

“Does working a night-shift pattern influence eating behaviour and sleep duration among hospital workers?”

Introduction

Within the past 10 years, the number of employees working a night-shift pattern have doubled to 20% on a global scale (Global Wellness Institute, 2018). Within the UK, due to increasing economic pressures employers are facing, between 2011 to 2016 the number of employees working a night-shift pattern has risen by more than 250,000, with a continued upwards trend anticipated (Trade Union Congress, 2016). A night-shift period is work between the hours of 11 pm – 6 am and staff working at least 3 hours during this period can be defined as ‘night workers’ (Health and Safety Executive, 2006).

The characteristics of night-shift work have been shown to negatively impact on various aspects of employee wellbeing, especially in women (Lowson and Arber, 2014). Cognitive performance (Magee *et al.*, 2016) has been shown to be impaired, dependent upon length of shift pattern (Kazemi *et al.*, 2018) which can result with an increased risk to health and safety (Costa, 2010). A deterioration in employee wellbeing (Dall’ora, Ball, Recio-Saucedo and Griffiths, 2016), physical activity level (Atkinson, Fullick, Grindey, and Maclaren, 2008) and emotional health (Khan, Duan, Yao and Hou, 2018) have been associated with a disruption in circadian rhythm (Huang, Ramsey, Marcheva and Bass, 2011; Amirian, Andersen, Rosenberg and Gögenur, 2015; Centofanti *et al.*, 2018) associated with weight gain (McHill *et al.*, 2014; Proper *et al.*, 2016).

The circadian clock plays a critical role in maintaining homeostasis (Tahara and Shibata, 2018) including hormonal, metabolic and physiological functioning. Disruptions of this clock during night work patterns have been associated with an increase risk in developing cardiovascular disease (Thosar, Butler and Shea, 2018). Eating whilst the body should be asleep has been shown to disrupt metabolism (Holmback *et al.*, 2003; Canuto, Anderson and Olinto, 2013; Johnston, 2014) and thermogenesis (Morris *et al.*, 2015). Night-shift working patterns have been linked with incidents of cancer (Haus and Smolensky, 2013) and stroke (Li *et al.*, 2016) with associating factors being sleep duration (Wang *et al.*, 2015) and eating behaviour (Lindström, 2016; Nolan and Geliebter, 2016).

According to results of a recent survey conducted by the National Institute for Occupational Safety and Health, night-shift workers have the highest risk of sleep problems (Druley, Musick and Trotto, 2016). In addition to needing 7-8 hours of sleep a night, the body requires uninterrupted rest to replenish energy (Phillips and Houghton, 2007). Poor diet habits have been associated with workers who experience short-sleep durations (Silva, *et al.*, 2017) including consumption of high sugary snacks (Heath *et al.*, 2012), excess energy intakes (Chaput, 2014; Smith, Ludy and Tucker, 2016) and unhealthy food cravings (Lv, Finlayson and Dando, 2018). An increase in carbohydrate consumption has been associated with sleep duration of less than 5 hours and an increased fat consumption following less than 4 hours sleep among shift workers (Heath, Coates, Sargent and Dorrian, 2016). However, other lifestyle factors were not considered in the study.

Eating habits during a night-shift vary due to social, environmental, cultural and physiological factors (Lowden, Holmbäck, Lennernäs and Tucker, 2010). A recent study (Seychell and Reeves, 2017) identified nurses working a night-shift consumed significantly more calories than nurses working a day shift. Night-shift workers also report higher energy dense diets and lack of availability of healthy food as a factor affecting their diet choice during a shift (Bonnell *et al.*, 2017). Preference for high fat food on days preceding a night shift have also been identified (Cain, Filtiness, Phillips and Anderson, 2015).

Minimal research has been conducted into the associations between eating behaviour and sleep duration, with gender comparisons among night-shift workers in a hospital setting within Wales. Therefore, the current proposal looks to determine whether there are any associations between eating behaviour and sleep duration among, hospital night-shift workers and whether there are differences in intake before, during and after the night-shift period and between gender. Research suggests that there is a positive relationship between working a night shift, food intake and sleep duration in both male and female shift-workers.

The results from this study could be used by employers to develop policies and strategies designed to improve and promote employee wellbeing, with regards to healthy eating and importance of sleep as a critical lifestyle consideration. Employers may consider maximising opportunities for promoting health by reviewing food and dining facilities including availability of rest areas available to staff working night shifts.

Limitations to the study include examination of other lifestyle factors including physical activity, fatigue, family dynamics, responsibilities, stress levels, mood and female menstrual cycle that may impact upon some participants' nutritional intake and sleep duration among this population group, as this falls outside of the scope of this research.

