERI model (Smith et al., 2013); however each study used modified and/or shortened versions, thus validity may be reduced, risk for measurement error may have increased, and comparability across research is compromised. Han and colleagues (2011) used principal components analysis to categorize correlated observed variables into the concepts: job demands; control; support; and work schedules. This method enabled the researchers to produce component scores for each concept that they were able to use in regression analysis, and to describe construct validity in the sample. King and colleagues (2009) developed a study specific questionnaire, but did not specify a theoretical background. To assess validity of the newly developed survey an expert panel reviewed the content, and to demonstrate reliability the researchers administered the survey twice to a convenience sample of nurses (unknown licensure) and reported a Pearson correlation for the job stress subscale (r=.78) (King et al., 2009). Wong and colleagues (2010) measured nurses experience at work with the previously developed and validated

Perceived Organizational Support scale that measures employees perception of support and reward at work; the researchers did not provide a sample reliability.

Obesity is defined as a body mass index (BMI) >30kg/$m^2$. BMI is a ratio of height to weight. Height, weight, and weight change can be measured directly or self-reported. In this review, all five studies measuring weight or BMI used self-reported data with no direct measurement of height and weight (Overgaard et al., 2004; Wong et al., 2010; Han et al., 2011; Han et al., 2012; Smith et al., 2013). Self-reported BMI or weight tends to overestimate lower values and underestimate higher values (Stommel & Schoenborn, 2009). Thus, with self-reported BMI data, obese individuals may be misclassified as overweight or normal weight, and this could bias the results towards the null.

Stress-related eating is another concept that is widely defined and measured. Participants can be asked if they eat more or less in response to stress; or be asked to report changes in appetite, or type of food consumed. Additionally, those who rigidly control their food intake tend to overconsume when experiencing stress (Groesz et al., 2012). There is evidence high workload and occupational stress increases appetite for high fat and high sugar foods, particularly for restrained eaters (Wardle, Steptoe, Oliver, & Lipsey, 2000). Another stress-related eating behavior is emotional eating; emotional eaters are those who eat to cope with negative feelings; such individuals are at increased risk of consuming more high fat/ high sugar foods when they are under stress (Oliver, Wardle, & Gibson, 2000). In this review, three of the included studies described stress-related eating (King et al., 2009; Persson & Martensson, 2006; Wong et al., 2010). Persson and Martensson's (2006) qualitative study described work-related disruption to

eating habits experienced by the nurses. King and colleagues' (2009) study specific instrument included emotional eating as one of 15 possible disordered eating behaviors. The researchers evaluated content validity by asking experts to review the questionnaire, and reported test-re-test correlation for disordered eating (r=.88). A previously well-validated instrument, the Dutch Eating Behavior Questionnaire, was utilized to measure emotional and restrained eating by Wong and colleagues, but the researchers did not report a sample reliability (Wong et al., 2010).

According to Whitmore and Knafl's (2005) criteria for integrative review, study results were reviewed for possible outlier findings explained by methodological limitations. No such outlier findings were identified and none of the studies were excluded for outlier (highly incongruous) results due to methodological limitations.

**Data Extraction and Synthesis**

Data from included studies was extracted into a summary table (Table 1) to facilitate comparison of methods, measurements, and results using Whittemore and Knafl's (2005) data reduction approach. From comparison of the results across studies, three plausible categories were identified: requirements of the job; control over work; and coping and social support (Table 2).

## Results

The included empirical studies used diverse methodological designs (Table 1). The seven studies included: one cohort study (Overgaard et al., 2004); five cross-sectional surveys (King et al., 2009; Wong et al., 2010; Han et al., 2011; Han et al., 2012; Smith et al., 2013); and one qualitative design study (Persson & Martensson, 2006).

**Requirements of the job.** The requirements of the job included the psychological and physical demands of work, and these factors were associated with either weight gain or obesity or higher BMI in three studies (Overgaard et al., 2004; Han et al., 2011; Smith et al., 2013), and stress-related eating in two studies (Persson & Martensson, 2006; Wong et al., 2010).

Overgaard and colleagues (2004), followed 6,704 licensed nurses, recruited from the Danish Nurses Association, for 6 years. Overgaard et al. (2004) reported a U shaped relationship between job busyness (a concept used to measure high demands at work) and weight gain, with the least and most busy in their jobs reporting significantly more weight gain compared to the reference group (being "sometimes busy"). Among those nurses who were the least busy, the average 6 year weight gain was 1.1 kg ±0.53 higher than among the reference group ($p$ =0.049). Among those who were the most busy the average weight gain was 0.7 kg ±0.27 higher than the reference group ($p$=0.01). In a Swedish qualitative study including 27 community-based nurses working at night, respondents described that high demands and stressful situations at work led them to eat less healthy foods (Persson & Martensson, 2006).

A cross-sectional, secondary analysis of data from the Nurses Worklife and Health study used principal components analysis to identify the sub-concept of "limited movement" as an item to measure job demands (Han et al., 2011). Although not explicitly specified by the researchers, "limited movement" appears to have measured the physical demands of the job (limited movement described sedentary work). In this study of 2,103 female RNs, Han et al. (2011) reported that nurses with limited

movement had a 14% higher odds of being overweight/obese than being in the normal/overweight category (95% CI 1.02-1.28).

Work schedule requirements were associated with obesity and stress-related eating behaviors. Work schedules were measured by Han et al. (2011), and the researchers included four work schedule components: long work hours; weekly burden; required on-call; and lack of rest. Among these components, the RNs with long work hours had 23% higher odds of being overweight/obese than being in the normal/underweight weight category (95% CI 1.08 – 1.40) (Han et al., 2011). Smith and colleagues (2013) found a difference in percentage of nurses with job strain by shift worked ($p$=0.001), and that among female respondents, working night shift was associated with higher BMI ($p$=0.05). However, this study reported no mediating effect of occupational stress between shift-worked and BMI (Smith et al., 2013). Working at night was associated with stress-related eating in a study of 378 licensed nurses recruited from one hospital in Hong Kong, as researchers reported that the nurses working more than 4 shifts per month had 2.9 times higher odds of emotional eating compared to those working no shifts (95% CI 1.5-5.4) (Wong et al., 2010).

**Control over work.** The lack of control over work was associated with weight gain in one study (Overgaard et al., 2004) and conversely, having control over work was associated with overweight/obesity in another study (Han et al., 2012). In Overgaard and colleagues' (2004) cohort study, the researchers included a question about nurses' influence over their daily work and found that among those with no job influence the average weight gain was 1.3 kg ±0.5 higher than those with a major job influence ($p$=0.007) over the six year period.

Han et al. (2012) re-analyzed data from the Nurses Worklife and Health and the researchers controlled for the effect modification of work schedule by stratifying the analysis by a dichotomized "work schedule" score. The researchers used principal components analysis to create a score for the concept of work schedule from 13 questions about typical schedules over the previous 6 months, the score was then dichotomized below the mean to denote favorable schedule and above mean for unfavorable. The work schedule score was comprised of the following concepts: weekly burden, long work hours, lack of rest, and required on-call/overtime. The favorable/unfavorable schedule variable in Han and colleagues (2012) study does not specifically include night shift work as a component of the work schedule score, but the researchers did include a question about shift rotation. Interestingly, the study found that among those nurses with favorable schedules, having nurse input (in this study a sub-concept related to better job control) have 21% higher odds of being overweight/obese than being normal/underweight (OR 1.21 95% CI 1.02-1.44) (Han et al., 2012).

**Coping and social support.** Licensed nurses' eating behaviors and eating habits may have been used to cope with occupational stress in one study (King et al., 2009). Supervisor support helped protect against overweight/obesity in one study (Han et al., 2012).

A survey of nurses practicing in Ohio, reported that 33% of nurses frequently or always ate when stressed (King et al., 2009). Eating in response to negative emotion is a way to cope for some individuals (Oliver et al., 2000). Han and colleagues (2012) reported that among female RNs with a favorable schedule, having a supportive boss (presumably a stress-reducing factor) was protective against overweight/obesity;

specifically, in a logistic regression model adjusted for depression, age, race/ethnicity, and education, they found that among those with favorable schedule, nurses with a supportive boss have a 17% lower odds of being overweight/obese than being in the normal/underweight category (OR 0.83 95% CI 0.68-99) (Han et al., 2012).

## Discussion

This integrative review of current literature identified three themes: requirements of the job; control over work; and coping and social support at work that may be associated with weight changes, lower or higher BMI and obesity, or stress-related eating behaviors among licensed nurses. High and low levels of being busy at work, and limited movement (a physical demand), were associated with weight gain or overweight/obesity (Overgaard et al., 2004; Han et al., 2011); the demands of work influenced food choice towards junk foods among night shift-working nurses in Sweden (Persson & Martensson, 2006). Work schedule stressors such as long work hours or working at night were associated with higher BMI (Han et al., 2011; Smith et al., 2013), and working shifts was associated with stress-related eating (Wong et al., 2010).

Counterintuitively, for those nurses with a favorable schedule, more "nurse input" was associated with higher BMI (the definition of the term "nurse input" in this study was not entirely clear; it was reported by the researchers to be a sub-concept related to job control) (Han et al., 2012). Yet in contradiction to this finding, no influence at work was associated with weight gain in another study (Overgaard et al., 2005).

In regards to coping and social support at work, for nurses with a favorable schedule, having a supportive boss is protective against weight gain (Han et al., 2012),

but occupational stress may have some impact on stress-related eating behaviors (King et al., 2009).

**Requirements of the job.** The requirements of the job, which included levels of high and low demand, long work hours, and shift-work was the theme most supported by the evidence in this review. In this review, high and low demands at work (being busy) were associated with weight gain for licensed nurses. This is consistent with a Finnish study that followed 449 engineering industry employees for 28 years and found that women with increased working pace had higher weight gain ($p$=0.001) (Lallukka et al., 2008a). Another longitudinal study of 1355 US adults reported that for those working at baseline (work sector not specified) job demands were associated with weight gain in both men and women with high baseline BMI > 30 kg/m$^2$ (Block et al., 2009). Future prospective studies examining occupational stress and weight gain in licensed nurses could help to ascertain if those who are already living with higher BMIs are also more vulnerable to additional excessive weight gain.

Job demands may be lessened by legislation requiring minimum staff to patient ratios. Such legislation was enacted in California in 2004, to help to reduce licensed nurses' workload and to ensure that they take 30 minute meal breaks during their shifts (Aiken et al., 2010). It would be interesting to assess whether licensed nurses in states with minimum staff to patient ratios have lower levels of occupational stress and lower prevalence of obesity that in those states without legislation. If such legislation has reduced workload and occupational stress, a realistic and potentially effective solution towards less occupational stress and healthier BMIs among licensed nurses would be to enact national staff to patient ratio legislation.

In this integrative review, work schedule factors including working at night and working long hours were associated with higher BMI and affected licensed nurses' food choices. This is somewhat consistent with other research in non-nursing worker populations where long work hours and working at night were also associated with weight gain and obesity: an analysis of 3397 men and women office workers found that women working more than 40 hours per week had 1.71 (95% CI 1.11 - 2.65) the odds of being obese than those who did not work overtime (Lallukka et al., 2008b). Another longitudinal study of 7332 Finnish workers (Helsinki City employees) found that women shift-workers had 1.43 (95% CI 1.13-1.82) the odds of weight gain than those who were not shift-workers over the 5 year follow-up period (Roos, Lallukka, Rahkonen, Lahelma, & Laaksonen, 2013). Among 90 male and female department store workers followed for 6 months, a higher workload increased dietary intake of saturated fat ($p<0.01$) and sugar ($p=0.05$) (Wardle, Steptoe, Oliver, & Lipsey, 2000).

**Control over work**. In this review influence at work, and having control at work had differential associations with obesity, Overgaard et al. (2004) reported that no influence was associated with weight gain, but Han et al. (2004) reported that having control at work was associated with overweight/obesity. Interestingly, the evidence for an association between low job control and weight gain, reported by a systematic review of 39 cross-sectional and longitudinal studies from 1995 to 2012, was also found to be mixed and inconclusive (Solovieva, Lallukka, Virtanen, & Viikari-Juntura, 2013).

**Coping with occupational stress and social support.** This review found evidence to suggest that occupational stress tends to increase unhealthy eating behaviors among nurses (King et al., 2009). Similarly, in a descriptive cross-sectional design

survey of 194 nurses (97% female, 3% male) from one hospital in the USA, found that 17% used eating to cope with stress (Nahm et al., 2012). Nahm and colleagues also reported that higher perceived stress (occupational stress was not measured) was positively correlated with irregular meals (Nahm et al., 2012). The association between chronic stress and unhealthy eating behaviors is supported by other studies, especially among females (Epel, Lapidus, McEwen, & Brownell, 2001; Groesz et al., 2012).

This review identified that for nurses with a "favorable schedule" social support at work defined as having a supportive boss reduced the odds of being overweight/obese (Han, 2012). This review did not provide evidence that a lack of social support at work may increase risk for excessive weight gain in licensed nurses, however, among male and female office workers low perceived social support at work predicted increased risk of abdominal obesity over a 19 year follow-up (Brunner et al., 2007).

This review did not summarize occupational stress prevalence among licensed nurses. Overgaard et al. (2004) reported that few (4.5%) of Danish nurses experienced job strain and this is likely not generalizable to US licensed nurses. It is often assumed that licensed nurses are experiencing occupational stress because many potential stressors have been identified in their work (McVicar, 2003; Happell et al., 2013). However, this does not mean that licensed nurses appraise such stressors as threatening. Occupational stressors could be positive motivators at work. Licensed nurses may self-select into the profession because they are enthused and driven by the types of occupational stressors that they encounter, or they may have effective coping strategies for managing such stressors. Licensed nurses may not perceive themselves to be stressed at work. Occupational stress is a poorly defined concept and licensed nurses' appraisal

of stressors such as job responsibilities, work organization, and work characteristics, as well as individual coping ability may all vary between and among individuals.

Stressors are not always contained within the occupational framework. Psychological stress can also be defined by perceived stress, or difficulty in social relations with friends and family, or financial difficulties, all of which may also be associated with weight changes (Block, He, Zaslavsky, Ding, & Ayanian, 2009). Even past life experiences can contribute to individual's vulnerability to experiencing stress (Hurrell & McLaney, 1988). None of the studies in this review measured or controlled for the possible additive or moderating effect of non-work stress. The consideration of stress outside of the work environment may be important to include in future research among licensed nurses as such kinds of stress might exacerbate the effect of job stressors on the individual.

**Limitations**

Although suggestive that there is an association between occupational stress and obesity or stress-related eating behaviors among licensed nurses, the small number of studies included in this review limits the strength of the conclusions that can be made. Four of the seven included studies were from licensed nursing populations outside of the USA. Scope of practice, job requirements, and work characteristics may be different among licensed nurses working in other countries than in the USA. It may not be valid to generalize from these international studies to populations of licensed nurses in the USA. Furthermore, the type of license held by nurses in the sample populations varied across studies. Three of the included studies limited sample populations to RNs; but the extent to which the differences in job responsibilities and practice by license affects

occupational stress and weight gain is unknown. It would be enlightening to examine if there are such differences among US licensed nurses, as it may assist in developing interventions and policies that target prevention of both occupational stress and excessive weight gain.

The association between occupational stress and obesity or eating behaviors may depend on gender (Gram Quist et al., 2013; Epel et al., 2001; Tomiyama et al., 2013). In addition, in the USA, prevalence of obesity varies by age and by race/ethnicity (Ogden, Carroll, Kit, & Flegal, 2014). Due to the small number of studies in this review it was not possible to examine whether the associations between occupational stress and weight gain, or obesity, or eating behaviors were dependent on these factors.

**Conclusion**

Obesity is a complex disease with many contributory factors, such that occupational stress may be only a part of a multifactorial web of causation. This integrative synthesis of the evidence suggests that to promote a healthy nursing workforce, it may be necessary to adjust the requirements of the job by changing the workload, modifying shift schedules, promoting supportive work environments, and assisting licensed nurses to learn coping skills to mitigate occupational stress.

