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Title: Exploring the associations between shift work disorder, depression, anxiety and sick leave taken amongst nurses.

Running Title: Mental health and Shift Work Disorder.

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Summary [max 250]- 245

This study aimed to evaluate the association between Shift Work Disorder and mental health in hospital-based nurses. Staff completed an online survey comprising demographic questions, the Shift Work Disorder Questionnaire, Patient Health-9 and General Anxiety Disorder-7 scale. Sick leave data was collected from archival records from Human Resources. 202 nurses (95% Female, age M=35.28yrs ± SD=12) participated, 42% of eligible staff. Those at high risk for Shift Work Disorder had higher

depression (M=7.54 ± SD=4.28 vs. M=3.78 ± SD=3.24; p< .001) and anxiety (M=5.66 ± SD=3.82 vs. M=2.83 ± SD=3.33, p<.001) compared to those at low risk. Linear regression models showed that being at high risk for Shift Work Disorder was the most significant predictor of depression, explaining 18.8% of the variance of depression (R^2=.188, adjusted R^2=.184, F (1, 200)=46.20, p<.001). Shift Work Disorder combined with the number of night shifts and alcoholic drinks on non-work days accounted for 49.7% of the variance in anxiety scores (R^2=.497, adjusted R^2=.453, F (3, 35)=11.51, p<.001). Mean sick leave utilization in those with high risk of Shift Work Disorder was 136.17hrs (SD=113.11) vs 103.98 hrs (SD=94.46) in others (p=.057). Depression and years of shift work experience accounted for 18.9% of the variance in sick leave taken (R^2=.189, adjusted R^2=.180, F(2, 175)=20.36, p<.001). Shift Work Disorder is strongly associated with depression and anxiety, providing a potential target to improve mental health in shift workers. Depression, in turn, is a significant contributing factor to sick leave.

Keywords: sleep, shift work, depression, anxiety, sick leave, nurses, circadian.

Introduction

Impaired mental health and sleep are common consequences of shift work (Ardekani, Kakooei, Ayattollahi, Choobineh, & Seraji, 2008; Eldevik, Flo, Moen, Pallesen, & Bjorvatn, 2013; Lee, Kim, Kim, Lee, & Kim, 2016; Letvak, Ruhm, & McCoy, 2012). The relationship between mental health and sleep impairment secondary to shift work, known as shift work disorder (SWD), is not well described. Mental health disorders are now the leading cause of illness related absenteeism in most countries (Beyondblue,

2017; Merkus et al., 2012), with an annual cost of lost productivity in Australia of approximately $10-$15AUD billion , while the cost of inadequate sleep is around $17.9AUD billion per year (Department of Health, 2009; Sleep Health Foundation, 2017). To our knowledge, however, no study has explored the associations between mental health, SWD and sick leave using a validated SWD screening tool.

Depression affects approximately 3-9% of the adult general population, with a higher prevalence in women (Beyondblue, 2017; Ohayon & Hong, 2006) and shift workers, at 18-30% (Lee et al., 2016; Letvak et al., 2012; Oyane, Pallesen, Moen, Akerstedt, & Bjorvatn, 2013). In addition, anxiety disorders affect approximately 14% of the adult population, with women more likely to have anxiety than men (18% and 11% respectively) (Australian Institute of Health and Welfare, 2010; Department of Health, 2009). This prevalence is also higher in shift workers, ranging from 18-35% (Ardekani et al., 2008; Letvak et al., 2012).

Depression and anxiety can differ between industries as well. Compared with other occupations, healthcare workers experience elevated stress levels in the workplace due to exposure to emotional and traumatic situations, potentially impacting on an individual's mental health (Adriaenssens, de Gucht, & Maes, 2012; Campbell, 2014; Spelten, Totterdell, Barton, & Folkard, 1995). Furthermore, unlike other shift-work industries such as truck drivers, pilots, police officers and miners, the healthcare sector is predominantly female (Australian Bureau of Statistics, 2011). Females are at higher risk of developing depression and anxiety compared to males. (Beyondblue, 2017; Kessler, Merikangas, & Wang, 2008; Oyane et al., 2013) They also have additional potential stressors outside work, such as a greater responsibility for domestic duties, family responsibilities and social commitments that can further restrict the availability of time for sleep and recovery from shift work (Clissold, Smith, & Acutt, 2001; Spelten et al., 1995).

