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Literature Review

The risk factors associated with obesity and Shift work among female nurses

Donna Robinson

A Paper to meet partial Requirements

NRSG 594

MSN Capstone

Southern Adventist University

School of Nursing

Chapter One

Introduction/Problem

The obesity epidemic has been widely documented and recognized as one of the most common and devastating health problems in the United States. The Center for Disease Control (CDC) reported in 2009-2010 that one-third of U.S. adults were obese, which is an astounding 37.5% (Center of Disease Control). Obesity is defined as a chronic condition in which the body's homeostatic balance between energy intake and energy expenditure is dysfunctional, therefore resulting in excess energy stored in adipose tissue, which are fat cells that store energy in the form of triglycerides and glycerol (Buttaro, Trybulski, Baily, & Sandberg-Cook, 2013, p. 105). Classification of healthy weight is based on body mass index (BMI). A healthy BMI is considered to be 18.50 to 24.99 percent. A person is considered overweight when his or her BMI is 25.00 to 29.99 percent and a BMI greater than 30 percent is considered to be obese (Buttaro, Trybulski, Baily, & Sandberg-Cook, 2013, p. 105) Obesity is a dangerous health problem that decreases the quality of life in individuals as well as increasing their risk for multiple diseases such as, diabetes, hypertension, heart disease, sleep apnea and certain cancers (Han, Trinkoff, Storr, & Geiger-Brown, 2011). Obesity ranks as the fifth leading risk for global death and the World Health Organization (WHO) estimates 2.8 million adults will die each year as a result of being obese (World Health Organization, n.d.). In the United States obesity accounts for 5% to 15% of deaths and has a related annual cost of \$147 billion for Medicare, Medicaid and private insurance payers. It is predicted that the costs will increase to \$344 billion by 2018 if current obesity trends continue (Buttaro et al., 2013, p. 105).

Nurses are considered role models and play an integral part in promoting health and wellness to their patients. The U.S. Department of Labor predicts nursing is one of the fastest

growing occupations in the United States between 2010 and 2020; Register Nursing (RN) jobs will increase by 26% (US Department of labor, n.d.). Females make up 91% of nurses and 64% of all nurses work in hospital on various shifts. Unfortunately obesity is increasing among nurses and the percentage of nurses that were overweight increased from 37 percent in 1980 to 51 percent in 1992 (Zitkus, 2011). A study performed in 2011 by the University Of Maryland School Of Medicine in Baltimore analyzed data on 2200 nurses and found that 55% were obese and a majority of those had adverse work schedules.

Recent studies have lead researchers to believe that shift work increases a person's risk for obesity (Han, Trinkoff, Storr, & Geiger-Brown, 2011). Shift work is defined as a work schedule that involves irregular or different hours as compared to those working the conventional day time work schedules. Many different work schedules can be described as shift work, including night-shift and rotating shifts (Wang, Armstrong, Cairns, Key, & Travis, 2011). In 2004, the Bureau of Labor Statistics (BLS) reported that over 15 million Americans were working shift work in response to a society that is now open 24-hours-a-day. Shift work, particularly night shift, has been implicated as a risk factor for many illnesses including obesity, metabolic syndrome, diabetes, coronary artery disease, and certain cancers due to disturbance in circadian rhythms (Women's Health Watch). To understand the impact of disturbance in circadian rhythms and link to obesity, one must understand circadian rhythms and its function. The suprachiasmatic nucleus situated in the hypothalamus generates the circadian rhythm, which is the body's biological clock that drives most physiological systems such as wakefulness, sleep, and body temperature (Markwald & Wright, 2012). The system also regulates the production of certain hormone peaks that include, but are not limited to: melatonin, the hormone responsible for sleepiness; ghrelin, the hormone that stimulates hunger; leptin, the hormone that stimulates

fullness; and cortisol, the stress hormone. Each of these hormones is important in maintaining a healthy weight (Peate, 2007). Circadian misalignment is defined as an altered relationship between individual's desired bedtime and timing of his or her circadian system. This misalignment is more often seen in shift workers. When individuals attempt to initiate sleep at suboptimal times during their circadian cycles can cause sleep disturbances, difficulty falling asleep and staying asleep which in turn can contribute to weight gain and obesity through modification of feeding hormones and daily energy expenditure (Louis, Zizi, Lazzaro, & Wolintz, 2008).