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**Figure 1.**
*Search strategy flow diagram*

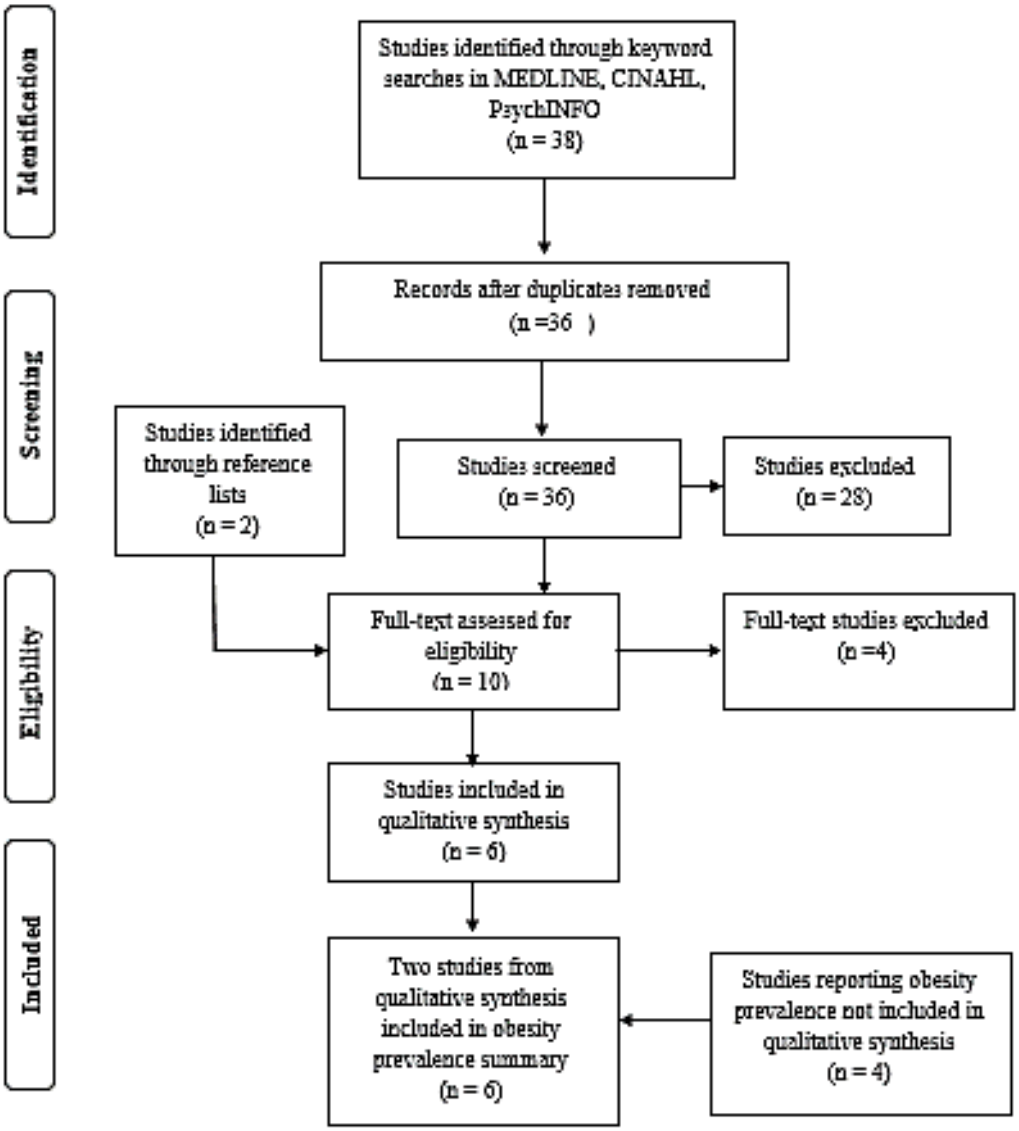


**Table 1**

*Summary and Comparison of Studies Included in the Integrative Review*

| Authors | Quantitative<br>Overgaard (2004) | King (2009) | Wong (2010) | Han (2011) | Han (2012) | Smith (2013) | Qualitative<br>Persson (2005) |
|---|---|---|---|---|---|---|---|
| Aims | To examine associations between psychological workload and 6 year weight changes. | To examine disordered eating among nurses, does disordered eating depend upon job stress? | To examine factors associated with abnormal eating among hospital nurses. | To examine the relationship between job stress, work schedules and obesity among nurses. | To compare obesity-related factors between nurses with favorable and unfavorable work schedules. | To examine shift work and BMI. The psychosocial work environment will mediate the relationship between shifts and BMI. | To describe situations that have influence on healthy diet and exercise habits. |
| Methods | *Design:* cohort.<br>*Sample*: female members of the Danish Nurses' Association.<br>N=6704<br>*Response rate*: 86%<br>*Location:* Denmark. | *Design*: cross-sectional<br>*Sample*: random sample of male and female nurses from Ohio State licensing board list.<br>N=435<br>84% RNs<br>16% LPNs<br>*Response rate*: 47%<br>*Location*: Ohio, USA. | *Design*: cross-sectional<br>*Sample*: male and female hospital-working registered and enrolled nurses and nurse managers<br>N=378<br>67% RNs<br>*Response rate*: 57.1%<br>*Location*: one hospital in Hong Kong. | *Design:* cross-sectional<br>*Sample*: female RNs<br>N=2103<br>*Response rate*: 52.5%<br>Location: Illinois and N. Carolina, USA. | *Design*: cross-sectional<br>*Sample*: female RNs<br>N=1724<br>*Response rate*: 52.5%<br>*Location:* Illinois and N. Carolina, USA. | *Design*: cross-sectional<br>*Sample*: random sample, male and female RNs.<br>N=9541<br>*Response rate*: 80%<br>*Location*: Canada. | *Design*: semi-structured interviews with open-ended questions.<br>*Sample*: male and female licensed nurses working at night.<br>N=27<br>*Location:* Sweden. |

**Table 1**

*Summary and comparison of studies included in the integrative review (continued)*

| Authors | Quantitative<br>Overgaard (2004) | King (2009) | Wong (2010) | Han (2011) | Han (2012) | Smith (2013) | Qualitative<br>Persson (2005) |
|---|---|---|---|---|---|---|---|
| Occupat-ional stress | Based in the demand/control model. Occupational stress defined by the researchers as psychological workload that includes the concepts: job influence, busy in the job, and job speed.<br><br>*Validity:* not reported. *Reliability*: not reported. | A 65 item questionnaire developed for this survey that included factors regarding job stress.<br><br>*Validity:* reviewed by expert panel for use in this survey. *Reliability*: test-retest, Pearson's correlations reported r= 0.77-0.88. | Perceived organizational support (POS) questionnaire measures lack of supervisor or organizational support.<br><br>Number of shifts per month.<br><br>*Validity:* POS prior use in Chinese workers, but validity not clearly established *Reliability*: not reported for this sample, reported from other research. | Questionnaire based in demand/control model with items from Nursing Work Index and Procedural Justice Scale. Researchers identified job stress variables that included concepts for: job support and job control, job demands.<br><br>Work schedules.<br><br>*Validity:* The researchers used principle components analysis (PCA) to identify factors measuring job stress *Reliability*: Cronbach's alphas ranging .82-.90 | Re-analysis of data used in Han (2011) Job control Job support Job demands.<br><br>*Validity:* validated in Han (2011) where researchers use principal components analysis to identify factors measuring job stress. *Reliability*: not reported for this sample. | Researchers used items from the demand/control model and effort reward imbalance.<br><br>*Validity:* not reported. *Reliability*: not reported. | Questions about coping ability at work. Describes the experience of work perspectives of the participants.<br><br>*Reliability:* categories identified by researcher were re-identified with 91% agreement. |

**Table 1**

*Summary and Comparison of Studies Included in the Integrative Review (continued)*

| | Quantitative | | | | | | Qualitative |
|---|---|---|---|---|---|---|---|
| Authors | Overgaard (2004) | King (2009) | Wong (2010) | Han (2011) | Han (2012) | Smith (2013) | Persson (2005) |
| Obesity or eating behaviors | Self-report weight. | Self-report. Researcher developed questions that measured 15 eating behaviors including emotional eating. | Self-report height and weight used to calculate BMI. Self-perceived overeating Emotional eating and restraint eating measured using previously validated Dutch Eating Behavior Questionnaire (DEBQ). *Validity:* DEBQ: previously validated. *Reliability*: not reported in this sample. | Self-report. BMI calculated from the median of a weight range selected by participants and height. BMI category dichotomized to underweight/normal BMI<25 overweight/obese BMI >25 | Self-report. BMI calculated from the median of a weight range selected by participants and height. BMI category dichotomized to underweight/normal BMI<25 overweight/obese BMI >25 *Reliability:* Kappa = 0.78 from a median value from reported weight range compared to measured weights from national sample. | Self-report height and weight used to calculate BMI. | Questions about eating habits. Describes the experience of eating habits from the perspectives of the participants. |
| Analysis | Descriptive statistics and multiple linear regression. | Dichotomized job stress scores to high or low. Descriptive statistics and multiple linear regression. | Descriptive statistics and logistic regression. | Descriptive statistics and logistic regression. | Stratified analyses by work schedule. Descriptive statistics and logistic regression. | Descriptive statistics and multiple linear regression. | Critical incident technique, an exploratory method to gather and analyze nurses' experiences. |

**Table 1**

*Summary and Comparison of Studies Included in the Integrative Review*

| Authors | Quantitative<br>Overgaard (2004) | King (2009) | Wong (2010) | Han (2011) | Han (2012) | Smith (2013) | Qualitative<br>Persson (2005) |
|---|---|---|---|---|---|---|---|
| Interpret-ation of results | Among those with no job influence, 6 year weight gain (1.3kg ±0.5 p=0.007) was higher than those with a major influence. Among those who were never busy, 6 year weight gain was higher (1.1kg ±0.53 p=0.049) than among those who were sometimes busy. Among those who were almost always busy, 6 year weight gain was higher (0.7kg ±0.27 p=0.01) than those who were sometimes busy. | Stressors identified included workload, paperwork, and repeated interruptions.<br><br>Participants with higher levels of job stress had higher levels of disordered eating compared to those with low stress (F=1.8, p=0.03). | More than 4 shifts per month 2.9 times higher odds of emotional eating compared to 0 shifts per month (95%CI.1.5-5.4). No significant effect on emotional eating from perceived organizational support. | Limited movement is categorized as a job demand variable, and those with limited movement have 14% higher odds of overweight/obesity than being normal/underweight (95%CI:1.02-1.28). Work schedule: those working long hours had 23% higher odds of being overweight or obese (95%CI:1.08-1.40) | Among those with favorable schedules: Nurses with job control defined by the researchers as "nurse input" have 23% higher odds of being overweight/obese (95%CI: 1.02-1.44) than being normal/underweight. Nurses with a supportive boss have 17% lower odds of being overweight/obese (95%CI: 0.68-0.99) than being normal/underweight. | No evidence to support the mediating effect of job stress on the relationship between shift work and BMI.<br><br>Working night shift associated with higher BMI among female nurses (p=0.05). | Nurses' diet is influenced by coping at work and during leisure hours. Stress and sleep disturbance are negative influences on diet habits. When they feel hungry and stressed nurses often chose junk food. |

**Table 1**

*Summary and Comparison of Studies Included in the Integrative Review (continued)*

| | Quantitative | | | | | | Qualitative |
|---|---|---|---|---|---|---|---|
| Authors | Overgaard (2004) | King (2009) | Wong (2010) | Han (2011) | Han (2012) | Smith (2013) | Persson (2005) |
| | Danish nurses may have work environment and scope of work compared to US licensed nurses. Measurement bias. Self-reported weight. | Measurement error in occupational stress and eating behaviors. Disordered eating is a wider group of behaviors including possible stress-related concepts, but not limited to stress-related eating. | Chinese nurses working in one hospital may have different work stressors, and appraisal and coping compared to other groups of licensed nurses. | Self-report weight range as basis for BMI may have introduced measurement error. Measurement bias | Self-report weight range. Measurement bias | Measurement bias. Self-reported height and weight. | The experience of Swedish nurses in this sample may not be relevant to other nurses, and this study may have limited transferability to other contexts, such as hospital working nurses, or nurses working in the USA |
| Limitations | | | It is likely that low organizational support contributes to occupational stress; however occupational stress was not specifically measured in this study. | | | | |

RN, registered nurse; LPN, licensed practical nurse.

**Table 2**.

*Summary of the Results from Included Studies*

| | Occupational stress associated with weight change, obesity, or stress-related eating | | |
|---|---|---|---|
| Author (year) | Requirements of the job | Control over work | Coping and social support |
| Overgaard (2004) | High and low levels of "busyness" associated with weight gain | No job influence associated with weight gain | |
| Persson (2005) | Job demands and stress led to choosing unhealthy foods | | |
| King (2009) | | | Higher stress associated with disordered eating |
| Wong (2010) | Shift work increased odds of emotional eating | | |
| Han (2011) | Limited movement at work and long work hours increased odds of overweight/obesity | | |
| Han (2012) | | A favorable schedule and input into job decisions increased odds of overweight/obesity | A favorable schedule and supportive boss lowered odds of overweight/obesity |
| Smith (2013) | Working night shift associated with higher BMI | | |

# Chapter 3

## Work Organization and Personal Health Characteristics

## In Hospital-based Female Registered Nurses: a Descriptive Study

# Chapter 3

## Work Organization and Personal Health Characteristics In Hospital-based Female Registered Nurses: a Descriptive Study


## Abstract

### Background

Organizational factors in hospital work may compromise the health of registered nurses (RNs). Shift work may affect sleep, and contribute to occupational stress, and these factors may increase risk for obesity. This study describes work organizational factors and personal health characteristics among a sample of female hospital-based RNs, working days and rotating or night shifts, and examines associations between sleep quality, occupational stress, and body mass index (BMI).

### Methods

A cross-sectional web-based survey collected data from members of the Academy of Medical/Surgical Nurses and 256 female RNs completed the survey. Sleep quality was measured with the Pittsburgh Sleep Quality Index (PSQI). Scores can range from 0-21, and >5 indicates poor sleep quality. Occupational stress was measured with the Effort Reward Imbalance (ERI) short form. An ERI >1 indicates high effort and low reward indicative of occupational stress. Descriptive statistics were used to summarize the results, and Pearson's correlations were used to identify significant associations between sleep quality, occupational stress, and BMI.

### Results

The majority of RNs (62%) worked permanent day shift, 58% worked more than 40 hours per week, 33% were never able to take a meal break, and 35% were obese

(BMI ≥30 kg/$m^2$). There was a high prevalence of self-reported poor sleep quality (78%), and occupational stress (77%) regardless of shift schedule. BMI was correlated with both poor sleep quality (r=0.23 $p$<0.001) and higher occupational stress (r= 0.16 $p$=0.02).

**Conclusions**

Shift work, inadequate meal breaks, sleep quality, and occupational stress may be risk factors for obesity in female RNs. Interventions to improve sleep and reduce stress among RNs need to be included in health and safety and wellness programs. Hospital policies can support RNs to take adequate and uninterrupted meal breaks, particularly on night shift.

## Introduction

There are approximately 2.5 million registered nurses (RNs) in the United States (USA), 90% are female, and more than half work within hospital settings (Budden, Zhong, Moulton, & Cimiotti, 2013). Hospital work is known to be hazardous to health (Occupational Safety and Health Administration, 2013). Health and wellness, or illness and disease, result from a multi-level, transactional relationship between the individual and their physical and social environments (Stokols, 1992). In the workplace the individual is in a relationship with these multi-level environments that are influenced by the organization of work. The organization of work is a broad concept referring to the processes, practices, and context of work (National Institute for Occupational Safety and Health, 2011). It is possible that the organization of hospital work (work schedules, shift work, and rest and meal breaks) interacts with personal health behaviors to compromise the health of RNs. Work organization processes and practices may affect RNs ability to eat regularly, to rest properly, and thus increase risk for obesity. The health-related problems that may result from work organization include: poor sleep quality, psychological stress, and participation in regular physical activity.

On average, adults in the USA work 37.9 hours per week; and the average is slightly less (35.3 hours per week) for women (Bureau of Labor Statistics, 2010). Work schedules vary by profession, and working as an RN often involves being at work for extended hours, and working at night or on rotating day to night shifts. It has been estimated that one third of RNs typically work more than 40 hours each week (Trinkoff, Geiger-Brown, Brady, Lipscomb, & Muntaner, 2006), and approximately two thirds of RNs work 12-hour shifts (Stimpfel, Sloane, & Aiken, 2012). Both long working hours

and shift work have been associated with increased risk for excessive weight gain among women. An analysis of white collar workers in the United Kingdom found that the odds for obesity were 1.7 times higher among women working more than 40 hours per week (OR 1.7; 95% CI 1.11-2.65) than for women who did not work overtime (Lallukka et al., 2008). In a Finnish study, the odds for weight gain over a 5-year period were 1.4 times higher among women working shifts (including night shifts) (OR 1.4; 95% CI 1.08-1.74) than among regular day workers (Roos, Lallukka, Rahkonen, Lahelma, & Laaksonen, 2013).

Furthermore, shift work and work hours can affect sleep quality. Indeed, one study that examined short sleep among shift working RNs, reported that respondents had an average sleep of 5.5 hours between 12-hour shifts (Geiger-Brown et al., 2012). Less than 7 hours of sleep per night increases the risk of weight gain and obesity (Gangwisch, Malaspina, Boden-Albala, & Heymsfield, 2005), and is associated with abdominal fat accumulation (Ford et al., 2014). Short sleep due to shift work may affect appetite and increase preference to consume sweet snacks (Heath et al., 2012), as well as provide more opportunity to eat just from being awake rather than being asleep (Chaput, Klingenberg, Astrup, & Sjodin, 2011), and such changes in appetite and food preference may increase risk for weight gain.

A type of psychological stress related to work is defined as occupational stress, which is when the worker does not have the resources or abilities to cope with the requirements and activities of their job (National Institute for Occupational Safety and Health, 2014). RNs employed in hospitals can experience occupational stress due to their work, and as it is a psychological stress, occupational stress is likely a risk factor

for poor sleep quality, and a risk for weight gain (Akerstedt et al., 2012; Block, He, Zaslavsky, Ding, & Ayanian, 2009). Both psychological stress and short sleep can increase the hedonic aspects of food, increasing appetite and changing food preferences for high fat and sweet foods, perhaps with detrimentally additive effects for some individuals (Groesz et al., 2012; St-Onge, Wolfe, Sy, Shechter, & Hirsch, 2014).

The experience of psychological stress can reduce participation in physical activity (Barrington, Ceballos, Bishop, McGregor, & Beresford, 2012). Among women, participation in regular physical activity is associated with maintaining a healthy weight (Lee, Djoussé, Sesso, Wang, & Buring, 2010). Physical activity may also be protective against psychological stress (Hamer, 2012). Thus, physical activity may mediate or moderate the relationship between occupational stress and weight gain. Additionally, working long hours, shift work at night, and feeling fatigued, can make it difficult for RNs to find the leisure time to both rest and exercise when they are not working (Persson & Martensson, 2006).

This study describes hospital work organizational factors (work schedules, work hours, and meal break practices), and RNs' personal health characteristics (sleep quality, occupational stress, and physical activity) among a sample of female RNs working in acute care hospitals in the USA. Poor sleep quality, and occupational stress may influence health behaviors such as eating and physical activity. All of these factors may increase risk for obesity. Secondarily, work organizational and personal characteristics among RNs working permanent days are compared with RNs working permanent night or rotating shifts. Finally, correlations between sleep, occupational stress, and obesity are examined.

## Methods

**Research design and sample.** A cross-sectional web survey was distributed, to nurses who are members of the Academy of Medical Surgical Nurses (AMSN). Study data were collected and managed using REDCap electronic data capture tools hosted at University of California, San Francisco (Harris et al., 2009). The survey included questions about RNs' shift work, work hours, and meal break practices, as well personal health characteristics such as sleep quality, level of occupational stress, physical activity habits, and height, weight, and waist circumference. Initial pilot testing among 15 volunteer RNs indicated that the survey took approximately 20-30 minutes to complete.

**Recruitment**. A link to the online survey was posted on the AMSN website for a 6 month period in 2014. Emails were sent to the 11,306 members in April, 2014 with reminder emails sent out again after one month. A research request to participate was included in the AMSN e-newsletter for May/June and July/August, 2014. In April, AMSN posted the research request to their Facebook and Twitter pages. On July 1st, 2014 email invitations to participate were sent to 17 AMSN local chapter contacts, and the email was followed up after 2 weeks. Additionally, flyers with information and a link to the survey were handed out to approximately 700 attendees of the annual AMSN convention in September 2014.

At completion of the survey, respondents were given the option to provide their email address to be entered into a raffle to win one of eight Amazon gift certificates. The study was approved by the Institutional Review Board of the University of California, San Francisco (UCSF), and respondents were provided with electronic written informed consent included at the beginning of the online survey.

**Eligibility criteria.** Study respondents included RNs working in acute care hospital settings in the USA. Only female RNs were included and working a minimum of 32 hours per week was an inclusion criterion. Respondents were ineligible and excluded if they were currently taking a leave of absence from work for any reason, were pregnant, or had delivered a baby within the previous 6 months.