Shift work requires an individual to work outside standard sleep/wake cycles. The resultant conflict between a person's circadian rhythm and work schedules (Boivin & Boudreau, 2014; Costa, Lievore, Casaletti, Gaffuri, & Folkard, 1989) may affect mood and sleep (Boivin & Boudreau, 2014; Boudreau, Dumont, & Boivin, 2013). Sleep impairment from shift work can result in a circadian rhythm sleep-wake disorder known as Shift Work Disorder (SWD). This is characterized by chronic insomnia (difficulty

falling, staying asleep and/or not feeling well-rested) and/or excessive sleepiness (American Academy of Sleep Medicine, 2014) and affects 20-30% of the shift work population (Di Milia, Waage, Pallesen, & Bjorvatn, 2013; Waage et al., 2009). Previous work has shown a relationship between insomnia/ excessive sleepiness associated with SWD and the presence of mental health disorders such as depression and anxiety (Eldevik et al., 2013; Kalmbach, Pillai, Cheng, Arnedt, & Drake, 2015; Oyane et al., 2013; Waage et al., 2014). The combination of a stressful work environment and shift work is therefore likely to exacerbate impaired mental health. In the past, few studies have used validated SWD tools to evaluate this relationship (Booker, Magee, Rajaratnam, Sletten, & Howard, 2018). Studies have used various tools to evaluate shift work-related sleep impairment, such as excessive sleepiness, sleep latency, sleep duration, sleep quality and insomnia symptoms, making results hard to compare (Booker et al., 2018).

On average, shift workers take 11.5 days of sick leave a year compared to 8-9 days for non-shift workers (Australian Bureau of Statistics, 2011; Australian Institute of Health and Welfare, 2010; Sleep Health Foundation, 2017) and, compared to other industries, the healthcare industry overall utilizes even more sick leave, with an average 13.6 days per year of sick leave (Australian Bureau of Statistics, 2011; Australian Institute of Health and Welfare, 2010; Merkus et al., 2012; Rajaratnam, Howard, & Grunstein, 2013). It is important to explore the reasons underlying this increased propensity to mental illness and absenteeism amongst shift workers. This study aims to assess the relationship between SWD risk, depression and anxiety using validated tools. Secondly, the study aimed to explore the factors that influence sick leave utilization in particular the impact of SWD risk, depression and anxiety on sick leave. It is hypothesised that, compared to individuals at low risk of SWD, individuals at high risk of SWD will have more severe depression and anxiety symptoms and take more sick leave.

Methods

Participants and procedure:

Data were collected as part of a clustered randomised controlled trial (RCT), which evaluated the effectiveness of an individualised program to treat SWD, at Austin Health, Melbourne, Australia (ACTRN 12616000369426). Recruitment and randomisation for the RCT was undertaken via clusters (hospital wards) with multiple staff within each cluster. Participants were aged over 18 years, employed on regular rotating or permanent night shifts, worked a

minimum of 15 hours a week, permanently based on one ward and had not received treatment for a sleep disorder. Participation was voluntary, and participants provided written informed consent prior to participation. Out of a total of 475 staff that were approached, 224 consented to participate and 202 (Age, M=35.28 ± SD=12; 95% female) completed the required protocol (42.52% response rate). For the sick leave data, due to some of the participants being new employees, a total of 179 participants were included in this analysis.

Participants were screened for SWD with the Shift Work Disorder Questionnaire (SWDQ) and grouped into low vs high risk. The study protocol was approved by the Austin Health and Monash University Human Research Ethics Committees and conformed to the standards set by the latest revision of the Declaration of Helsinki. Recruitment was undertaken across 16 wards via flyers, education sessions, attending staff hand-over meetings and walk-arounds on the ward with a nurse educator to reach as many staff as possible. This paper presents cross-sectional baseline data.