Problem Statement

Obesity is a dangerous health problem and is an epidemic in the United States. One major factor of growing obesity rate among nurse is the night shift. Health care is a twenty -four hour job and the working night shift is essential for the operation of a hospital; however, the majority of people, including nurses, are not aware of the negative impact night shift has on their health including risk for obesity.

Purpose

The purpose for this review is to understand the risk factors for obesity and effect working the night shift has on obesity, and ways to reduce these factors.

Theoretical Frame Work

The frame work used to guide this study is The Roy Adaptation Model which states that human beings are constantly adapting to their environment. Adaptation is responding positively to environment and is a process of outcomes in which individuals use conscious awareness, self-reflection and choice to create human and environmental integration (Nursing Theories). Roy's Theory of Adaptation believes a person is a bio psychosocial being in constant interaction with a

changing environment and acquired mechanisms to adapt. Environment involves focal, contextual and residual stimuli. Focal stimuli are internal or external stimulus which is immediately confronting the person. Contextual stimuli are all other stimuli present in the situation that contributes to the effects of the focal stimuli. Residual stimuli are environmental factors within or without the persons whose effects are unclear (Nursing Theories). The adaptive problem for those working night shift can be summed up as an alteration of circadian rhythms, focal stimuli would be day time sleep and the contextual stimuli social issues that increase the added stress on the individual. This theory could assist in understanding how persons respond and adapt to the stressful environment of night shift.

Chapter Two

Methods

In conducting this literature review research data bases used were Cinhal, Pub Med, as well as online articles. Articles were chosen based on the relevance to the topic of obesity, nurses and night shift. No articles older than 2005 were included into the review in efforts to keep with the more accurate up to date research. Statistical data incorporated into this review was retrieved from credible organizations such as Center for Disease Control, U.S. Department of Labor, Bureau Labor Statistics and World Health Organization (WHO). The criteria in searching for articles include such terms as: *obesity, night shift, shift work, nurses and circadian rhythms*.

Literature Review

Zhao et al conducted a cross sectional analysis on female nurses and midwives to measure the outcome of shift work and unhealthy weight. Among the 2492 participants (1259 day shift and 1235 night shift) studies found that shift workers were 1.15 times more likely to be

overweight/obese than day workers ($P=0.013$, 95% confidence interval, 1.03 TO 1.28; $P=0.02$, 95% confidence interval, 1.02 to 1.30, respectively). Crude comparisons between shift workers and day workers indicated that the prevalence of having low physical activity was higher in shift workers. Shift workers were found to have a higher prevalence of being overweight or obese as compared with day workers and shift. The research concluded since the results were based on self-reported data that might be affected by social desirability and the ability to report information accurately (e.g., height and weight data) but feel that there should be no reason to expect that response bias would differ between shift workers and day workers. However, information on the participant's circadian factors, metabolic changes, duration and past experience of shift work as well as food availability were not collected in the baseline survey which could have been beneficial in strengthening the results (Zhao, Bogossian, Song, Turner, & Grad Dip, 2011).

Marquezez, Lemos, Soares, Lorenzi-Filho & Moreno wanted to investigate the relationship between working at night and increased body weight in nurses. Considering that the night shift leads to circadian misalignment, and in turn seems to be associated with obesity, they hypothesized that night shift leads to increased body weight in nurses working night shift. An epidemiological cross-sectional study was conducted with 948 nursing professionals from a public hospital and a total of 548 volunteered to participate and after excluded those volunteers that were male a total of 446 females participated in the study. For data collection, nursing professionals filled out questionnaires about their job, health and life-style. A linear and logistic regression analysis was performed and the results showed working at night is associated with a weight gain greater and greater increase in BMI. The results of the study confirmed the hypothesis that working night shift does, in fact, lead to greater increase in body mass index

(BMI) and weight gain compared to those working the day shift and that night shift and concluded that night shift is an important occupational risk for weight gain and obesity (Marqueze, Lemos, Soares, Lorenzi-Filho, & Moreno, 2012).