## Measurement

**Work organizational factors.** Work organizational factors included shift worked, work hours, and meal break patterns. Respondents were asked to report their present work shift from the options: permanent day shift, permanent night shift, or rotating shift pattern. Respondents were asked to report their normal work hours, length of their usual work shift (either 8-hours or 12-hours), overtime hours in an average week, to report hours per week (if any) working on any other job, and years of work experience in their current position.

Respondents reported the characteristics of their typical meal breaks, including: if they typically take regular meal breaks (i.e. a 30 minute break for an 8-hour shift or two 30 minute breaks for a 12-hour shift), if they have choice over when to take breaks, if they are able to sit down to eat, if interrupted for patient care during meal breaks, and if healthy food is available to them while at work. To answer these questions, the respondents were asked to select one of five choices: (1) Always, (2) Most of the time, (3) Sometimes, (4) Rarely, (5) Never.

**Personal health characteristics.** Personal health characteristics included sleep quality, occupational stress, and physical activity, self-perception of health and weight, body mass index (BMI), and waist circumference.

Sleep quality and duration were measured with the Pittsburgh Sleep Quality Index (PSQI). The PSQI is a 19-item, self-report tool to measure sleep quality over the previous month (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). It includes 7 subscale components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disruption, use of sleeping medication, and daytime dysfunction. Each of the seven component scores can range from 0-3, and 3 indicates severe difficulty. Sleep duration is then calculated as the difference between their habitual bed time and rise time, subtracting the typical time to fall asleep. Global scores range from 0-21, and a score >5 is suggestive of poor quality sleep.

The PSQI is a valid measure of sleep quality and sleep duration in the general population. In initial development researchers compared the PSQI global score to a gold standard clinical diagnosis of sleep disorder, and reported that the PSQI cut-point of 5 had sensitivity = 89.5% and specificity = 86.5% (Buysse et al., 1989). The PSQI is not validated for use in shift-workers, so night and rotating shift working respondents were asked to complete the questions thinking about their sleep when working day shift or during days off. For this sample, overall Cronbach's alpha (0.75) was acceptable. In addition to completing the PSQI, the respondents reported use of caffeine to stay awake during the work shift, and use of alcohol to assist with sleeping.

Occupational stress was measured with the 16-item short form version of the Effort-Reward Imbalance Questionnaire (ERI). ERI is based on the concept of social reciprocity, which posits that if work efforts (job demands, workload, work pressures) are higher than work rewards (job security, support from coworkers, and financial rewards) the individual may be vulnerable to experience occupational stress.

Occupational stress may depend on a personality trait or behavior of excessive overcommitment to work, an additional key concept in ERI that can adversely inflate perception of work demands, and reduce coping abilities thereby exacerbating occupational stress (Siegrist, 1996).

The 16-item ERI scale asks respondents to respond to questions with a 4 point Likert scale (1) strongly disagree, (2) disagree, (3) agree, and (4) strongly agree. The effort/reward ratio is calculated from the effort and reward multiplied by a correction factor for the difference in number of items in the subscales. A ratio value >1 indicates an imbalance with higher effort and lower reward. Job reward subscales measure three dimensions of reward and include esteem, promotion, and security. The short form version of ERI was recently tested in a study of 1916 Chinese workers and researchers reported that ERI scores were predictive of poor physical and mental health (Li et al., 2012). From the data collected in this study, reliability of the ERI questionnaire was acceptable as measured by Cronbach's alpha: (effort scale = 0.78, reward scale = 0.83, the overcommitment scale = 0.81).

Physical activity was assessed by asking respondents the following questions: During the past month, other than your regular job, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise? Respondents were asked how many times per week they engage in the particular physical activity, and for how many minutes. The Centers for Disease Control and Prevention (CDC)'s minimum recommended total minutes of physical activity per week is 150 minutes of moderate intensity exercise (Centers for Disease Control and

Prevention, 2014), so the participant's exercise level was dichotomized into above or below 150 minutes of exercise per week.

Demographic questions were asked regarding age, race/ethnicity, educational-level, USA region in which they reside, type of hospital, job title, as well as years in nursing. Respondents reported their waist circumference in inches, for women abdominal obesity is waist circumference >88 cm. The respondents' height in inches and weight in pounds were used to calculate body mass index (BMI). Obesity is defined as BMI $\geq$30 kg/m$^2$. Respondents were asked whether they eat more or less at work compared to a day off with three response options: (1) I eat the same, (2) I eat less at work, (3) I eat more at work. In addition, the respondents were asked if they are currently on a diet to lose weight. Respondents were also asked to rate their health on a 4-point Likert scale: (0) very good, (1) good, (2) fair, (3) bad, (4) very bad.

## Analysis

Descriptive statistics including means and standard deviations (SD) for quantitative variables, and frequencies and percentages for categorical variables are provided for the participant demographics. Work shifts were categorized into two groups, either day shift for those who reported working on permanent day shift or Night/Rotating shift for all other shift patterns. Differences in work organizational factors and personal health characteristics by shift were determined by Students *t*-tests for continuous variables, or Wilcoxon Rank-Sum tests for non-normally distributed or ordinal variables, and chi-square tests of independence, or Fisher's exact tests for proportions. The associations between sleep and occupational stress variables and BMI

and waist circumference were tested with Pearson's correlations. In all cases, two-tailed *p* values of 0.05 or less were considered statistically significant.

All data were analyzed using STATA 13 (College Station, TX, USA).

## Results

**Demographics.** A total of 322 RNs completed the online screening questions, of whom 256 met criteria of being female, currently employed at least 32 hours per week, and completed any survey questions after reviewing the consent form.

The sample demographics are presented in Table 1. The average age of this female RN sample was 46 ±11.9 years. The RNs working permanent day shift (62% of respondents) averaged 48 ±11.1 years of age and were significantly older than the RNs who worked permanent nights or rotating shifts who averaged 42 ±12.5 years of age ($p$ <0.001). Permanent day shift RNs also had more years in nursing with a median of 20 years in nursing compared to 8 years in nursing in the rotating or night shift RNs ($p$<0.001). The majority of the respondents were White (76%), with a Bachelor's degree (48%), worked as a staff nurse (55.3%), in Community non-profit hospitals (67%), from all regions across the USA. Between the RNs working permanent day shift and those RNs working either rotating or permanent night shifts, there were significant differences between the groups by race ($p$ =0.01), education ($p$ <0.001), job title ($p$ <0.001), and number of years in nursing ($p$ <0.001).

### Work Organizational Factors

The work organization factors are detailed in Table 2.

**Work schedule.** Most RNs worked 12-hour shifts (62%). There were fewer RNs working 12-hour duration permanent day shifts (49%) than RNs working rotating or

permanent night shifts for 12-hour duration (82%) ($p$ <0.001). The majority of RNs were happy with their work schedule (78%), and more day shift RNs were happy with their work schedule (86%) than the rotating or night shift RNs (65%) ($p$ <0.001). Overall, RNs worked an average of 36 hours per week in their jobs. However, when including overtime and work in additional jobs 58% of RNs worked more than 40 hours per week. The median total hours worked (including overtime and any work in second jobs) was 40 hours per week.

**Meal breaks.** Overall, 33% of RNs reported never being able to take a 30-minute meal break during their shift. Other descriptions of meal break practices reported by the respondents included: 19% of RNs rarely or never choose when they take a break, 23% rarely or never sat down to eat during their shift, 43% were rarely or never relieved of patient care responsibilities during meals, 45% were interrupted for patient care during meal breaks most of the time or always, and 37% reported that their work schedule rarely or never allowed for regular eating habits. Healthy food was always available at work for only 21% of the respondents.

There was no difference for RNs being able to take a meal break by working day shift, or night and rotating shifts. However, there were significant differences between day shift and rotating or night shift RNs for choosing when to take a break ($p$ <0.001), whether they sat down to eat during the shift ($p$ <0.05), were relieved of patient care for meals ($p$ <0.001), had meal breaks interrupted for patient care ($p$ <0.05), had a work schedule that allowed for healthy eating ($p$ <0.001), and had healthy food available to them while at work ($p$ <0.001).

## Personal Health Characteristics

The personal health characteristics are detailed in Table 3.

**Sleep.** The sleep quality score indicates poor sleep for the majority of RNs with 78% reporting a global PSQI sleep quality score >5, and average global PSQI sleep quality score of 7.2 for the overall sample. RNs reported sleeping an average duration of 7.4 ±1.5 hours per night, although 55% reported sleeping less than 7 hours per night. Most RNs (86%) reported that they did not use alcohol to help them get to sleep at night, and 33% did not use any caffeine to stay awake at work. The PSQI sleep components scores for the overall group are detailed in Table 4.

There were no significant differences in global PSQI sleep quality score or sleep duration, or use of alcohol to get to sleep between those RNs working permanent day shift and those working rotating or permanent night shifts. However, there was a difference in use of caffeine to stay awake at work between the RNs working permanent day and rotating or permanent night shifts ($p$ <0.05).

**Occupational stress**. The RNs reported high levels of occupational stress with median ERI ratio of 1.3 (IQR 1.0-1.6), and the majority (77%) reported experiencing occupational stress defined by an ERI ratio >1, where job effort is higher than job reward. There was no difference in ERI between the RNs working permanent day and rotating or permanent night shifts.

**Other health characteristics.** More than one third (35%) of the RNs were obese, and 50% were abdominally obese (waist circumference >88 cm) with an average waist circumference of 89.9 ±17.2 cm among the respondents. BMI was missing data from 19 respondents (7%), and waist circumference missing from 44 respondents (17%).

Self-perception of weight underestimated level of obesity as 27% reported themselves in the top category of "very overweight." Overall, 35% reported being on a diet to lose weight, and 61% reported that they eat less at work compared to the amount they eat on a day off. More than half (56%) reported less than 150 minutes or more of exercise per week.

There were no differences in BMI among the female RNs when compared by USA region; however BMI differed by education level ($p$=0.02), and by race ($p$=0.003). There were no differences in BMI, waist circumference, self-perception of weight, whether currently dieting, or amount eaten at work compared to a day off, or physical activity levels between the RNs working day shift, and RNs working rotating or night shifts.

**Associations between Sleep, Occupational stress, and Obesity**

The associations between sleep, occupational stress and obesity are detailed in Table 5.

**Correlations between sleep variables and BMI.** Worse sleep quality was correlated with higher BMI (r=0.23 $p$<0.001) (see Figure 1 for a scatterplot), and higher waist circumference (r=0.23 $p$=0.001). Sleep duration was negatively correlated with BMI (r= -0.15 $p$=0.02) such that the shorter the sleep duration, the higher the BMI.

**Correlations between occupational stress, BMI, and waist circumference.** Among the RNs, occupational stress was weakly correlated with higher BMI (see Figure 2 for a scatterplot) (r=0.16 $p$=0.02), and with higher waist circumference, although this was not statistically significant with the reduction in sample size for missing data on BMI (r=0.13 $p$=0.07).

**Correlations between sleep and occupational stress.** Worse sleep quality was correlated with higher levels of occupational stress (r=0.25 $p<0.001$), with higher overcommitment (r=0.40 $p<0.001$), and with higher job effort (r=0.22 $p=0.01$). Higher job reward was correlated with lower sleep quality scores (r=-0.21 $p=0.02$), such that higher the job reward, the better quality sleep.

## Discussion

The majority of respondents were permanent day shift RNs, who were older, and had more years in nursing than the RNs working rotating or permanent night shifts. Overall, nearly two-thirds of RNs reported working 12-hour shifts, which is consistent with a recent study of RN work schedules (Stimpfel et. al, 2012). More than half of the respondents worked more than 40 hours per week, and one third reported never being able to take a meal break during their shifts, with the majority reporting that they eat less at work than they eat on a day off.

The majority of the respondents reported poor sleep quality, and experienced occupational stress. In this sample, more than a third (35%) were obese, which is higher than national obesity prevalence of 27.2% among female workers (Luckhaupt, Cohen, Li, & Calvert, 2014). There is evidence that poor sleep quality and occupational stress are both associated with increasing BMI. Additionally, more than half of the RNs did not meet CDC's recommendations of 150 minutes for weekly physical activity. These results suggest that many RNs are coping with shift work at night, 12-hour shifts, long work hours, and inadequate meal breaks. It is possible that these factors, both independently and interactively, reduce the quality of sleep, contribute to occupational stress, affect health behaviors, and might also be associated with obesity.

The percentage of RNs working 12-hour shifts was highest among rotating or night shift workers. Working 12-hour shifts can be beneficial to RNs in that extended shifts can facilitate more days off work, but alternatively there may be less opportunity to recuperate between shifts, and more opportunity to work extra shifts, thus actually increasing work hours. Increasing shift duration may contribute to risk for overweight and obesity among female nurses (Kim et al., 2013). In addition to length of shift, working at night or on rotating shifts can also increase risk for weight gain and obesity (Niedhammer, Lert, & Marne, 1996; Smith, Fritschi, Reid, & Mustard, 2013).

Obesity due to shift work and work schedule factors may result from disruption of the circadian clock, which affects the molecular and hormonal control of appetite and can promote fat accumulation (Karlsson, Knutsson, & Lindahl, 2001). Working at night can disrupt habitual behaviors, reduce participation in physical activity, and be detrimental to healthy eating habits (Persson & Martensson, 2006). It is probably necessary to examine both shift work and work schedules in order to create interventions and policies that will reduce or eliminate their negative impacts on the health of RNs.

Working for long hours increases risk for weight gain over time (Solovieva, Lallukka, Virtanen, & Viikari-Juntura, 2013), and more than half of the RNs were working over 40 hours per week. It is possible that there may be socio-economic (SES) differences among RNs that explain why there is a tendency towards some RNs working such long work weeks. For instance, one study reported that single parents were more likely than other nurses to work 50-60 hours per week (Trinkoff et al., 2006). Hospital employers may mandate, or workplace culture may pressure RNs to work overtime, and the extent to which SES differences between RNs moderates the amount of overtime

worked is not known, although it is a possible contributing factor and worth future consideration. In addition, SES (education, income, or race) differences may contribute to obesity risk (Winkleby, Cubbin, Ahn, & Kraemer, 1999), and this study found significant differences in BMI between the participating RNs by race and by education level.

This study showed that RNs do not always take meal breaks, or get uninterrupted meals breaks. The lack of ability to take adequate breaks is a longstanding problem for RNs working in hospital environments. Earlier research reported that RNs were unable to take any break for 10% of their shifts worked (Rogers, Hwang, & Scott, 2004). Irregular meal breaks may possibly contribute to obesity risk, and to occupational stress (Nahm, Warren, Zhu, An, & Brown, 2012). In states such as California, where legislation mandates nurse-to-patient ratios, RNs may be more able to take uninterrupted breaks; indeed, following the implementation of nurse-to-patient ratios, 74% of RNs reported being able to take a 30-minute break during their shift (Aiken et al., 2010). However, the effect of any improvement in ability to take to uninterrupted meal breaks on risk for weight gain in RNs is not known, but would be enlightening and perhaps helpful to policymakers.

The majority of RNs reported poor quality sleep, and this study found a positive correlation between poor sleep quality and BMI. In previous research there is evidence for an association between sleep quality or sleep disturbance and increasing BMI or obesity among women (Bidulescu et al., 2010). Furthermore, this study found a negative correlation between sleep duration and BMI, such that shorter sleep is correlated with higher BMI, which supports findings from previous research where the association

between short sleep duration and obesity risk is well recognized (Patel & Hu, 2008). Sleep quality was also positively correlated with occupational stress, and most of the RNs reported high levels of occupational stress. The relationship between sleep and psychological stress is complex, as some research suggests that sleep deprivation may also act as a stressor, rather than a consequence of activation of the stress response (McEwen, 2006), and both are associated with obesity.

**Limitations**

There are several limitations to this study. There was an extremely low response rate of less than 3% to the email invitations to participate in this study. This probably means that results are biased, as the sample of RNs who were motivated to participate may have had very different shift patterns and personal health characteristics compared to RNs who did not participate. Indeed, the high level of obesity, occupational stress, and poor sleep quality among respondents suggests that these factors may have prompted certain RNs to participate over other healthier weight, non-stressed RNs, without sleep problems. Therefore, it is not possible to generalize beyond this sample. However, taken as a small exploratory survey, the results include a full range of normally distributed scores that indicate poor sleep quality and occupational stress is associated with higher BMI.

As this online survey was self-report, the respondents may have under-reported their weight, height, and waist circumference. Furthermore, 7% of height and weight responses, and 17% of waist circumference responses were missing from the survey, suggesting the possibility that some RNs did not feel comfortable in reporting their body measurements, and those who did not report may have been different from those who

did. As a cross-sectional survey, this study was unable to capture any of the time-varying aspects of work organization, sleep quality and duration, or occupational stress. Male RNs were excluded from participation in this study, and men may have different work organization and personal characteristics compared to female RNs. More than 90% of RNs in the USA are female (Budden et al., 2013), and weight gain in response to occupational stress may vary by gender (Kivimaki et al., 2006).

Sleep quality worsens with aging, and can also decrease during menopause (Freeman, Sammel, Gross, & Pien, 2014). The average age for RNs was young to mid-life (46 ± 11.9 years old) in this study. Studies of the effects of menopause on sleep quality and risk for excessive weight gain in shift working, mid-life and older women would be enlightening.

The PSQI has not previously been validated for use in shift workers, and so the sleep scores only pertain to sleeping when the RNs were working days or on days off. Therefore, there may be additional differences in rotating or night shift workers' sleep that were not captured in this study. As the PSQI is a widely used survey instrument for measurement of sleep quality, it will be important in the future to validate its use in shift workers. Another possible issue with the PSQI score dichotomized as good or poor sleep is that a cut-point of >5 may be too low for some populations, particularly women (Carpenter & Andrykowski, 1998).

**Policy and Practice Implications**

Hospital work organization needs to be evaluated at a local level to identify problems that may be changed to facilitate wellness and positive health behaviors among RNs. Ideally, staffing levels need to allow for RNs to take breaks, the environment

should provide space and healthy food, and the socio-cultural milieu at work needs to accept the value of rest, even for extended or nap breaks for night workers. The interaction between sleep and occupational stress and the effect on shift workers remains to be fully elucidated. Yet, promotion of good sleep and learning to cope with occupational stress are important factors not to be overlooked in health promotion at work.

