School of Postgraduate Studies  
Higher Degree Project Description Template

| Research theme          | Cardiovascular Disease  
|                        | Neuroscience  
|                        | Population Health  
|                        | Respiratory Disease
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| **Title of PhD project**| Examining the links between circadian disruption, sleep apnoea and metabolic disorders in professional drivers
| **Brief project description** | In western economies, up to 1 in 5 workers undertake shift work involving night work as part of their recurring working arrangements. Given this high number, understanding the health and wellbeing implications of shift work should be of major concern from a public health perspective. Epidemiological evidence indicates that shift work is associated with elevated risk of many conditions, including metabolic disease and obesity. Shift work is also associated with sleep disturbance and a significant shortening of the sleep obtained each day. Further, shift work is also associated with a misalignment of the internal circadian clock with environmental stimuli such a light exposure.

In this study we set out to investigate how all of these factors may interact in a group of shift workers, professional taxi drivers. We will recruit night drivers, day time taxi drivers with a prior history of night work and non-night working bus drivers (n=30 per group). Firstly we will produce data on the prevalence of metabolic and sleep disorders in the night working drivers. We will then examine the associations between metabolic function (eg. glucose tolerance, BMI), sleep function and quality, circadian rhythms and sustained attention in night worker taxi drivers, compared to day working professional drivers. We hope to uncover relationships that will be amenable to future novel therapeutic intervention, as well as increasing our understanding of the aetiological link between shift work and metabolic and sleep disorders.

In this study we set out to examine whether professional drivers who engage in night work have elevated risks of metabolic disorders, sleep apnoea and other impairments of sleep and display signs of the desynchronisation of their internal circadian pacemakers from environmental cycles.

The specific aims and objectives of this study are:

1. To assess the prevalence of diabetes, insulin resistance, obstructive sleep apnoea and other sleep disturbances along with conventional risk factors for cardiovascular disease in shift working occupational drivers, compared to non-shift working drivers and historical population controls.
2. To assess the associations between circadian rhythm disturbance, metabolic and sleep disturbance in occupational drivers

We hypothesise that:

1. Occupational drivers that work shift patterns involving night work will have a higher prevalence of diabetes, insulin resistance, sleep apnoea and other sleep disturbances.
disturbance and conventional risk factors for cardiovascular disease than historical population controls and non-shift working drivers.

2. The prevalence of diabetes, obesity and sleep disturbance will be correlated with the history of night shift work and the resultant circadian desynchrony.

3. That differences in meal content, meal timing, exercise levels and light exposure will also impact on metabolic, circadian and sleep parameters.

4. That there will be significant associations between the magnitude of impairment of circadian rhythms and the severity of metabolic disorders.

Aside from the substantial adverse health consequences, development of diabetes/obesity and sleep disturbance can have implications for an occupational driver’s ability to safely perform his/her job. Diabetes, obesity and obstructive sleep apnoea (OSA) are associated with excessive sleepiness during driving and are associated with increased motor vehicle accidents. These conditions may remain undetected for long periods unless screening tests are performed. We propose to screen occupational drivers for these disorders, in the first instance to establish the prevalence of these disorders in this population. This study alone will have significant health benefits both for the drivers themselves, as well as significant public health benefits. Treatment of these conditions, if discovered, will improve participants’ health and may contribute to increased road safety.

As well as an association between poor sleep quality and diabetes/obesity, recent studies have established a link between sleep duration and timing and diabetes/obesity. It has long been known that shift workers have an increased risk of cardiovascular disease and obesity, and the precise reasons for this remain unknown. The concept of circadian desynchrony, where sleep and food intake occur at a time when the individual’s circadian clock is in awake or sleep mode respectively is one proposed mechanism for weight gain and metabolic disturbance, but little detailed study has taken place into this phenomenon outside of the laboratory. We therefore propose, in conjunction with the study above, to examine the relationship between shift working, sleep duration and sleep quality, diet and exercise habits, along with multi-layered assessment of circadian rhythms, and the risk of diabetes/obesity in occupational drivers, using non-shift working colleagues as internal controls.

A successful pilot study has already been performed in order to establish the research techniques, with ethical approval granted through the Connolly Hospital Research Ethics Committee.

References:

Coogan AN, Baird Al, Siddiqui A, Donev R and Thome J. Adult attention/deficit hyperactivity disorder is associated with alteration in circadian rhythms at the behavioural, endocrine and molecular levels. Mol Psychiatry In Review 2011.


| Skills & techniques | The PhD candidate will be an integral member of the Endocrinology Unit at Connolly Hospital and the Chronobiology research team at NUI Maynooth, and will attend Departmental research meetings on a regular basis, thereby gaining an in-depth understanding of metabolic disease and chronobiology. The research project requires proficiency in: patient recruitment, blood sample handling and processing, PCR and ELISA assays/clock gene assays, cortisol and melatonin assay, actigraphy data collection and handling, data collection and handling, statistical analysis, co-writing research manuscripts and reports and presenting data at scientific meetings. Training in all of the above skills and techniques will be provided in the course of the research. |