Kivimaki, Kuisma,, Virtanen & Elovainio indicated that shift work has been reported to predict health problems and a possible explanation could be that shift work may lead to poorer health habits, therefore, increasing a person's vulnerability to illness. This cross-sectional study was designed to examine the association between shift work and health habits such as smoking, physical activity, being overweight, and alcohol consumption. It was part of the on-going project "Work and Health in Finnish Hospital Personnel" which was carried out in the 10 hospitals of two Finnish health care districts. Out of the 2,299 nurses that responded a total of 689 nurses (30%) met the inclusion criteria. Out of those nurses, 506 were shift workers and 183 day shift workers that ranged from 22 to 62 years of age. Questionnaires were given to the participants that ask them to rate which of the following categories described their current shift and health habits was measured by smoking habits, body mass index, type of physical life style and alcohol consumption. The results showed that 14% were current smokers, 13% were former smokers and 73% were non-smokers. Shift workers were more often over weight than day shift workers and differences in the two groups increased in age. Fifty-two percent of shift workers over the age of 45 were overweight, whereas 32 percent of day workers 45 or older were overweight. The BMI differences in the two groups were 0.9 (25.7 vs. 24.8) kg m². Sedentary lifestyle was significantly more prevalent in shift workers versus day workers, however, in the overall total sample physical activity decreased by age. Alcohol consumption between the two groups indicated that it was higher in shift workers but, the difference did not reach statistical significance. Their findings for female nurses suggest that shift work is associated with health

risk such as smoking and being overweight. Nurses working night shift use smoking as coping mechanism to stress and risk for being overweight in shift workers may relate to other factors such as poorer diet and disturbances of gastrointestinal and psychophysiological functioning which can be linked to continual disruption of the circadian rhythm (Kivimaki, Kuism, Virtanen, & Elovainio, 2007).

Han, Trinkoff, Storr & Geiger-Brown examined the relationship between job stress/work schedules and obesity among nurses. The total of 2,694 registered nurses participated. Three elements of job stress (demands, control and support) were assessed. Items related to job stress had 4-point Likert-type response. Psychological demands ($\alpha=.90$) physical demands ($\alpha=.83$) were assessed using items adopted from the Job Content Questionnaire. Obesity was based on a derived body mass index (BMI) dividing weight in kilograms by the square of height in meters which was categorized into 2 weight groups: underweight/normal (UW/NW; $BMI < 25.0 \text{ kg/m}^2$) and OW/OB ($BMI \geq 25.0 \text{ kg/m}^2$) Height was assessed a continuous variable and weight categories were 1=less than 100 lb.; 2=100-129 lbs., 3=10-159 lbs., 4=160-189 lbs., 5= 190-200 lbs. and 6= > 200 lbs. BMI were calculated using minimum, median and maximum values of the body weight range for each category. The prevalence of overweight (BMI. 25) for the sample was 55% and 27.1 % of the sample were obese (BMI. 30). There was no variation in this prevalence's by place of employment hospital vs. non hospital. When compared with UW/NW nurses, OW/OB nurses were about 2.5 years older ($P, .01$) more likely to be African American ($P, <.01$) with less education ($P<.01$) worked as RNS longer ($P< .01$) and more likely to work full time ($P<.02$). In addition WE/OB nurses reported significantly more depressive symptoms ($P< .01$) perceived their health as worse ($P=.03$) than UW/NW nurses did, whereas sleep quality did not differ between the 2 groups

($P=.40$). This study does demonstrate an association between nurses long work hours and obesity. Shift rotation and long work hours may affect circadian rhythms and could have detrimental effect on quality of sleep and appetite control. Disrupted day/night cycles and sleep patterns have been shown to suppress melatonin, which in turn affects the metabolic process such as physical activity and food efficiency. Shift work may play a role in appetite-related hormones levels ghrelin and leptin which could lead to increased food consumption and weight gain. Han et al studied incorporated a variety of work-related variables that included job stress and work schedules and found long work hours and activity on the job were related to risk for obesity (Han et al., 2011).

Korompeli, Sourtzi, Tzavara & Velonakis conducted a study to see how changes in hormone levels in nurses working night shift had an effect on weight. Study participants were the nursing staff of an intensive care unit comprised of 32 nurses. Twenty-five nursing staff comprised an irregular rotating shift group (morning, evening and night shift) and seven comprised an exclusively morning shift group. Morning shift lasted from 7 am to 3 pm, evening shifts from 3 pm to 11 pm and night shifts from 11 pm to 7 am. All nurses who participated in the study had been working for more than 3 years in the ICU. The mean reduction of cortisol level between the two measurements was statistically significantly greater for rotating shift group than morning shift group ($P=0.032$). There were no statistically significant differences between the two groups in overall mean change from the first to the second measurement of prolactin triiodothyronie and thyroid stimulating hormone. Levels of thyroxine increased statistically significantly in the rotating group ($P=0.049$) but not in the morning group. The results suggest that night shift has an effect on circadian rhythm of serum hormone levels of cortisol and long

term exposure to cortisol can lead to weight gain, as a person's appetite and insulin levels are continuously increased (Korompeli, Sourtzi, Tzavara, & Velonakis, 2009).