One approach to promoting wellness at work is The Total Worker Health Program (TWH) from the National Institute for Occupational Safety and Health (NIOSH) that aims to integrate already existent workplace safety activities with worker health promotion recognizing that health behaviors are not separate from work environment and work organizational factors (Schill & Chosewood, 2013). The American Nurses Association (ANA) position statement on reducing nurse fatigue provides evidence-based guidance to employers and to individual RNs, with specific recommendations including uninterrupted rest breaks, enabling naps for RNs during their breaks, limiting work hours to 40 per week, and shift length to 12 hours or less (American Nurses Association, 2014). The implementation of ANA recommendations are likely to improve RN's overall health and reduce risk for obesity. Research to investigate the long-term effect of the implementation of these recommendations by hospital employers and RNs will be helpful.

**Conclusion**

Although this study does not provide a generalizable description of work organization and personal health characteristics among the nation's RNs employed in hospital settings, it suggests that there may be room to improve work organization for

hospital RNs, and potentially reduce their risk for obesity as a favorable result. How much is the health of RNs affected by shift work, inadequate sleep, and occupational stress? If indeed the problem is as extensive as this study suggests, then we need to focus our attention on changing RNs work organization to better support their health.

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**Table 1**

*Characteristics of the Female RNs who Participated in the Online Survey*

| | | All | By Shift | | |
|---|---|---|---|---|---|
| | | | Day n=159 | Night or Rotating n=96 | |
| | N | n (%), or mean ± SD, or median (IQR) | | | *p* value |
| **Age (years)** | 238 | 45.9 ± 11.9 | 48.0 ± 11.1 | 42.4 ± 12.5 | <0.001 |
| **Race** | 256 | | | | 0.01 |
| Asian | | 10 (3.9) | 2 (1.3) | 8 (8.3) | - |
| African American | | 13 (5.1) | 7 (4.4) | 6 (6.3) | - |
| White | | 194 (75.8) | 132 (83.0) | 62 (64.6) | - |
| Other or not reported | | 39 (15.2) | 18 (11.3) | 20 (20.8) | - |
| **Education** | 255 | | | | <0.001 |
| Associates or diploma | | 72 (28.2) | 38 (23.9) | 34 (35.4) | - |
| Bachelor's degree | | 122 (47.8) | 69 (43.4) | 53 (55.2) | - |
| Master's degree | | 55 (21.6) | 47 (29.6) | 8 (8.3) | - |
| Doctoral degree | | 6 (2.4) | 5 (3.1) | 1 (1.0) | - |
| **US region** | 256 | | | | NS |
| West | | 52 (20.5) | 36 (22.6) | 16 (16.8) | - |
| Midwest | | 76 (29.9) | 53 (33.3) | 23 (24.2) | - |
| Northeast | | 44 (17.3) | 27 (17.0) | 17 (17.9) | - |
| South | | 82 (32.3) | 43 (27.0) | 39 (41.1) | - |
| **Type of hospital** | 255 | | | | NS |
| Community Hospital (non-profit) | | 170 (66.7) | 105 (66.0) | 65 (67.7) | - |
| Community Hospital (for-profit) | | 29 (11.4) | 20 (12.6) | 9 (9.4) | - |
| University Medical Center | | 38 (15.0) | 21 (13.2) | 17 (17.7) | - |
| Military or Veteran's Hospital | | 7 (2.8) | 5 (13.4) | 2 (2.1) | - |
| County Hospital | | 4 (1.6) | 6 (3.77) | 2 (2.1) | - |
| **Job title** | 253 | | | | <0.001 |
| Staff nurse | | 140 (55.3) | 72 (45.8) | 68 (70.8) | - |
| Charge nurse | | 37 (14.6) | 18 (11.4) | 19 (19.8) | - |
| Nurse manager | | 28 (11.1) | 24 (15.3) | 4 (4.2) | - |
| Clinical nurse specialist | | 17 (6.7) | 17 (10.8) | 0 | - |
| Other | | 31 (12.3) | 26 (16.5) | 5 (5.2) | - |
| **Years in nursing** | 254 | 16.5 (5-27) | 20 (9-30) | 7.8 (2.9-23) | <0.001 |
| **Day or night shift** | 255 | | | | - |
| Permanent day shift | | 159 (62.4) | | | - |
| Permanent night or Rotating shift | | 96 (37.6) | | | - |

*NS not significant

**Table 2**

*Work Organization Characteristics Reported by RNs*

| | | All | By Shift | | |
|---|---|---|---|---|---|
| | | | Day n=159 | Rotating or Night n=96 | |
| | N | *n (%), or median (IQR)* | | | *p* value |
| ***Work schedule variables*** | | | | | |
| **Length of work shift** | 255 | | | | <0.001 |
| 8-hours | | 98 (38.4) | 81 (51.0) | 17 (17.7) | |
| 12-hours | | 157 (61.6) | 78 (49.0) | 79 (82.3) | |
| **Years worked in current shift** | 254 | 5 (2-11) | 6 (2-11) | 4 (2-11) | 0.08 |
| **Work hours per week** | 255 | 36 (36-40) | 37.5 (36-40) | 36 (36-36) | <0.001 |
| **Overtime hours per week** | 254 | 2 (0-7) | 3 (0-8) | 2 (0-6) | NS |
| **Total hours work per week all jobs plus overtime** | 254 | 40 (36.5-45) | 40 (37.5-46) | 38 (36-44) | NS |
| **Happy with work schedule** | 255 | 198 (77.7) | 136 (85.5) | 62 (64.6) | <0.001 |
| ***Meal break variables*** | | | | | |
| **Takes a 30 minute meal break** | 244 | | | | NS |
| Always | | 16 (6.6) | 11 (7.2) | 5 (5.5) | - |
| Most of the time | | 33 (13.5) | 24 (15.7) | 9 (9.9) | - |
| Sometimes | | 47 (19.3) | 33 (21.6) | 14 (15.4) | - |
| Rarely | | 67 (27.5) | 42 (27.5) | 25 (27.5) | - |
| Never | | 81 (33.2) | 43 (28.1) | 38 (41.8) | - |
| **Chooses when to take break** | 244 | | | | 0.001 |
| Always | | 48 (19.7) | 34 (22.2) | 14 (15.4) | - |
| Most of the time | | 103 (42.2) | 71 (46.4) | 32 (35.2) | - |
| Sometimes | | 46 (18.9) | 27 (17.7) | 19 (20.9) | - |
| Rarely | | 30 (12.3) | 18 (11.8) | 12 (13.2) | - |
| Never | | 17 (7.0) | 3 (2.0) | 14 (15.4) | - |
| **Sits down to eat during the shift** | 244 | | | | 0.009 |
| Always | | 29 (11.9) | 24 (15.7) | 5 (5.5) | - |
| Most of the time | | 88 (36.1) | 62 (40.5) | 26 (28.6) | - |
| Sometimes | | 72 (29.5) | 38 (24.8) | 34 (37.4) | - |
| Rarely | | 46 (18.9) | 25 (16.3) | 21 (23.1) | - |
| Never | | 9 (3.7) | 4 (2.6) | 5 (5.5) | - |
| **Relieved of patient care during meals** | 244 | | | | <0.001 |
| Always | | 49 (20.1) | 44 (28.8) | 5 (5.5) | - |
| Most of the time | | 54 (22.1) | 29 (19.0) | 25 (27.5) | - |
| Sometimes | | 37 (15.2) | 20 (13.0) | 17 (18.7) | - |
| Rarely | | 51 (20.9) | 33 (21.6) | 18 (19.8) | - |
| Never | | 53 (21.7) | 27 (17.7) | 26 (28.6) | - |
| **Meal break interrupted for patient care** | 243 | | | | 0.004 |
| Always | | 34 (14.0) | 14 (9.2) | 20 (22.0) | - |
| Most of the time | | 75 (30.9) | 47 (30.9) | 28 (30.8) | - |
| Sometimes | | 81 (33.3) | 54 (35.5) | 27 (29.7) | - |
| Rarely | | 36 (14.8) | 21 (13.8) | 15 (16.5) | - |
| Never | | 17 (7.0) | 16 (10.5) | 1 (1.1) | - |
| **Work schedule allows for regular eating habits** | 244 | | | | 0.02 |
| Always | | 8 (3.3) | 5 (3.3) | 3 (3.3) | - |
| Most of the time | | 70 (28.7) | 55 (35.6) | 15 (16.5) | - |
| Sometimes | | 76 (31.2) | 42 (27.5) | 34 (37.4) | - |
| Rarely | | 74 (30.3) | 43 (28.1) | 31 (34.1) | - |
| Never | | 16 (6.6) | 8 (5.2) | 8 (8.8) | - |
| **Healthy food available at work** | 243 | | | | <0.001 |
| Always | | 50 (20.6) | 40 (26.1) | 10 (11.1) | - |
| Most of the time | | 66 (27.2) | 48 (31.4) | 18 (20) | - |
| Sometimes | | 72 (29.6) | 49 (32.0) | 23 (25.6) | - |
| Rarely | | 36 (14.8) | 12 (7.8) | 24 (26.7) | - |
| Never | | 19 (7.8) | 4 (2.6) | 15 (16.7) | |

*NS not significant

**Table 3**

*Personal Health Characteristics Reported by RNs*

| | | | By Shift | | |
|---|---|---|---|---|---|
| | | All | Day n=159 | Rotating or Night n=96 | |
| | N | n (%), or mean ± SD or median (IQR) | | | *p* value |
| ***Sleep variables*** | | | | | |
| **Sleep quality (day shift or days off)** | 222 | 7.2 ± 3.6 | 7.1 ± 3.8 | 7.4 ± 3.2 | NS |
| **Sleep quality score >5** | | 173 (78.0) | 105 (74.5) | 68 (84.0) | - |
| **Sleep duration hours (day shift or days off)** | 228 | 7.4 ± 1.5 | 7.4 ± 1.2 | 7.6 ± 1.8 | NS |
| **Used alcohol to help get to sleep** | 226 | | | | |
| Not during the past month | | 195 (86.3) | 119 (82.6) | 76 (92.7) | NS |
| Less than once per week | | 12 (5.3) | 8 (5.6) | 4 (4.9) | - |
| Once or twice per week | | 13 (5.8) | 11 (7.6) | 2 (2.4) | - |
| Three or more times per week | | 6 (2.7) | 6 (4.2) | 0 | - |
| **Used caffeine to stay awake at work** | 227 | | | | 0.003 |
| Not during the past month | | 74 (32.6) | 59 (40.7) | 15 (18.3) | - |
| Less than once per week | | 29 (12.8) | 18 (12.4) | 11 (13.4) | - |
| Once or twice per week | | 34 (15.0) | 16 (11.3) | 18 (22.0) | - |
| Three or more times per week | | 90 (39.7) | 52 (35.8) | 38 (46.3) | - |
| ***Occupational stress variables*** | | | | | |
| **Effort reward imbalance ratio** | 238 | 1.3 (1.0-1.6) | 1.3 (1.0-1.6) | 1.2 (1.0 -1.5) | NS |
| **Effort reward ratio >1** | | 182 (76.5) | 118 (79.2) | 64 (72.0) | - |
| **Overcommitment** | 245 | 14.9 ± 3.7 | 15.2 ± 3.6 | 14.4 ± 3.7 | NS |
| **Effort** | 246 | 10.3 ± 1.7 | 10.4 ± 1.7 | 10.0 ± 1.7 | 0.04 |
| **Reward** | 243 | 18.9 ± 3.9 | 19.0 ± 3.7 | 18.6 ± 4.2 | NS |
| **Esteem** | 251 | 5.7 ± 1.3 | 5.9 ± 1.3 | 5.4 ± 1.3 | 0.01 |
| **Promotion** | 246 | 7.6 ± 1.9 | 7.5 ± 1.9 | 7.7 ± 2.0 | NS |
| **Security** | 248 | 5.5 ± 1.5 | 5.6 ± 1.4 | 5.4 ± 1.6 | NS |
| ***Other health characteristics*** | | | | | |
| **^BMI category (kg/m2)** | 237 | | | | NS |
| Underweight (<18.5) | | 5 (2.1) | 1 (0.7) | 4 (4.6) | - |
| Normal weight (18.5 to 24.9) | | 78 (32.9) | 53 (35.6) | 25 (28.4) | - |
| Overweight (25.0 to 29.9) | | 71 (29.9) | 40 (26.9) | 31 (35.2) | - |
| Obese (≥30) | | 83 (35.0) | 55 (36.9) | 28 (31.8) | - |
| **Waist circumference (cm)** | 212 | 89.9 ± 17.2 | 91.5 ± 17.0 | 87.2 ± 17.2 | NS |
| **Self-perception of weight** | 239 | | | | |
| Very underweight | | 2 (0.8) | 2 (1.3) | 0 | NS |
| Somewhat underweight | | 7 (2.9) | 5 (3.3) | 2 (2.3) | - |
| Normal weight | | 56 (23.4) | 31 (20.5) | 25 (28.4) | - |
| Somewhat overweight | | 109 (45.6) | 66 (43.7) | 43 (48.9) | - |
| Very overweight | | 65 (27.2) | 47 (31.1) | 18 (20.4) | - |
| **Currently on a diet to lose weight** | 242 | 84 (34.7) | 59 (38.6) | 25 (28.0) | NS |
| **Amount eaten at work compared to day off** | 242 | | | | |
| Eat the same at work | | 45 (18.6) | 29 (19.0) | 16 (18.0) | NS |
| Eat less at work | | 148 (61.2) | 93 (60.8) | 55 (61.8) | - |
| Eat more at work | | 49 (20.3) | 31 (20.3) | 18 (20.2) | - |
| **150 minutes or more of exercise per week** | 192 | 84 (43.8) | 56 (47.0) | 28 (38.4) | NS |
| **Currently smokes cigarettes** | 247 | 16 (6.5) | 11 (7.1) | 5 (5.4) | NS |
| **Self-perception of health** | 249 | | | | |
| Very good | | 70 (28.1) | 48 (30.6) | 22 (23.9) | NS |
| Good | | 120 (48.2) | 73 (46.5) | 47 (51.1) | - |
| Fair | | 57 (23.0) | 35 (22.3) | 22 (23.9) | - |
| Bad | | 2 (0.8) | 1 (0.6) | 1 (1.1) | - |

*NS not significant ^ BMI calculated from ht (lb) / (Height (in)2) x 703

**Table 4**

*Sleep Component Scores Measured by the Pittsburgh Sleep Quality Index*

| Sleep component | n (%) |
|---|---|
| **Subjective sleep quality** | |
| Very good | 32 (14.2) |
| Fairly good | 127 (56.2) |
| Fairly bad | 60 (26.6) |
| Very bad | 7 (2.1) |
| **Sleep latency** | |
| ≤15 minutes | 58 (25.6) |
| 16-30 minutes | 88 (38.8) |
| 31-60 minutes | 52 (22.3) |
| >60 minutes | 29 (12.8) |
| **Sleep duration** | |
| ≥7 hours | 103 (45.2) |
| 6-7 hours | 84 (36.8) |
| 5-6 hours | 30 (13.2) |
| <5 hours | 11 (4.8) |
| **Habitual sleep efficiency** | |
| >85% | 151 (66.2) |
| 75-84% | 43 (18.8) |
| 65-74% | 17 (7.5) |
| <65% | 17 (7.5) |
| **Sleep disturbances** | |
| 0 | 2 (0.8) |
| 1-9 | 129 (50.4) |
| 10-18 | 77 (30.1) |
| 19-27 | 48 (18.8) |
| **Sleeping medication use** | |
| None during the past month | 147 (65.0) |
| Less than once per week | 20 (8.9) |
| Once or twice per week | 20 (8.9) |
| Three or more times per week | 39 (17.3) |
| **Daytime dysfunction** | |
| None during the past month | 41 (18.22) |
| Less than once per week | 118 (52.4) |
| Once or twice per week | 51 (22.7) |
| Three or more times per week | 15 (6.7) |
| **Global score >5 poor sleep** | 173(78.0) |

**Table 5**

*Pearson Correlations between BMI, Waist Circumference, Sleep, and Occupational stress*

| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) | Body mass index | 1 | | | | | | | | | |
| (2) | Waist circumference | 0.88** | 1 | | | | | | | | |
| (3) | Hours of sleep | -0.15* | -0.07 | 1 | | | | | | | |
| (4) | Sleep quality | 0.23** | 0.23** | 0.04 | 1 | | | | | | |
| (5) | Alcohol to aid sleep | 0.01 | -0.002 | -0.06 | 0.15* | 1 | | | | | |
| (6) | Caffeine to stay awake | 0.03 | 0.08 | 0.04 | 0.26** | 0.18* | 1 | | | | |
| (7) | Effort/reward imbalance | 0.16** | 0.13 | -0.06 | 0.25** | 0.05 | 0.13 | 1 | | | |
| (8) | Overcommitment | -0.003 | 0.02 | -0.03 | 0.40** | 0.29** | 0.25** | 0.37** | 1 | | |
| (9) | Effort | 0.08 | 0.06 | -0.06 | 0.22* | 0.16* | 0.12 | 0.64** | 0.52** | 1 | |
| (10) | Reward | -0.11 | -0.08 | 0.05 | -0.21* | 0.002 | -0.14* | -0.84** | -0.21* | -0.29* | 1 |

**$p$ value <0.001; * $p$ value <0.05

Figure 1. Scatterplot of the relationship between sleep quality and BMI

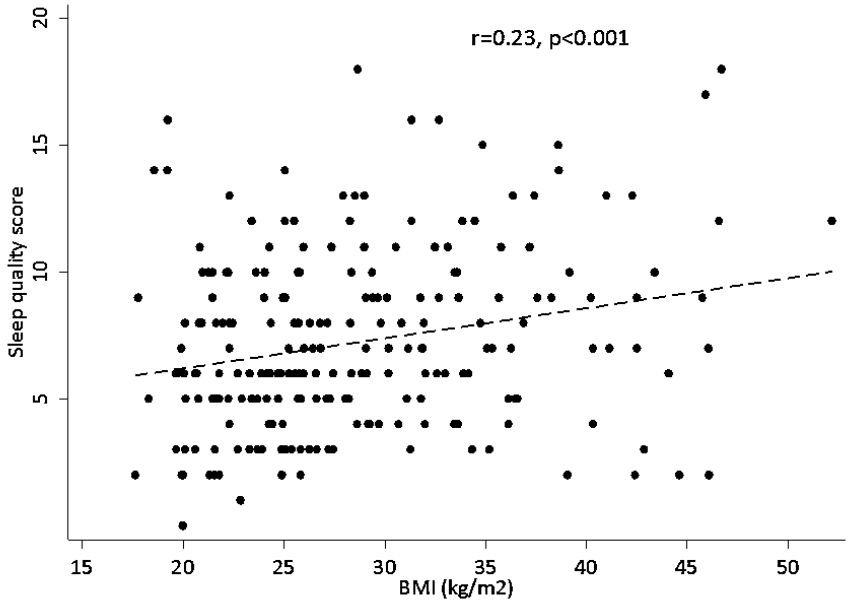
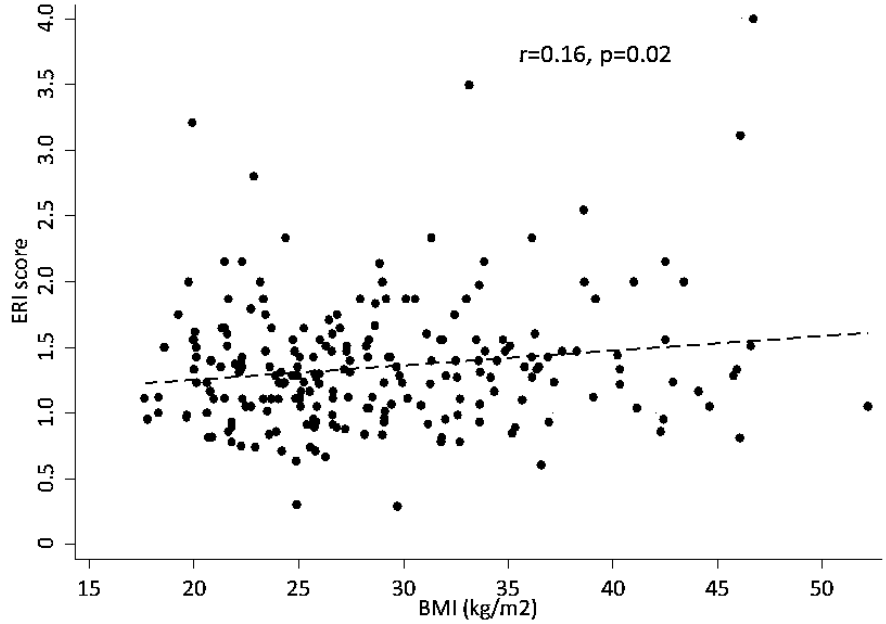



Figure 2. Scatterplot of the relationship between occupational stress (ERI) and BMI



# Chapter 4

# The Effect of Occupational Stress on Eating Behaviors and Adiposity Among Female Registered Nurses

# Chapter 4

## The Effect of Occupational Stress on Eating Behaviors and Adiposity Among Female Registered Nurses


## Abstract

### Background

Chronic stress is associated with stress-related eating behaviors, preferences for high fat and sweet foods, and weight gain. This study tests a model of occupational stress and adiposity, and mediating pathways through stress-induced eating behaviors and food cravings among hospital-working female registered nurses (RN).