Further qualitative research opportunities (Zoellner and Harris, 2017) could develop from this study to establish the existence of external, environmental and cultural barriers (Bonnell *et al.*, 2017) that may have an impact on lifestyle choices including eating behaviour and whether there is a gender difference.

Aim:

To determine whether there is a relationship between dietary intake and sleep duration among hospital employees working a regular night-shift pattern.

Objectives:

- To compare eating behaviour, diet quality and sleep pattern according to shift type
- To identify if there is a gender difference between eating behaviour, diet quality and sleep pattern
- To identify any relationship between diet quality and sleep pattern
- To identify any relationship between shift type and sleep pattern

Method

Participants:

A self-selected, cohort study of night-shift workers in a South Wales hospital. An anticipated sample size of 50 volunteers who meet the criteria will be recruited to take part in the study via a poster with contact details of the researcher (Appendix 1).

Employees that meet these requirements and agree to participate will provide their email and assigned an ID to ensure anonymity. They will then be issued with information sheet and consent form (Appendix 2) along with the template questionnaire (Appendix 3) containing instructions on how to complete it accurately to increase reliability of the results. Upon completion the participant

will return their questionnaire by a mutually convenient method and invited to request a copy of the results of the study upon completion. If it is identified through the data that the participant requires the services of an external support agency, in relation to eating, alcohol intake and sleep behaviour, the researcher will signpost the participant as required.

Design:

The research will comprise of quantitative data collection. Participants will be asked to provide their gender, age and occupation, which will be required for data comparison. Participants will then be required to record the type of shift pattern they work; sleep duration in hours, sleep disruptions and their food and drink intake using a food frequency questionnaire (Day *et al.*, 2001; Haftenberger *et al.*, 2010) over a period of 7 days, which has been identified as a validated and reliable length of time to capture food intake in shift-workers (Bingham and Nelson, 1991). Participants will be asked to record consecutive days; prior too, during and following a night-shift working pattern (Navrux Varli and Bilici, 2016). The food frequency questionnaire will be analysed by the researcher and categorised into two groups of ‘healthy’ or ‘unhealthy’ food, as defined in Table 1. (Lenk, Caspi, Harnack and Laska, 2018). Analysis of eating behaviour rather than energy intake via a food diary will be used in this study to increase the reliability of the results as estimated quantities will not be measured.

Table 1. Definition of food categories

Healthy	Unhealthy
Fruit and Vegetables	Sugar Sweetened drinks
Wholegrains	Savoury Snacks – high in fat, salt and sugar
Non and Low Dairy	Sweets
Homemade Meals	Processed / Fast Food – high in sugar and salt

The researcher will record the percentage of ‘healthy’ and ‘unhealthy’ food eaten against the below defined categories of shift type and sleep duration outlined in the below Table 2. (Grandner, Jackson, Gerstner and Knutson, 2013).

Table 2. – Sleep duration and shift type categories

Shifts between these hours	Shift category		Sleep amount in hours	Sleep category
6 am – 12 noon	Morning		≤ 5 hours	Very short

6 am – 6 pm	Day		5.01 - 6 hours	Short
noon – 11 pm	Afternoon		6.01 - 9 hours	Moderate
11 pm – 6 am	Night		9.01 ≥ hours	Long

Data Analysis:

The researcher will record results using an Excel spreadsheet and assign the data into the relevant categories in terms of shift type, sleep duration, disruptions and eating pattern. The data will then be analysed per day and issued with a weekly average score. SPSS software will be used to conduct all statistical analysis. Assumptions will be made at this stage that the data follows normal distribution. Descriptive statistics will be produced to calculate the mean and standard deviation scores which will be used to conduct various parametric tests including independent sample t-tests to assess differences between the mean of the scores of the gender and shift type variables. Paired sample t-tests will be used to compare eating and sleep patterns before, during and after a night shift. Chi-square tests will be used to test the association between 2 of the categorical variables. Finally, Pearson's correlation will be used to identify relationships between the nominal data.

Proposed Timetable:

Proposal & Ethical Approval <i>(Data collection can then commence)</i>	November
Literature Review <i>(3 months to gather relevant resources)</i>	October – December
Data Collection <i>(Sufficient time to recruit and enable participants to complete and return 7-day diary during their night-shift working pattern)</i>	November – January
Data Analysis <i>(A lot of time given to allow for data to be recorded and categorised appropriately)</i>	January – March
Discussion <i>(6 weeks given to interpret and discuss results – also allows for amendment of literature review if necessary following findings)</i>	March – April
Final amendments <i>(1 week to amend prior to submission)</i>	April – April
Submission	April

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