Chapter Three

Discussion

Obesity is a growing epidemic in the United States and nurses are among this population especially those working night shift (Chung, Wolf, & Shapiro, 2009). The literature suggests that there is a correlation between night shift and obesity due to several reasons. Nurses that work night shift have poorer eating and exercise habits as compared to day shift and on their days off they were just too tired or fatigued to participate in an exercise program (Zhao & Turner, 2006).

The literature reviewed indicates other possible risk for obesity and nurses working night shift which are changes seen in hormone levels such as melatonin, leptin, ghrelin and cortisol (Markwald & Wright, 2012). Melatonin is the hormonal messenger of the biological clock that helps regulate the timing of sleep. In humans these levels are higher during the night and lowest during the day in which the circadian clock is promoting wakefulness. Disrupted day/night cycles and sleep patterns for those working night shift suppress melatonin which effects metabolic process such as physical activity, food efficiency (i.e., body weight change divided by food intake) and visceral adiposity (Han et al., 2011). Day sleepers have more difficulty falling asleep and staying asleep as well as receiving inadequate duration and quality of sleep. Research indicates that many people who work night shift get an average of 5 hours of sleep per day and suggests that less daily sleep may be the cause of adverse health effects including obesity (Feldman & Eberly, 2010).

Ghrelin is the hormone produced by the stomach and stimulates appetite. Ghrelin levels increase before meals and decrease after meals. Studies suggest that individuals working night shift have an increase of ghrelin, due to circadian misalignment, causing them to over eat and increasing their risk for obesity (Marqueze, Ulhoa, & Moreno, 2012). On the other hand, leptin is a hormone responsible for feeling full and literature suggests that circadian misalignment such as night shift can decrease leptin levels therefore allowing individuals to never feel satisfied after eating causing them to crave foods high carbohydrates and sugar thus increasing risk for obesity (Wong, Wong, Wong, & Lee, 2010).

Cortisol is a hormone produced by the adrenal gland and is the key hormone involved in the body's response to stress both physical and emotional. Nurses working night shift are at greater risk for higher levels of cortisol due to job stress (Zhao et al., 2011) and the circadian rhythms effect on cortisol peaks in the early morning (Markwald & Wright, 2012). Exposure to cortisol over a long period of time can lead to weight gain due to appetite and insulin's levels continuously being increased (Spudich, 2007).

It is inevitable nurses must work night shift, however, understanding the impact that shift work has on weight, daily health habits and adverse health conditions are important for nurses to acknowledge. Perhaps there are underlying issues not mentioned in the review that may contribute to obesity among nurses working night shift. It could be that many nurses do not understand the health implications of obesity and how night shift can be a risk factor (Wong et al., 2010). Therefore, it is important to that nurses are aware of that night shift can increase their risk for obesity and other health problems and what they can do to prevent them. Improving health and lifestyle behaviors especially weight management such as healthy eating habits,

regular physical activity, and getting the proper amount of sleep can help reduce the negative effects night shift has on a person's overall health (Feldman & Eberly, 2010).

Conclusion

The reasons for the increased risk of obesity seen with night shift work in the previously cited studies are still being researched. Based on the published literature comparing weight gain and night shift workers versus those who work day shift it is likely that there is a greater inclination to weight gain in those who work at night (Zhao & Turner, 2006). Shift work appears to be an independent risk factor for obesity as well as the more widely recognized factors of age, gender, race, diet and levels of physical activity (Persson & Martensson, 2006). It is likely that there is more than one cause that includes lifestyle alterations in eating and exercise, disruption of circadian rhythm and chronic fatigue that contribute to night shift work and weight gain (Yuan et al., 2011). However, the available literature linking shift work to obesity is relatively dense in comparison to other risks factors for obesity. Limitations in the research were that most used self-reported data and nurse's response might be affected by recall bias or denial of the problem (Zhao et al., 2011). Most of these were cross sectional studies that looked at one point in time which is not indicative of what a person might do if assessed in a prospective longitudinal study. Further research is still needed to fully understand the relationship between obesity and night shift and exactly how circadian rhythms are involved in the overall process.

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