### Methods

A cross-sectional online survey collected data from members of the Academy of Medical/Surgical Nurses (AMSN). The association between occupational stress, adiposity, and mediating pathways were assessed using structural equation modelling (SEM).

The Effort/Reward Imbalance short form measured occupational stress, including subscales for effort, reward, and overcommitment. Mediating latent variables were food cravings and eating behaviors. Food cravings were measured with the Food Craving Inventory. Eating behaviors (emotional, restrained, and external eating) were measured with the Weight-Related Eating Questionnaire. Adiposity was assessed with body mass index, weight perception, and waist circumference.

### Results

Of 256 female, hospital working RNs who completed the survey, 76% reported occupational stress, and 35% were obese. The structural equation model findings

supported an indirect effect of occupational stress on adiposity mediated by eating behaviors ($p$<0.001). The direct effect of occupational stress on adiposity was negative, and non-significant.

**Conclusions**

Occupational stress is associated with adiposity through its effect on stress-induced eating behaviors. There are individual differences in coping with occupational stress, and eating behaviors may be maladaptive coping strategies for some RNs.

**Keywords.** Occupational stress; obesity; conceptual model; eating behaviors.

## Introduction

Workplace hazards that increase risk for excessive weight gain include: extended work hours, sedentary work, shift work, and occupational stress such as job strain due to high demand and low control at work, or high effort and low reward, as well as lack of social support, or job insecurity (Cohen, Tarule, Rambur, & Vallett, 2012; Karasek et al., 1998; Pandalai, Schulte, & Miller, 2013; Roos, Lallukka, Rahkonen, Lahelma, & Laaksonen, 2013; Siegrist, 1996). Yet, the research into associations between occupational stress and weight gain or adiposity in prospective cohort studies has found inconclusive results, ranging from a positive dose response for job strain plus lack of social support at work with increasing weight gain (Brunner, Chandola, & Marmot, 2007), to null associations found in a meta-analysis examining 14 prospective studies that measured associations between occupational stress and adiposity (Wardle, Chida, Gibson, Whitaker, & Steptoe, 2011).

Why have epidemiological studies found such mixed results? One possibility may be that the association is moderated by gender. In an analysis of Whitehall II study data researchers stratified by gender and reported that the main effect of occupational stress on weight gain was only statistically significant among women (Kivimaki et al., 2006). Moreover, a 28 year longitudinal Finnish study of 449 industrial employees, reported that an increased working pace increased the odds of weight gain, but only among women (Lallukka et al., 2008). Conversely, other epidemiological research reported the effect of occupational stress on weight gain was stronger in men than in women (Brunner et al., 2007). Although it is not clear whether women are more vulnerable than men, there appear to be differences that are dependent upon gender.

The effect of occupational stress on weight gain may also depend upon body mass index (BMI), with those at higher BMI being more vulnerable to additional weight gain when chronically stressed. Among men with a higher body weight at baseline, occupational stress exposure increased the risk of additional weight gain, and among men with low body weight stress exposure increased the risk of weight loss (Kivimaki et al., 2006). This interaction was further examined in a study of US men and women where researchers reported weight gain associated with occupational stress depended upon higher BMI at baseline (Block, He, Zaslavsky, Ding, & Ayanian, 2009).

Another reason for the inconclusive associations between occupational stress and weight gain or adiposity, may be due to individual variations in behaviors and psychological traits, which are associated with individual differences in food consumption in response to psychosocial stress. It appears that approximately 40% of individuals eat more in response to psychosocial stress, 40% eat less, and 20% eat the same amount (Epel et al., 2004; Oliver & Wardle, 1999). These individual differences in response to stress also depend upon gender; in experimental studies women eat more, and select unhealthier foods more often (Epel, Lapidus, McEwen, & Brownell, 2001; Zellner et al., 2006). In a 2013 national survey, 43% of women reported that they had eaten unhealthy food within the previous month because of stress, compared to 32% of men (American Psychological Association, 2013). It is possible that such an increase in consumption and/or change in preference for unhealthier foods in response to chronic stress may lead to weight gain over time.

Therefore, despite the inconclusive results, it seems reasonable to hypothesize that for some individuals there may be increased vulnerability to gain excessive weight

when exposed to occupational stress. Such vulnerable individuals are likely to be female with higher BMIs, experiencing chronic psychological stress, and "stress-related" eating behaviors and food cravings. In order to address these problems this study will evaluate a conceptual model of the association between occupational stress and adiposity and possible mediating pathways via eating behaviors and food cravings in a sample of women.

## Theoretical perspective

The conceptual model for this study proposes that occupational stress is associated with adiposity in vulnerable individuals. The model is grounded in the theoretical framework of allostasis, and allostasic load (AL), when chronic exposure to demands (stressors) leads to the risk of various long-term health problems. Allostasis is regulation of physiology through "variation of the body's internal environment to meet perceived and anticipated need" (Sterling & Eyer, 1988). Allostasis describes regulation and anticipatory regulation, which incorporates individual differences in psychology, physiology, genetics, social factors, and differences in responses to environmental pressures, in a centrally orchestrated biochemical system that evolved to promote survival (McEwen, 2012). An allostatic state is a prolonged imbalance in the regulatory system from perceived threat (i.e. chronic stress), and AL refers to the changes that occur from the allostatic state, which can be pathological, or increase an individual's risk for disease.

The allostatic model posits that in order to cope with immediate or anticipated stressors, the brain coordinates cascades of biochemical mediators such as glucocorticoids and catecholamines that promote or inhibit physical and behavioral

actions in response to both environmental pressures and changing internal needs; ideally, the response manages the stress (i.e. it is adaptive), and is beneficial to the individual (McEwen, 1998). However, the physiological and behavioral responses to stress may also be maladaptive and increase risk for various diseases and pathological states, and for some individuals, these maladaptive stress responses may increase risk for obesity (McEwen, 2000). Specifically, the metabolic changes in allostatic load result from the repeated activation of the hypothalamic-pituitary axis (HPA), and/or the inability of the HPA axis to switch off (Sterling, 2012). The resultant chronic increased production of cortisol from the adrenal glands promotes visceral fat accumulation and insulin resistance (Bjorntorp, 1996). In contrast, the general adaptation response stress theory posits that a hyperactive HPA response is likely to predict appetite loss and anorexia, and conversely an attenuated stress response to predict obesity (Chrousos & Gold, 1992). Appetite loss from a hyperactive HPA response helps to explain why 40% eat less in response to stress, but does not explain the 40% who eat more.

In regards to changes in appetite, cortisol affects the biochemistry of appetite control driving food preferences towards highly palatable foods (i.e. high fat and sweet), and increases the motivation to eat (Dallman, 2010). In animal studies, when rats were exposed to chronic stressors, cortisol increased their motivation to eat, and in the presence of insulin and cortisol, rats showed preference for highly palatable foods (Pecoraro, Reyes, Gomez, Bhargava, & Dallman, 2004). In humans, increased food consumption has been demonstrated in a laboratory setting; in healthy adults administered corticotropin-releasing hormone (CRH), their cortisol levels increased, and consequently food consumption increased as well (George, Khan, Briggs, & Abelson,

2010). Indeed, many experimental studies have demonstrated stress-induced changes in food consumption. In women exposed to stress tests in a laboratory setting, and among chronically stressed women, food consumption and preference for highly palatable foods increases (Epel et al., 2001; Groesz et al., 2012).

The type of stress, either chronic or acute, as well as individual differences in cortisol reactivity in response to such stress appear to affect food preference and consumption. In an experimental setting, women with high levels of chronic stress, ate more highly palatable foods than those with lower levels of chronic stress (Tryon, Decant, & Laugero, 2013). In an experimental study of women exposed to acute stress, those women with a high level of cortisol reactivity had an increase in appetite and food preferences for highly palatable foods (Epel et al., 2001). Thus chronic stress prompts motivation to eat palatable foods in some, and the experience of an acute stress with high cortisol reactivity may prompt consumption in others. Additionally, high levels of insulin (often associated with obesity) may trigger food cravings (a strong appetite and desire to eat) (Jastreboff et al., 2013). It is possible that cravings may increase intake of certain foods, and thus be associated with increasing weight gain (Chao, Grilo, White, & Sinha, 2014).

In addition, variation in individual psychological traits helps to explain why not all people eat more and/or gain excessive weight in response to experiencing repeated or chronic stress (Greeno & Wing, 1994). Chronic stress can exacerbate certain types of eating behavior traits, such as emotional eating, restrained eating, and eating in response to external cues. Emotional eating is a concept that refers to the consumption of food in response to negative emotions (Kaplan & Kaplan, 1957). When exposed to stress,

emotional eaters tend to eat more (Oliver, Wardle, & Gibson, 2000). Restrained eating is the concept of cognitive control of eating behaviors, such as when dieting (Herman & Mack, 1975). The emphasis on cognitive control of eating behavior may lead restrained eaters to over-consume when control fails under chronic stress (Lattimore & Caswell, 2004). It is postulated that restrained eating may be further sub-divided to compensatory restraint, which is flexible and has a beneficial effect on eating, or routine restraint, which is rigid and more vulnerable to failure under stress (Schembre, Greene, & Melanson, 2009). External eating is the behavior of consumption in response to food cues in the environment, regardless of feelings hunger or physiological need for energy (Van Strien, Schippers, & Cox, 1995), and stress can prompt an increase in such food consumption (Conner, Fitter, & Fletcher, 1999).

The conceptual model for this study hypothesizes that occupational stress is associated with adiposity and that this relationship is mediated by the latent variable of food cravings, and the latent variable of eating behaviors (routine restrained, emotional, and susceptibility to external cues) (see Figure 1). In this study, the term adiposity is used as a descriptor of body fatness as a broader concept than obesity, which indicates a cut-point of body mass index (BMI) $\geq 30$ kg/m$^2$.

The aim of this study is to develop and test a model of the association between occupational stress and adiposity, and the possible mediating pathways through food cravings for highly palatable foods and eating behavior types that are induced by chronic stress (emotional, routine restrained, and eating in response to external cues). This study examines if the conceptual model is supported by the data collected from a sample of female, hospital working RNs.

## Methods

### Research Design and Sample

An online cross-sectional survey was used to collect data from nurses who are members of the American Academy of Medical/Surgical Nurses (AMSN). Study data were collected and managed using REDCap electronic data capture tools hosted at University of California, San Francisco (Harris et al., 2009). A link to the online survey was posted on the AMSN website from April to October 2014. Emails were sent to the 11, 306 members in April, 2014 with reminder emails sent out again after one month. A research request was also included in the AMSN e-newsletter for May/June and July/August, 2014. In April, AMSN posted the research request to their Facebook and Twitter pages. On July 1st, email invitations to participate were sent to 17 AMSN local chapter contacts, and the email was followed up after 2 weeks. Additionally, flyers with information and a link to the survey were handed out to approximately 700 of the attendees of the annual AMSN convention. A total of 322 RNs completed the online screening questions, of whom 38 did not meet eligibility criteria, and a further 28 did not enter any data into the online survey beyond the consent form. The final sample size included 256 RNs.

To be eligible for the study participants had to be hospital-based RNs. Gender may moderate the relationship between stress and eating behaviors as women tend to consume more food in response to stress exposure than men (Zellner et al., 2006), and because gender may moderate the association between occupational stress and adiposity, only female RNs were included. The participants were currently working a minimum of 32 hours per week in an acute care hospital in the USA. Participants were ineligible and

excluded if they were currently taking a leave of absence from work for any reason, or pregnant or had delivered a baby within the previous 6 months.

The study was approved by the Institutional Review Board of University of California, San Francisco, and participants provided with electronic written informed consent included at the beginning of the online survey.

**Measurement**

Demographic data regarding age, race/ethnicity, education, type of work, and shift-work characteristics were self-reported via the online questionnaire.

The exogenous latent variable occupational stress was measured with the Effort/Reward Imbalance scale (ERI scale), which is based on the concept of social reciprocity: when efforts (perceived job demands, workload, work pressures) are higher than rewards (job security, support from coworkers, and financial rewards) the individual may be vulnerable to experience occupational stress (Siegrist, Wege, Puhlhofer, & Wahrendorf, 2009). An additional key concept in the scale is overcommitment to work, where excessive commitment to work (either due to individual personality type and/or external work environment factors) can adversely affect perception of work demands and coping ability, thereby exacerbating occupational stress (Siegrist et al., 2004).

This study used the 16 item short form version of the ERI instrument. The 16 item scale asks participants to rate their usual work situation by responding to questions with a 4 point Likert scale (1) strongly disagree, (2) disagree, (3) agree, and (4) strongly agree. The subscale of effort is measured by 3 items, reward by 7 items, and overcommitment by 6 items. Higher ratings in the subscales indicates higher effort,

reward, or overcommitment. The ERI short form was evaluated for validity in sample of 10,698 German workers; confirmatory factor analysis indicated the instrument's items are representative of the concepts of effort, reward, and overcommitment in the theoretical model (Siegrist et al., 2009). From the data collected in this study, reliability was acceptable as measured by Cronbach's alphas: for the effort scale = 0.78, for the reward scale = 0.83, and for the overcommitment scale = 0.81.

**Mediating variables.** The latent endogenous variable food cravings (defined as an intense desire for a particular food that is difficult to resist), includes subscales from the Food Craving Inventory (FCI) (White, Whisenhunt, Williamson, Greenway, & Netemeyer, 2002). In this study, food cravings were a surrogate measure for preference for types of highly palatable foods distinct from hunger, as actual food consumption and appetite were not measured. The FCI measures specific food cravings for highly palatable foods with four subscales: for foods high in fat (e.g. gravy, fried fish, bacon), for carbohydrates (e.g. pasta, rice, baked potato), for sweets (e.g. donuts, cinnamon rolls, cookies), and for fast-food fats (e.g. French fries, chips, pizza). The FCI is a 28 item scale, and participants rate the frequency of their food cravings over the previous month on a 5-point Likert scale (1) never, (2) rarely, (3) sometimes, (4) often, and (5) always/almost every day. Scores are obtained by averaging the responses to items in each of the subscales, and the total score is an average of all the items. A higher score indicates higher cravings. In a study of 379 adults, researchers used confirmatory factor analysis to examine validity of the scale and demonstrate that the items included in the subscales adequately measure cravings for the specified four food categories (White et al., 2002). From the data collected in this study, Cronbach's alpha (0.92) was excellent.

The endogenous latent variable eating behaviors includes subscales from the Weight-related Eating Questionnaire (WREQ) (Schembre, Greene, & Melanson, 2009). From this scale, three aspects of eating behaviors that may mediate the relationship between occupational stress and adiposity were included in the latent variable. These WREQ subscales included: emotional eating, routine restrained eating, and eating in response to external cues. Routine restrained eating as measured by WREQ defines a rigid approach to eating (Schembre et al., 2009). The WREQ is a 16 item scale that asks the participants to rate how well each item describes their eating behavior on a five-point Likert scale: (1) not at all, (2) slightly, (3) more or less, (4) pretty well, and (5) completely. Scores are obtained by averaging the responses to items in each of the subscales. WREQ subscales are valid as demonstrated by confirmatory factor analysis in a sample of 257 adults (Schembre & Geller, 2011). From the data collected in this study, Cronbach's alphas ranged from excellent to good: emotional eating scale (0.92) for eating in response to external cues (0.85) and for routine restrained eating (0.80).

**Outcome variables.** The outcome of interest, the latent variable adiposity, includes BMI, waist circumference, and weight perception. To measure BMI, the participants were asked (1) How much do you weigh (pounds) without shoes? (2) How tall are you without shoes? From self-reported height in feet and inches, and weight in pounds, BMI was calculated by converting to metrics and then dividing weight in kilograms by height in squared meters ($kg/m^2$). Self-report BMI tends to underestimate actual BMI compared to direct measurement; but underestimations may be relatively small as reported in a systematic review of 10 studies, where underestimates of self-report as compared to direct measurement were under 1 BMI unit difference in most

studies (Connor Gorber, Tremblay, Moher, & Gorber, 2007). Participants were asked to self-reported waist circumference (WC), and given the following instructions: "To correctly measure your waist, stand and place a tape measure around your middle, just above your hipbones. Measure your waist just after you breathe out." WC was reported in inches and converted to centimeters. It is a valid measure of adiposity; a study of 151 adults compared direct measurement WC to CT scan, and in regression analyses found that WC measurement explained 91% of the variance in body and abdominal fat (Pouliot et al., 1994). Self-reported WC may underestimate, but has been shown to correlate with direct measurement in women (Rimm et al., 1990). Participants were asked to categorize their own perception of their weight on a 5 point Likert scale (1) very underweight, (2) somewhat underweight, (3) normal weight, (4) somewhat overweight, and (5) very overweight.

## Analysis

Descriptive statistics including means and standard deviations (SD) for quantitative variables, and frequencies and percentages for categorical variables are provided for the participant characteristics.

The association between occupational stress and adiposity was assessed using structural equation modelling (SEM) to specify the relationships between the hypothesized exogenous latent variable occupational stress and the endogenous latent variable adiposity. The model was used to estimate evidence for mediation between occupational stress and adiposity through eating behaviors and mediation through food cravings.

The distributions of univariate data used as measured variables within the latent variables were assessed for normality and outliers. A Pearson's correlation matrix between variables examined the strength and direction of relationships between all the measured variables. Then, using a factor analysis approach, the measurement model components were assessed. The factor loadings of the latent variables on the measured variables were assessed to estimate how much the measured variables represented the latent variables, and non-significant measures with low factor loadings removed from the latent variables. No changes were made to the hypothesized latent variables based upon these estimations. Next, the structural model between the latent variables was estimated.

The SEM global model fit was tested with the chi-square test of exact model fit, the Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), and the Standardized Root Mean Square Residual (SRMR). Adequate global model fit is reached when two of the following three conditions are met: CFI $\geq .95$, RMSEA $\leq .06$, and SRMR $\leq .08$ (Hu & Bentler, 1999).

In the analysis all latent and observed variables were included as continuous. In order to use all available information missing data were assumed to be missing at random and maximum likelihood estimation with missing values was used for the model estimation. The unstandardized estimate (B), its standard error (SE), the estimate divided by its standard error (Z), the p-value for Z, and the standardized parameter estimate ($\beta$) are reported for each estimated parameter.

The indirect effects of the mediating latent variables food craving and eating behaviors were calculated as products of their respective constituent path coefficients

between occupational stress and adiposity. Mediation is present if the product of the constituent paths is significantly different from zero (MacKinnon, 2008). All analyses were considered significant at $p < .05$. Two-tailed *p*-values are reported for all analyses. Data analysis, including model estimation, was completed with STATA version 13.1 statistical software (College Station, TX, USA).

## Results

### Characteristics of the Study Participants

The sample characteristics are presented in Table 1 and the measures of central tendency and variability for variables included in the SEM are presented in Table 2. A total of 256 RNs completed the online survey. Of these, 76% (n=194) were white, 72% (n=183) received a Bachelor's degree or higher level of education, 55% (n=140) were staff nurses, 67% worked in non-profit community hospitals, and 62% (n=159) worked permanent day shift. The mean age was 46 years. Approximately 7% of the self-reported weight responses were missing, and 3-5% of the effort-reward imbalance responses missing from the survey. Of the 237 participants reporting both height and weight, BMI categories were: 33% (n=78) of participants were normal weight, 30% (n=71) were overweight, and 35% (n=83) were obese. The mean waist circumference among participants was 89.9 cm, and 50% of them were abdominally obese with a waist circumference >88 cm according to national guidelines (National Heart Lung and Blood Institute, 1998). When reporting perception of their own weight 27% (n=65) perceived themselves to be very overweight, 46% (n=109) perceived themselves to be overweight, and 23% (n=56) perceived themselves to be normal weight. Among the 238 participants who completed the ERI questions, 76% (n=182) reported ERI ratio >1.

A comparison to 2014 AMSN membership demographics indicated that the sample group is different from the membership group in regards to percentage of RNs working as a staff nurse and years of experience, but not different in average age or percentage of RNs with a bachelor's degree. Among the AMSN members there was a higher percentage of staff nurses (75%) than in the sample group (55%), and a lower percentage of nurses with less than 2 years of experience (8%) than in the sample group (11%), as well as a lower percentage of nurses with 10 or more years of experience (50%) compared to the sample group (62%).

**Structural Equation Model Results**

The global fit estimates for the model were: $\chi^2(60) = 141.46$, $p < 0.001$; RMSEA = 0.07 (90 %CI: 0.06-0.09); CFI = 0.94 and SRMR = 0.07; these results indicate that one of the three fit statistics, the SRMR, met the recommended threshold value while the other two fit statistics are very close to the recommended cutoffs. These statistics' values might be improved further if the model were modified to be more consistent with the observed data. The model explained 24% of the variance in the latent variable adiposity ($R^2 = 0.24$), 20% of the variance in the latent variable food cravings ($R^2 = 0.20$), and 20% of the variance in the latent variable eating behaviors ($R^2 = 0.20$).

A correlation between the residuals of the food craving and eating behaviors latent variables was added to improve the model fit. Although the correlation was statistically significant, it did not improve the global model fit estimates. Though the RMSEA and CFI goodness of fit indices did not reach the desired cutoff level, the SRMR index did meet the target threshold. In light of this finding in conjunction with the SEM literature's caution against using absolute cutoffs for model fit statistics

(Marsh, Hau, & Wen, 2004), and because there was no theoretically feasible change to be made to the model, the initial model was retained.

For correlations between the measured variables see Table 3. For SEM results see Table 4 and Figure 2. Occupational stress has a significant positive direct effect on food cravings (B= 0.10; $Z$ = 4.9, $p$ <0.001), but food cravings are not directly associated with adiposity (B = -0.05, $Z$ = -0.64, $p$ = 0.52). Occupational stress has a significant positive direct effect on eating behaviors (B = 0.45, $Z$ = 6.0, $p$ <0.001) and eating behaviors has a significant positive direct effect on adiposity (B = 0.54, Z = 7.52, $p$ <0.001). The direct effect of occupational stress on adiposity is negative, but weak and non-significant (B = -0.30, $Z$ = -1.28, $p$ = 0.20). The total effect of occupational stress on adiposity is positive, but non-significant (B = 0.23, $Z$ = 1.13, $p$ = 0.26).

The results of the analysis of mediating effects found that occupational stress has a statistically significant positive indirect effect on adiposity that is mediated by eating behaviors (B = 0.24, Z = 4.18, $p$ <0.001, 95% CI: 0.13 to 0.36). However, occupational stress does not have a statistically significant indirect effect on adiposity mediated by food cravings (B = -0.02, $Z$ = -0.64, $p$ = 0.52, 95% CI: -0.09 to 0.05).

## Discussion

In this study population from a national sample of hospital-based female RNs, the participants had high levels of occupational stress and adiposity. In summary, 76% of the participants had an ERI ratio >1, 35% were obese, and 50% of the participants abdominally obese with a waist circumference >88 cm. Interestingly, RNs' perception of their own weight suggested that participants underestimated their weight at higher BMIs,

as 27% reported perceiving their weight to be "very overweight" compared to 35% self-reporting an obese category BMI (>30kg/$m^2$).

The results provide evidence in support of the conceptual model. There was a statistically significant indirect effect of occupational stress on adiposity mediated by eating behaviors. There was a statistically significant association with occupational stress and food cravings; however, food cravings were not associated with adiposity. The results did not provide evidence for a direct effect of occupational stress on adiposity.

The conceptual model hypothesizes that stress-induced eating behaviors (emotional eating, routine restrained eating, and eating in response to external cues) mediate the relationship between occupational stress and adiposity, and the data supported this hypothesis in the SEM. The appraisal of occupational stress as a threat may produce a negative emotional coping response (Lazarus & Folkman, 1984), leading to overconsumption or unhealthy eating for those who are emotional eaters. The current study included female RNs, and in previous research women with high levels of chronic stress were at increased risk of emotional eating (Tomiyama, Dallman, & Epel, 2011). Furthermore, eating in response to negative emotion is associated with weight gain (Van Strien, Rookus, Bergers, Frijters, & Defares, 1986).

The extent to which emotional eating actually improves mental wellbeing in the long term is unknown, but one study demonstrated that among chronically stressed women, the consumption of high fat/high sugar foods in response to stress might attenuate the HPA response to chronic stressors (Tomiyama et al., 2011). Additional factors in stress-induced eating behaviors are routine restrained eating and external cue

susceptibility, both have been previously associated with weight gain in women (Schembre et al., 2012). The extent to which RNs are coping with emotional, restrained, or external eating behaviors is not known, although one study that included male and female licensed nurses in Hong Kong reported above 60% for each eating behavior (Wong, Wong, Wong, & Lee, 2010).

The motivation or desire to eat highly palatable foods was measured by the latent variable food cravings. Food cravings were associated with occupational stress, but did not predict adiposity. These results support the possibility that occupational stress affects the salience of the rewarding and pleasurable aspects of highly palatable foods, and the desire to consume such foods. However, the model did not provide any evidence that increased food cravings promote weight gain. This is commensurate with other research into food cravings, where craving food may not be associated with higher BMI (Gilhooly et al., 2007). If indeed exposure to chronic occupational stress, does promote food cravings, then this may be problematic for those individuals who control food intake (i.e. restrained eaters), or for those with binge eating disorders, where food cravings have been shown to affect intake (Ng & Davis, 2013). In the current study, actual food consumption was not evaluated although participants were asked if they ate more or less while at work and 62% reported eating less at work. It is unknown whether eating less at work (with presumably calorie restriction) leads to rebound overconsumption or binging when the shift is completed and food no longer restricted by work.

In this study, there was no direct or total effect of occupational stress on adiposity. Prior research into occupational stress and associations with weight gain or

obesity has reported mixed results, with no association in a recent meta-analysis, and other research reporting associations dependent upon BMI status, and gender (Kivimaki et al., 2006; Wardle et al., 2011). A recent European pooled-analysis reported increased odds of occupational stress (defined by job strain) with increasing BMI, but concluded that given the small effect, population level interventions to reduce occupational stress may not substantively reduce obesity (Nyberg et al., 2012). Chronic psychosocial stress is a complex concept with many contributing factors. Occupational stress is only one facet of possible psychosocial stressors, which may include social stress outside of the workplace, or financial stress; additionally, individuals may be simultaneously coping with depression and/or anxiety, which may moderate the relationship between occupational stress and adiposity (Block et al., 2009).

There are several limitations to this study. A cross-sectional study cannot assess causality, and cross-sectional analysis cannot capture the time-varying aspects of occupational stress and adiposity. Future longitudinal research in this population, with measurement of biomarkers such as salivary cortisol is recommended to further examine the association between occupational stress and adiposity. All variables in this study were self-reported. Self-reported BMI tends to overestimate at lower values and underestimate higher values; it is preferable to directly measure body fatness, including height and weight to calculate BMI and measurement of waist circumference, or waist/hip ratio to capture abdominal adiposity (Stommel & Schoenborn, 2009). The characteristics in the sample of RNs who answered the online survey were probably different from the overall RN members of AMSN. The response rate was very low (approximately 3%) and a comparison to the member demographics indicated

differences in whether working as a staff nurse and by years of experience. This sample may contain those RNs who appraised themselves particularly affected by their work, highly stressed, and/or at higher BMI category.

There may also be individual variation in appraisal of threat, coping, and stress-induced eating behaviors among hospital-based RNs that are dependent on specific work contexts (i.e. intensive care unit, rehabilitation unit, or emergency department); accordingly qualitative and quantitative approaches should further explore occupational stress appraisal and coping differences by work context. Occupational stress is well-recognized as a nebulous concept to measure. Thus it is possible that ERI short form does not fully capture all dimensions of occupational stress among hospital-based RNs, and ERI does not capture non-occupational stress that may contribute to associations with chronic stress and adiposity. Food craving measurement using FCI did not measure giving into cravings, and the generalizability of the FCI is limited by its development within two samples of mostly female residents of Louisiana (White et al., 2002). Some of the food items are not necessarily relevant to all people. For example, vegetarians are not likely to crave hotdogs, gravy, or steak. However, since 2002 the FCI has been widely used in USA.

This study did not evaluate the food environment at work. Those exposed to chronic stress snack more, and consume more highly palatable foods, especially in an environment where such foods are readily available (Oliver et al., 2000). The food environments in hospitals may not be supportive of healthy eating habits, especially for night and evening shift workers, as one study in California hospitals reported that 24% of foods in vending machines was candy (Lawrence, Boyle, Craypo, & Samuels, 2009).

If there are also candies and chocolates readily available to RNs, perhaps because of appreciative gifts from patients, then RNs may be working in an environment with snack foods that are readily available. The ready availability of snack foods may influence eating behaviors and also increase consumption of highly palatable foods (Wansink, Painter, & Lee, 2006). Thus availability of snack foods, and occupational stress combined may be particularly problematic.

An assessment of participants' depression was not included in this study and it may be a mediating variable in the relationship between occupational stress and obesity, as depression may dysregulate the physiological stress response, and increase stress reactivity (Modell, Yassouridis, Huber, & Holsboer, 1997). The relationship is complicated as there is also evidence for a bi-directional relationship between depression and obesity as depression is a risk factor for obesity, and obesity is a risk factor for depression (Markowitz, Friedman, & Arent, 2008). Further research is needed to identify the extent to which depression is a mediator of the relationship between occupational stress and weight gain, or if occupational stress depends upon depressed mood.

Other factors that may mediate or moderate the relationship between occupational stress and adiposity that were not included in the conceptual model are sleep quality and duration, work hours and shift work, socio-economic status, age, and race/ethnicity.

## Summary

The prevalence of occupational stress and obesity were extremely high in this sample indicating the need for research into a more representative sample of the US

nursing workforce to accurately describe occupational stress and obesity in these workers. The extent of stress-induced eating behaviors among RNs in the US is unknown. However, in this study the association between occupational stress and adiposity was mediated by stress-induced eating behaviors (emotional, restrained, and external eating). These results have implications for the development of effective interventions to support healthy weight among RNs. Mindfulness eating is a cognitive-behavioral stress-reduction approach to weight loss, which helps individuals to self-regulate emotion in order to assist in healthy eating behaviors (Grossman, Niemann, Schmidt, & Walach, 2004). Interventions that teach mindfulness eating techniques may be useful to include in obesity prevention and worksite wellness programs. A randomized controlled trial of a mindfulness eating intervention among "stressed" women that included meditation and learning attention to and awareness of physical hunger, cravings and emotional cues to eating food, helped to reduce cortisol levels and prevent weight gain among obese women in the treatment group, whereas control women's cortisol increased and they gained weight (Daubenmier et al., 2011). Such interventions need to be evaluated in the workplace as a component of wellness and health promotion practices targeted to RNs.

In addition, a reduction in the availability of unhealthy snacks in the workplace may reduce susceptibility to consume high fat and sugary foods. The creation of work environments that support the practice of mindfulness eating, including designated and pleasant rest areas, plus the implementation of policies such as staff ratios, and RN break coverage might help to ensure that RNs can take 30 minute, uninterrupted meal breaks.

Such interventions and work policies may reduce occupational stress, and possibly will further assist in supporting healthier eating and preventing excessive weight gain.

Finally, hospital employers need to evaluate, perhaps with unit-level confidential surveys, the degree to which employee RNs are experiencing occupational stress. Employers can implement and evaluate the recommendations from National Institute of Occupational Safety and Health (NIOSH) to reduce occupational stress. NIOSH recommendations that may be particularly relevant to RNs include: improving work schedules, ensuring that the workload is achievable, as well as improving social support, and communication between RNs and other hospital workers (Sauter et al., 1999). Research is needed to determine the extent to which the reduction of occupational stress among hospital-based shift working RNs will contribute to an overall health and wellness program for obesity prevention.

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**Table 1**

*Characteristics of the Study Participants (N=256)*

| Variable | n(%), or mean ±SD, or median (interquartile range) |
|---|---|
| Age (years) n=238 | 45.9 ± 11.9 |
| **Race** | |
| Asian | 10 (3.9) |
| African American | 13 (5.1) |
| White | 194 (75.8) |
| Other or not reported | 39 (15.2) |
| **Education n=255** | |
| Associates or diploma | 72 (28.2) |
| Bachelor's degree | 122 (47.8) |
| Master's degree | 55 (21.6) |
| Doctoral degree | 6 (2.4) |
| **US region** | |
| West | 52 (20.5) |
| Midwest | 76 (29.9) |
| Northeast | 44 (17.3) |
| South | 82 (32.3) |
| **Type of hospital n=255** | |
| Community Hospital (non-profit) | 170 (66.7) |
| Community Hospital (for-profit) | 29 (11.4) |
| University Medical Center | 38 (15.0) |
| Military or veterans Hospital | 7 (2.8) |
| County Hospital | 4 (1.6) |
| **Job title n=255** | |
| Staff nurse | 140 (55.3) |
| Charge nurse | 37 (14.6) |
| Nurse manager | 28 (11.1) |
| Clinical nurse specialist | 17 (6.7) |
| Other | 31 (12.3) |
| **Length of work shift n=255** | |
| 8 hours | 98 (38.4) |
| 12 hours | 157 (61.6) |
| **Day or night shift n=255** | |
| Permanent day shift | 159 (62.4) |
| Permanent night shift | 68 (26.7) |
| Rotating shifts | 28 (11.0) |
| **Work hours per week n=255** | 36 (36-40) |
| **Overtime hours per week n=254** | 2 (0-7) |
| **Years worked in current shift n=254** | 5 (2-11) |
| **Happy with work schedule n=255** | 198 (77.7) |
| **BMI categories (kg/m2) n=202** | |
| Underweight (<18.5) | 5 (2.1) |
| Normal weight (18.5 to 24.9) | 78 (32.9) |
| Overweight (25.0 to 29.9) | 71 (29.9) |
| Obese (≥30) | 83 (35) |
| **Waist circumference (cm) n=212** | 89.9 ± 17.2 |
| **Perception of weight n=239** | |
| Underweight | 9 (3.8) |
| Normal weight | 56 (23.4) |
| Overweight | 109 (45.6) |
| Very overweight | 65 (27.2) |
| **Effort reward imbalance ratio n=238** | 1.3 (IQR 1.0-1.6) |
| Effort reward ratio >1 | 182 (76.0) |

**Table 2**

*Descriptive Statistics for Variables Included in the SEM*

| Variable | Mean ±SD | Median (p25-p75) | Skew |
|---|---|---|---|
| **Outcome variable: Adiposity** | | | |
| BMI (kg/m$^2$) n=205 | 28.6±6.9 | 26.9 (23.5-32.7) | 0.8 |
| Waist circumference (cm) n=212 | 89.9±17.2 | 88.9 (76.2-101.6) | 0.7 |
| Perception of weight n=239 | 4.0±0.8 | 4 (3-5) | -0.5 |
| **Exogenous variable: Occupational stress** | | | |
| Effort n=246 | 10.3±1.7 | 11 (9-12) | -1.0 |
| Reward n=243 | 18.9±3.9 | 19 (16-21) | -0.2 |
| Overcommitment n=245 | 14.9±3.7 | 15 (12-17) | 0.2 |
| **Mediating observed variables** | | | |
| Food cravings, total score n=215 | 2.1±0.6 | 2.0 (1.7-2.4) | 0.9 |
| Sweet cravings n=231 | 2.5±0.8 | 2.4 (1.9-3) | 0.5 |
| High fat cravings n=231 | 1.7±0.6 | 1.6 (1.3-2.1) | 1.2 |
| Fast food fat cravings n=238 | 2.4±0.8 | 2.5 (2-3) | 0.2 |
| Carbohydrate cravings n=233 | 2.0±0.7 | 1.9 (1.4-2.5) | 0.9 |
| Emotional eating n=239 | 2.5±1.2 | 2.2 (1.4-3.4) | 0.5 |
| Routine restrained eating n=245 | 2.1±0.9 | 2 (1.3-2.7) | 0.8 |
| External cue susceptibility n=243 | 2.7±1.1 | 2.6 (1.8-3.6) | 0.2 |

## Table 3

*Correlations for Analysis of Structural Equation Model of Occupational Stress and Adiposity*

| | Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Occupational stress** | | | | | | | | | | | | | |
| 1 | Overcommitment | 1 | | | | | | | | | | | | |
| 2 | Reward | -0.21*** | 1 | | | | | | | | | | | |
| 3 | Effort | 0.52*** | -0.29*** | 1 | | | | | | | | | | |
| | **Food cravings** | | | | | | | | | | | | | |
| 4 | Carbohydrates | 0.29*** | -0.01 | 0.18** | 1 | | | | | | | | | |
| 5 | Sweet | 0.30*** | -0.09 | 0.22*** | 0.58*** | | | | | | | | | |
| 6 | High fat | 0.25*** | 0.02 | 0.17** | 0.67*** | 0.43*** | 1 | | | | | | | |
| 7 | Fast food fat | 0.24*** | -0.08 | 0.23*** | 0.59*** | 0.55*** | 0.63*** | 1 | | | | | | |
| | **Eating behaviors** | | | | | | | | | | | | | |
| 8 | Emotional eating | 0.28*** | -0.16** | 0.2*** | 0.17** | 0.39*** | -0.09 | 0.24*** | 1 | | | | | |
| 9 | External cue susceptibility | 0.25*** | -0.18** | 0.24*** | 0.26*** | 0.41*** | 0.20*** | 0.30*** | 0.69*** | 1 | | | | |
| 10 | Routine restraint | 0.0 | 0.05 | -0.05 | -0.08 | -0.14** | -0.04 | -0.1 | 0.13** | 0.14** | 1 | | | |
| | **Adiposity** | | | | | | | | | | | | | |
| 11 | BMI (kg/m$^2$) | 0.0 | -0.11 | 0.08 | -0.05 | 0.09 | 0.11 | 0.05 | 0.35*** | 0.32*** | 0.06 | 1 | | |
| 12 | Waist circumference (cm) | 0.02 | -0.08 | 0.06 | -0.03 | 0.19** | 0.08 | 0.07 | 0.41*** | 0.36*** | -0.01 | 0.88*** | 1 | |
| 13 | Weight perception | 0.08 | -0.08 | 0.1 | 0.04 | 0.15** | 0.09 | 0.12 | 0.38*** | 0.38*** | 0.09 | 0.69*** | 0.66*** | 1 |

**$p$ value <0.05 ***$p$ value <0.001

**Table 4**

*Structural Equation Model Including Measured and Structural Variables*

| Measured variables | Coefficient | *Z* | *p*-value | 95% confidence interval | β |
|---|---|---|---|---|---|
| **Occupational stress** | | | | | |
| -> Overcommitment | 1 | 0 | | | 0.74 |
| -> Reward score | -0.46 | -3.83 | <0.001 | -0.70 , -0.22 | -0.32 |
| -> Effort score | 0.44 | 6.45 | <0.001 | 0.03, 0.57 | 0.68 |
| **Eating behaviors** | | | | | |
| -> Emotional eating | 1 | 0 | | | 0.85 |
| -> External cue susceptibility | 0.83 | 8.92 | <0.001 | 0.65, 1.01 | 0.81 |
| -> Routine restrained eating | 0.14 | 2.23 | 0.03 | 0.02, 0.26 | 0.16 |
| **Food Cravings** | | | | | |
| -> Carbohydrates | 1 | 0 | | | 0.82 |
| -> Sweets | 0.92 | 10.29 | <0.001 | 0.74, 1.09 | 0.68 |
| -> High fats | 0.84 | 12.37 | <0.001 | 0.71, 0.98 | 0.80 |
| -> Fast food fats | 0.98 | 11.37 | <0.001 | 0.80, 1.15 | 0.77 |
| **Adiposity** | | | | | |
| -> BMI | 1 | 0 | | | 0.94 |
| -> Waist circumference | 0.97 | 21.54 | <0.001 | 0.88, 1.06 | 0.93 |
| -> Weight perception | 0.09 | 14.30 | <0.001 | 0.08, 0.11 | 0.73 |
| ***Structural*** | | | | | |
| Occupational stress -> Eating behaviors | 0.17 | 4.80 | <0.001 | 0.10, 0.24 | 0.45 |
| Occupational stress -> Food Cravings | 0.10 | 4.90 | <0.001 | 0.06, 0.14 | 0.44 |
| Eating behaviors -> Adiposity | 3.38 | 5.94 | <0.001 | 2.27, 4.50 | 0.54 |
| Food Cravings -> Adiposity | -0.56 | -0.64 | 0.52 | -2.28, 1.16 | -0.05 |
| Occupational stress -> Adiposity | -0.30 | -1.28 | 0.20 | -0.77, 0.16 | -0.13 |

β standardized regression coefficient; -> denotes directional effects

Figure 1. Path Diagram of Hypothesized Variables Examining Associations Between Occupational Stress and Adiposity.

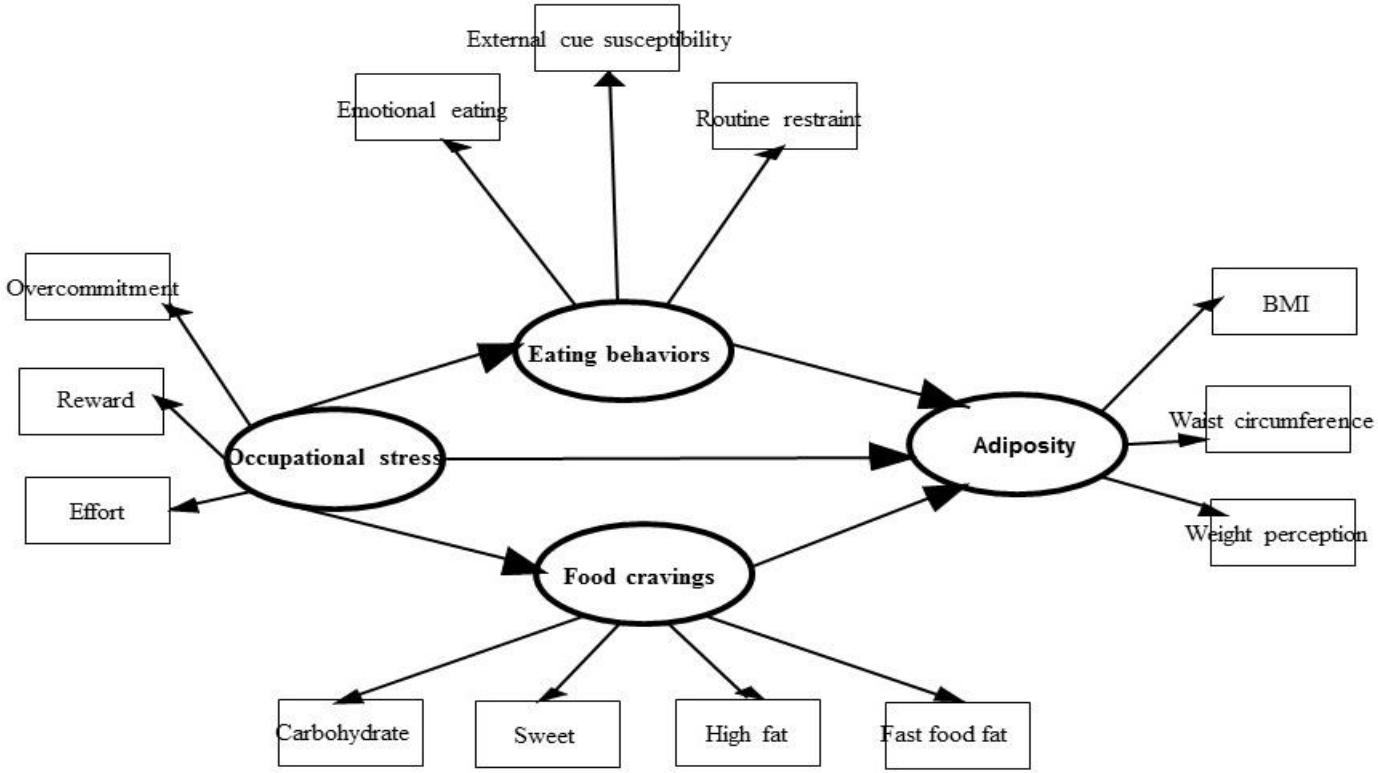
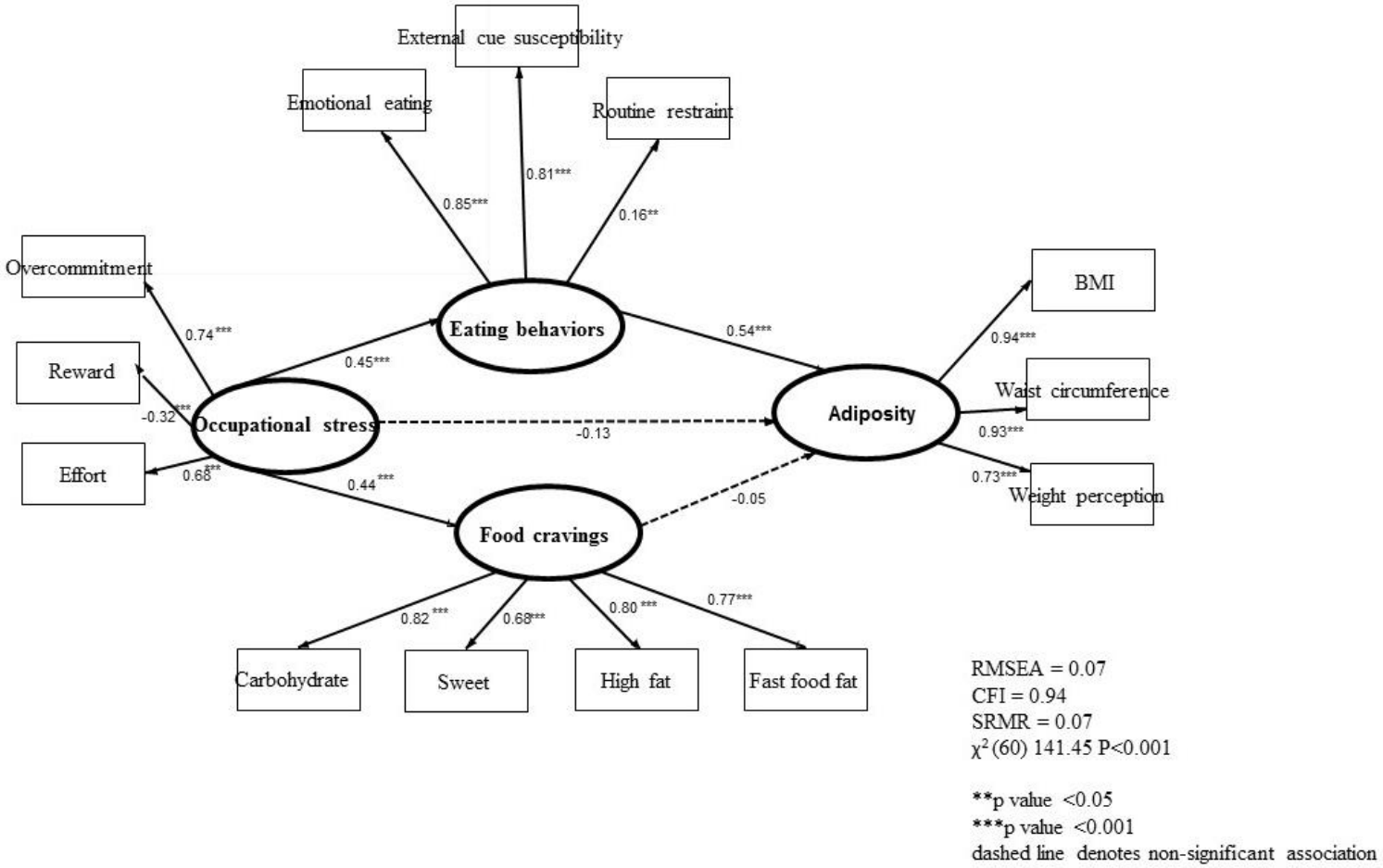


Figure 2. Standardized Path Coefficients for Structural Equation Model Examining the Associations Between Occupational Stress and Adiposity.



# Chapter 5

## Summary and Conclusions

# Chapter 5

## Summary and Conclusions

The overall purpose of this dissertation was to examine occupational stress and obesity among hospital working female RNs. Obesity is a disease with multiple causal factors, including a variety of influences due to type of work and working environment. This dissertation describes various work organizational and personal health characteristics that may be associated with risk for obesity among female hospital-based RNs. In particular, this study examined the effect of occupational stress on obesity. Previous research suggests that about 40% of people eat more food than they usually eat as a way to cope with stress (Oliver & Wardle, 1999). If female RNs are exposed to occupational stress, it is possible that some may use food to cope, and that this may contribute to risk for excessive weight gain and obesity. Thus this dissertation tested a conceptual model of association between occupational stress and adiposity (a concept used to define body fatness comprised of body mass index (BMI), waist circumference, and self-perception of weight), mediated by stress-related eating behaviors (emotional eating, rigid restrained eating, and eating in response to external cues), and food cravings.

### Key Findings

The first aim of this dissertation research project was to summarize what is known about occupational stress and associations with weight gain, obesity or stress-related eating behaviors among licensed nurses. An integrative review of empirical research indicated that requirements of the job, control over work, nurses' coping with occupational stress, and social support from a supervisor at work were all associated

with weight status and stress-related eating behaviors. However the data was insufficient and unable to provide strong evidence for the associations between occupational stress, weight gain, obesity, or stress-related eating behaviors among licensed nurses.

The second aim of this project was to assess the work organizational factors (work schedules, work hours, and meal break practices), as well as describe personal health characteristics (sleep quality, occupational stress levels, and physical activity habits) among female RNs, which may affect health and increase risk for obesity. The work organizational factors described in this study indicate that there is opportunity to improve work organization for female RNs in the hospital setting. RNs typically work long hours; in this study over half (58%) of the respondents worked more than 40 hours per week (including all jobs and overtime work). Nearly two-thirds of the respondents (62%) worked 12-hour shifts. However, despite their work hours, the majority of respondents reported that they were happy with their work schedule (78%). RNs' meal breaks were inadequate regardless of which shift they regularly worked. One-third (33%) reported never being able to take a meal break on their shift, and for those who took breaks, nearly half (45%) were always or often interrupted for patient care during meal breaks.

The personal health characteristics described by the respondents illustrate that obesity, occupational stress, and poor quality sleep are highly prevalent among female hospital working RNs. This study found over one third (35%) of female RNs to be living with obesity, which indicates that these workers are disproportionately affected by obesity, with higher obesity prevalence than average among female US workers (27.2%) (Luckhaupt, Cohen, Li, & Calvert, 2014). More than three-quarters of respondents had

occupational stress (77%) measured by effort/reward imbalance ratio >1. Additionally, a disturbingly high proportion of RNs (78%) reported that they experienced poor sleep quality. Occupational stress weakly correlated with body mass index (BMI). Both poor quality sleep and short sleep duration correlated with higher body mass index (BMI). Sleep can be disturbed by psychological stress and poor sleep quality may also be a stressor (Akerstedt, 2006). In this dissertation study poor sleep quality was correlated with higher occupational stress.

The third aim of the study was to evaluate a conceptual model that occupational stress is associated with adiposity (body fatness), and that the relationship is mediated by stress-induced eating behaviors and/or food cravings. The results of the conceptual model testing indicated no direct association between occupational stress and adiposity, and no association between occupational stress and adiposity mediated by food cravings. However, occupational stress was associated with adiposity via stress-related eating behaviors, including emotional eating (eating in response to negative emotions such as sadness or anger), rigid restrained eating behavior, and eating in response to cues from the external food environment.

**Implications and recommendations for Policy and Research**

The findings of the dissertation have several implications for occupational stress and obesity research, and for policies that aim to promote the health of hospital working RNs. This national survey of medical/surgical female RNs found a high prevalence of obesity (35%) among the respondents. This study tested a model of occupational stress and adiposity (the term adiposity was used to describe a latent variable consisting of BMI, waist circumference, and perception of body weight).

A key finding in this study was that stress-related eating behaviors (emotional eating, rigid restrained eating, and eating in response to the external environment) are mediators in the relationship between occupational stress and adiposity. In future research, it will be useful to determine the extent to which female RNs are affected by stress-related eating behaviors. At work, RNs are faced with with death and dying, the suffering of others, and various other emotionally challenging situations. The question of whether hospital work evokes negative emotions (e.g. sadness, anger or fear) among RNS, and if so, what percentage of RNs eat or do not eat to cope with negative emotions that arise from their work experiences is unanswered.

Interventions to promote female RNs' healthy weight may be more effective if they include strategies for individuals to cope with occupational stress in ways other than using eating behaviors. The use of interventions that focus on specific eating behavior traits may reduce mediating effects in the relationship between occupational stress and adiposity. For RNs with emotional eating behaviors, learning to recognize and differentiate hunger from emotion, and learning mindfulness eating skills such as appreciating food quality, avoiding triggers to eat, and allowing cravings to go by, may help them to reduce emotional eating in response to stress, and perhaps to avoid weight gain (Daubenmier et al., 2011). Some preliminary testing of mindfulness to reduce occupational stress has begun (Foureur, Besley, Burton, Yu, & Crisp, 2013). However, it will be enlightening to discover if mindfulness eating, or the addition of mindfulness eating practices to other workplace mindfulness stress reduction interventions, help RNs by preventing or reducing weight gain related to emotional eating behaviors.

Being on a diet to lose weight can be stressful (Tomiyama et al., 2010), and rigid restrained eating behaviors lead to overconsumption when stressed (Schembre, Greene, & Melanson, 2009). Therefore, for some RNs struggling with their weight, trying to lose weight with calorie restriction may be counterproductive. Workplace interventions to help with weight loss among RNs may be more effective if they promote healthy eating practices rather than focusing on calorie restriction. Such strategies need to be evaluated for effectiveness.

Thirdly, there is likely opportunity for the food environment at work to improve and thereby support healthier eating behaviors. If hospital work environments allow for easy accessibility to high fat or sweet foods such access promotes consumption of these kinds of unhealthy foods, therefore, attention to the types of snacks at-hand in the hospital might be beneficial to RNs (Wansink, Painter, & Lee, 2006). Hospital systems are already working to improve the food environment for their employees; for example the Healthy Hospitals Initiative is a national partnership of hospital systems with nonprofit organizations working to improve the quality of foods, and reduce sugary drinks served in hospitals (Healthy Hospitals Initiative, 2015). It will be interesting to discover if the initiative's actions result in a reduction of obesity prevalence among hospital employees including RNs.

The organization of hospital work involves shift work, and may require RNs to work extra hours in order to provide 24 hour care for patients. This study found that over half of RNs who responded worked more than 40 hours per week. The National Occupational Research Agenda (NORA) recommends research into the impact of work organization (shift work and work hours) on occupational stress and on productivity

(productivity includes absenteeism and presenteeism), with the goal of minimizing the harmful health effects of shift work on workers (Centers for Disease Control and Prevention, 2014).

Hospital policies need to consider the evidence as it becomes available on how best to reduce the harmful health effects of shift work on employees. Recently, the American Nurses Association (ANA) position statement on nurse fatigue summarized evidence-based, practical recommendations for employers and for individuals (American Nurses Association, 2014). The ANA's various recommendations include limiting the work week to less than 40 hours for paid and unpaid work, and involving RNs with more control over their work schedules.

This study found that RNs do not always take meal breaks and that meal breaks are often interrupted. The ANA position statement on nurse fatigue (2014) also recommends that employers support nurses to take breaks. Additionally, a minimum standard for safe staffing levels might also help to reduce occupational stress, and to improve RNs' ability to take adequate meal breaks. The Registered Nurse Safe Staffing Act is a federal bill to improve hospital staffing levels introduced in 2013 and is currently under consideration by the senate (Capps, 2014). As well as action to improve RNs work organization at the federal level, states can legislate staffing levels. In California nurse-patient ratio legislation requiring meal break coverage helped RNs to take breaks more often than their counterparts in states without such legislation (Aiken et al., 2010).

If RNs sleep quality is as poor as reported in this study then RNs' health may be compromised by poor quality sleep. The ANA's position statement on nurse fatigue

recommends that nurses get 7-9 hours of sleep a night (American Nurses Association, 2014). The Healthy People 2020 objective for healthy sleep points out that employers can help to promote sleep health through education about the importance of sleep to health, and providing information on common sleep disorders (Department of Health and Human Services, 2015). Research is currently examining the use of sleep improvement interventions to reduce weight (Cizza et al., 2010). If this research shows that sleep improvement is effective to reduce weight, then improving sleep quality, and emphasizing the importance of good sleep to maintain health among RNs needs to be included in hospital employer's workplace weight loss and healthy eating interventions. The ANA (2014) recommends promoting the use of naps during rest breaks for shift working RNs.

**Strengths**

This study surveyed a national sample of medical surgical, hospital working female RNs. It provides an overview of some of the work organization factors that may be modifiable to better support RNs health and wellbeing. By testing a model of occupational stress and adiposity, this study identified that eating behavior traits mediate the relationship between occupational stress and obesity in RNs. Interventions to help RNs to learn healthier ways to cope with occupational stress that do not increase risk for excessive weight gain may be beneficial to these workers.

**Limitations**

To protect RNs' health from occupational hazards it is important to be able to understand the factors that contribute to ill-health or excessive weight gain. To do so it is

necessary to be able to successfully collect information from hospital-based RNs. Web surveys are useful, but they are not necessarily successful. Web surveys in social science are likely at best to provide a 20-30% response rate (Sauermann & Roach, 2013), which is lower than usually deemed acceptable to reduce risk of respondent bias in research surveys. This survey of RNs was a web survey, with an extremely low response rate of 3% (calculated from the number who participated divided by the number invited), but it may not be unusual for web surveys used in marketing. A recent market research survey to examine nurses' use of the internet and mobile technology had a 4% participation rate (Wolters Kluwer, 2014).

The differences in response rates across web surveys could be from issues such around the invitation to participate, whether the invitation comes from a recognized source or a cold call, spam filtering, the incentives offered, the length of time it takes to complete survey, and the ease with which the survey web site is accessed and the survey completed (Fan & Yan, 2010). Additionally, the characteristics of the population to be sampled may be a factor. If those being invited do not have ready access to spend time at a computer, then it will probably be more difficult for them to respond. In the Wolters Kluwer (2014) survey, only 52% of the staff nurses reported owning a desktop computer. Perhaps hospital working RNs spend very little time online, especially if their work does not involve sitting at a computer all day, and if they do not own a computer at home then it is unlikely that they will be able to participate in a web survey.

The respondents in this study were invited to participate via email and social media (Facebook page and Twitter) by the Academy of Medical/Surgical Nurses (AMSN), in which they were members. The AMSN is presumably recognized and well-

respected by members. The link to the survey was available to members on the AMSN website for 5 months, although to get to the survey from the web page involved opening a pdf of the invitation letter and clicking on a link at the end of the letter. There was no way to confirm the numbers of members who actually received the emails and there is a risk that some number of emails were not delivered or delivered to junk mail. The survey took about 20-30 minutes to complete and did not allow respondents to save their answers and log-in later to complete. Respondents who completed the survey were entered into a raffle to receive 1 of 8 possible $100 Amazon gift certificates; the response rate in this dissertation study is corroborated by research suggesting that this kind of incentive is not necessarily very effective at promoting participation (Dykema, Jones, Piché, & Stevenson, 2013). The fundamental reasons for non-participation in this survey are not known. However, survey participation rates have been decreasing over recent decades for many reasons, including: a lack of willingness to volunteer engendered by experiencing repeated requests to participate in marketing and others surveys, or from lack of interest if people feel the study is not salient to their situation, time pressures, or email filtered to junk mail (Galea & Tracy, 2007), and perhaps web surveys are particularly vulnerable to this attrition.

This study aimed to describe work organization and personal health characteristics from female RNs across the USA. Due to the low response and small sample size this study was unable examine RN characteristics by geographic region. Within the workplace, there may be different environmental, social, and cultural influences upon RNs that are dependent upon where the hospital is located, or upon the specific hospital or hospital system practices and policies. In future research, the

identification of such influences may help to create work place interventions relevant to the specific needs of RNs, and perhaps as a result be more effective at health promotion.

The web survey was cross-sectional and therefore cannot determine causality. Male RNs were excluded, and it is possible that male RNs may respond differently to occupational stress than female RNs. All data was self-reported. Web survey, self-reported weight and waist circumference probably underestimate the direct measurement values (Bonn, Trolle Lagerros, & Balter, 2013). There may be measurement bias as both the Pittsburgh Sleep Quality Index and the Effort Reward Imbalance questionnaires are not validated for use in shift-workers. This study did not measure depression among RNs that may affect their sleep quality, and be associated with increased risk for obesity. Additionally, alcohol use was not measured, and alcohol use may be associated with BMI, sleep quality, and occupational stress.

**Summary**

This study suggests that occupational stress, obesity, and poor sleep quality are highly prevalent among hospital-based female RNs. Occupational stress may contribute to obesity via the mediating effect of stress-related eating behaviors. High occupational stress and poor sleep quality may both increase risk for obesity. RNs work organization characteristics are probably contributing to RNs lack of adequate sleep, high occupational stress, and so modifications to shifts, to limit long work hours, and to ensure adequate meal-breaks, might assist in reducing occupational stress and promoting good sleep quality and adequate sleep duration. Workplace wellness programs can be effective in helping workers to lose weight (Anderson et al., 2009). The addition of techniques to avoid stress-eating, and education regarding the importance of good sleep,

to the established physical activity and nutritional advice approach may help RNs to stay healthy and reduce risk of excessive weight gain.

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**Appendix 1.**

*Survey questions*

| *Question* | *Choices* | *Instructions* |
|---|---|---|
| ***Screening questions*** | | |
| *Are you a registered nurse?* | 1, Yes \| 0, No | |
| *Are you female?* | 1, Yes \| 0, No | |
| *Are you pregnant, or did you deliver a baby within the previous 6 months?* | 1, Yes \| 0, No | |
| *Are you currently on a leave of absence from work for any reason?* | 1, Yes \| 0, No | |
| *Do you work 32 hours or more per week in an acute care hospital?* | 1, Yes \| 0, No | |
| *Do you work within the USA (50 states & District of Columbia)?* | 1, Yes \| 0, No | |
| ***Survey questions*** | | |
| *What is today's date?* | | |
| *What is your highest nursing degree?* | 1, Associate's degree \| 2, Diploma degree \| 3, Bachelor's degree \| 4, Master's degree \| 5, Doctoral degree | |
| *For how many years have you worked as a nurse?* | | years |
| *Which state do you work in?* | 01, Alabama \| 02, Alaska \| 04, Arizona \| 05, Arkansas \| 06, California \| 08, Colorado \| 09, Connecticut \| 10, Delaware \| 11, District of Columbia \| 12, Florida \| 13, Georgia \| 15, Hawaii \| 16, Idaho \| 17, | |

| *Question* | *Choices* | *Instructions* |
|---|---|---|
| | Illinois \| 18, Indiana \| 19, Iowa \| 20, Kansas \| 21, Kentucky \| 22, Louisiana \| 23, Maine \| 24, Maryland \| 25, Massachusetts \| 26, Michigan \| 27, Minnesota \| 28, Mississippi \| 29, Missouri \| 30, Montana \| 31, Nebraska \| 32, Nevada \| 33, New Hampshire \| 34, New Jersey \| 35, New Mexico \| 36, New York \| 37, North Carolina \| 38, North Dakota \| 39, Ohio \| 40, Oklahoma \| 41, Oregon \| 42, Pennsylvania \| 44, Rhode Island \| 45, South Carolina \| 46, South Dakota \| 47, Tennessee \| 48, Texas \| 49, Utah \| 51, Virginia \| 50, Vermont \| 53, Washington \| 54, West Virginia \| 55, Wisconsin \| 56, Wyoming \| 99, Other | |
| *If you work in another state, please give a short description of where you work.* | | |
| *Please select the type of hospital where you work* | 1, Community hospital (non-profit) \| 2, Community hospital (for-profit) \| 3, University medical center \| 4, Military or veteran's hospital \| 5, County hospital \| 99, Other | |
| *If other, please specify the type of hospital* | | |
| *What is your current job title?* | 1, Staff nurse \| 2, Charge nurse \| 3, Nurse manager/supervisor \| 4, Clinical nurse specialist \| 5, Nurse practitioner \| 99, Other | |
| *If other, please specify your job title* | | |

| *Question* | *Choices* | *Instructions* |
|---|---|---|
| *Select the most appropriate description of your job situation:* | 1, Full-time regular employee (32 hours or more per week) \| 2, Full-time temporary employee (32 hours or more per week) \| 5, Casual (per diem) (32 hours or more per week) | A regular employee has no end date to employment. A temporary employee has a defined end date to employment. |
| *Select the description that comes closest to your present work shift:* | 1, Rotating eight hour shift (days- evenings -nights) \| 2, Rotating eight hour shift (evenings- nights) \| 3, Rotating eight hour shift (days - nights) \| 4, Rotating twelve hour shift \| 5, Permanent twelve hour shift (days) \| 6, Permanent twelve hour shift (nights) \| 7, Permanent eight hour day shift \| 8, Permanent eight hour evening shift \| 9, Permanent eight hour night shift | |
| *In your current position, how long (years) have you worked the shift you indicated above?* | | years |
| *If you work an 8 hour rotating shift, what rotation pattern do you follow?* | 1, Day to Evening to Night \| 2, Night to Evening to Day \| 3, No set pattern | |
| *If you work a 12 hour rotating shift, what rotation pattern do you follow?* | 1, Day to Night \| 2, Night to Day \| 3, No set pattern | |
| *How many times a week do you change shifts?* | 0, 0 times (I don't change) \| 1, 1 time \| 2, 2 times \| 3, More than 2 times \| 4, On call \| 5, Standby \| 6, Non-standard work week \| 99, Other | |
| *Please describe your shift change pattern* | | describe your shift pattern |

| *Question* | *Choices* | *Instructions* |
|---|---|---|
| *How many hours are you scheduled to work per week?* | | hours |
| *How many hours overtime do you work in your job in an average week?* | | hours |
| *How many hours per week do you work on any other (additional) job(s)?*<br><br>*Please mark 0 if no other job.* | | hours |
| *Are you happy with your work schedule?* | 0, No \| 1, Yes | |
| *Effort Reward Imbalance questionnaire inserted here* | | |
| *Would you say your health is* | 0, very good \| 1, good \| 2, fair \| 3, bad \| 4, very bad | please choose one answer to rate your health |
| *Have your natural menstrual periods ceased permanently?* | 0, No. I am pre-menopausal \| 1, Yes. I am post-menopausal \| 2, Not sure (peri-menopausal) | |
| *Do you currently smoke cigarettes?* | 0, Not at all \| 1, Every day \| 2, Some days | |
| *If you have quit smoking, how long has it been since you last smoked a cigarette, even one or two puffs?* | 1, Within the past month (less than 1 month ago) \| 2, Within the past year \| 3, More than a year ago \| 4, Never smoked regularly | |
| *During the past month, other than your regular job, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise?* | 0, No \| 1, Yes | |

| *Question* | *Choices* | *Instructions* |
|---|---|---|
| *How many times per week did you take part in this activity during the past month?* | | |
| *And when you took part in this activity, for how many minutes did you usually keep at it?* | | minutes |
| *Weight-related eating questionnaire inserted here* | | |
| *When I am feeling happy, I eat less than I usually do* | 1, Not at all \| 2, Slightly \| 3, More or less \| 4, Pretty well \| 5, Completely | |
| *Are you currently on a diet to lose weight?* | | |
| *Does your work schedule allow you to eat regularly?* | 1, Always \| 2, Most of the time \| 3, Sometimes \| 4, Rarely \| 5, Never | |
| *Is healthy food available to you while you are at work?* | 1, Always \| 2, Most of the time \| 3, Sometimes \| 4, Rarely \| 5, Never | |
| *Do you eat more or less when you are at work, compared to when you have a day off work?* | 1, I eat the same \| 2, I eat less at work \| 3, I eat more at work | |
| *Do you take a 30 minute meal break during your workday?* | 1, Always \| 2, Most of the time \| 3, Sometimes \| 4, Rarely \| 5, Never | Please select one answer |
| *Do you take two 30 minute breaks during your work shift?* | 1, Always \| 2, Most of the time \| 3, Sometimes \| 4, Rarely \| 5, Never | Please select one answer |
| *Typically, do you choose when you get to take your meal break?* | 1, Always \| 2, Most of the time \| 3, Sometimes \| 4, Rarely \| 5, Never | |
| *How often are you able to sit down for a meal during your shift?* | 1, Always \| 2, Most of the time \| 3, Sometimes \| 4, Rarely \| 5, Never | |

| *Question* | *Choices* | *Instructions* |
|---|---|---|
| *Are you relieved of patient care responsibilities during your meals?* | 1, Always \| 2, Most of the time \| 3, Sometimes \| 4, Rarely \| 5, Never | |
| *How often are your meal breaks interrupted because you must return to patient care responsibilities?* | 1, Always \| 2, Most of the time \| 3, Sometimes \| 4, Rarely \| 5, Never | |
| *What is your waist circumference (inches)?* | | If you need to measure your waist, stand and place a tape measure around your middle, just above your hipbones. Measure your waist just after you breathe out. |
| *Please enter your height in feet and inches in the next two drop-down boxes. First select feet.*<br><br>*For example, if you are 5"4" select 5 in this dropdown box and 4 in the next one* | 3, 3 \| 4, 4 \| 5, 5 \| 6, 6 \| 7, 7 | feet |
| *Now enter the additional inches to complete your height* | 0, 0 \| 1, 1 \| 2, 2 \| 3, 3 \| 4, 4 \| 5, 5 \| 6, 6 \| 7, 7 \| 8, 8 \| 9, 9 \| 10, 10 \| 11, 11 | inches |
| *How much do you weigh in pounds (without shoes)?* | | lbs. |
| *Do you think you are* | 1, very underweight \| 2, somewhat underweight \| 3, normal weight \| 4, somewhat overweight \| 5, very overweight | |
| *How old were you on your last birthday (years)?* | | |

| *Question* | *Choices* | *Instructions* |
|---|---|---|
| *"Food Craving Inventory (FCI)" developed by Don Williamson PhD, Frank Greenway MD, Marney White PhD, and Brook Whisenhunt PhD inserted here* | | |
| *Pittsburgh Sleep Quality Index inserted here* | | Please answer the questions thinking about your sleep when you were working days or on days off during the past month |
| *Now thinking about when you were working during the past month, please answer the sleep questions again.* | | This time, please answer the questions thinking about your sleep when you were working nights or evenings |
| *During the past month how often have you used alcohol to help you to get to sleep?* | 0, Not during the past month \| 1, Less than once a week \| 2, Once or twice a week \| 3, Three or more times a week | |
| *During the past month how often have you used caffeine to help you to stay awake at work?* | 0, Not during the past month \| 1, Less than once a week \| 2, Once or twice a week \| 3, Three or more times a week | |
| *Is there anything else you'd like to tell me about your work and health?* | | |
| *What is your ethnicity?* | 1, Hispanic or Latino \| 0, Not Hispanic or Latino | Select one. |
| *What is your race?* | 1, Black or African American \| 2, American Indian or Alaska Native \| 3, Asian \| 4, Native Hawaiian or Other Pacific Islander \| 5, White | Choose all that apply |

| *Question* | *Choices* | *Instructions* |
| --- | --- | --- |
| *You have the option to provide your email to be entered into a drawing for one of eight $100 amazon gift certificates. Entering your email is optional. You will be notified by email if your email is drawn randomly from all those who participated at completion of the survey. Thank you!* | | |

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**5/11/2015**

Author Signature Date