Measurements:

Participants who provided written consent completed an online questionnaire developed by members of the CRC for Alertness, Safety and Productivity, with the support of the Australasian Sleep Trials Network (ASTN). This questionnaire comprised of demographic, social and lifestyle questions as well as the following validated surveys: Shift Work Disorder Questionnaire (SWDQ) (Barger et al., 2012), Patient Health Questionnaire- 9 (PHQ-9) (Kroenke, Spitzer, & Williams, 2001) and General Anxiety Disorder- 7 (GAD-7) scale (Spitzer, Kroenke, Williams, & Lowe, 2006). Demographics and lifestyle questions included age, sex, body mass index (BMI), family situation (children), caffeine consumption habits, alcohol consumption and smoking. Work-related information was also collected around the frequency and type of shifts worked in the past month, number of hours worked in a typical week and month, annual income, education level and years of shift work experience.

Shift Work Disorder Questionnaire (SWDQ)- The SWDQ is a validated questionnaire that assesses and categorises individuals into either low or high risk of SWD based on the ICSD-3 (American Academy of Sleep Medicine, 2014; Barger et al., 2012). The SWDQ comprised of 4 questions; - Q1. Problems with waking up too early and not being able to get back to sleep; Q2. Sense of wellbeing during the time you were awake; Q3. Doze off at work; Q4. Doze off while driving after at least two days off from work. Each item was scored on a scale between 1 and 4 and is multiplied by a classification function coefficient and a constant added with a binary output of either high or low risk of SWD (Barger et al., 2012). The questionnaire has 89% positive predictive

value and 62% negative predictive value (sensitivity = .74; specificity = .82) (Barger et al., 2012). *Patient Health Questionnaire (PHQ-9)* - The PHQ-9 is a 9-item questionnaire used to measure depression symptoms (total score 0-27, higher scores indicate greater depression). The PHQ-9 has been validated in primary care patients (Kroenke et al., 2001) and the general population (Martin, Rief, Klaiberg, & Braehler, 2006), and has been utilised to assess depression in healthcare workers (Letvak et al., 2012). PHQ-9 scores were also categorised into cut points of 5, 10, and 15, with none/minimal symptoms are represented by a score of 0 to 4, mild 5–9, moderate/severe 10–15 and severe ≥15 severe (Kroenke, Spitzer, Williams, & Lowe, 2010; Kroenke et al., 2001). *General Anxiety Disorder (GAD-7) scale* - The GAD-7 is a 7-item questionnaire that measures anxiety symptoms (total score 0 to 24, higher scores indicate greater anxiety). The GAD-7 has good psychometric properties in large population-based samples and primary care (Kroenke et al., 2010; Lowe et al., 2008) and has been used in shift worker research as a primary outcome (Alharthy, Alrajeh, Almutairi, & Alhajri, 2017; Maatouk et al., 2018). The GAD-7 was also categorised into cut points of 5, 10, and 15, with none/minimal symptoms are represented by a score of 0 to 4, mild 5–9, moderate/severe 10–15 and severe ≥15 severe. (Kroenke et al., 2001; Spitzer et al., 2006). *Sick leave data* – Archival sick leave data was obtained from Human Resources records at Austin Hospital. Total sick leave hours taken per participant was divided by their total contracted hours, to get a rate of sick leave that was adjusted by their contracted hours (denominator). As recruitment was staged over multiple wards over the 2-year period, each ward was recruited at different times. For consistency and to account for factors such as seasonal variation, sick leave data were obtained for each ward for the 12 months prior to commencing recruitment on that ward.

Statistical analysis

SPSS Statistics 25 for Microsoft Windows was used for the statistical analysis. Separate analyses were conducted to assess demographic, lifestyle and work-related factors that may be related to each of the dependent variables (depression and anxiety). Independent-sample t-tests and Pearson's correlation were applied depending on the variable type, including ward as the cluster variable. Backward linear regression analysis was conducted including variables with significant univariate relationships to outcome variables, controlling for age. Backward regression involved multiple regressions being conducted, each time the weakest correlated variable is removed. At the end the remaining variables explain the distribution best. A p-value of 0.05 (2-tailed) was considered significant for all analyses with 95%

confidence intervals. Both depression and anxiety were normally distributed. Days were based on a typical 8 hour shift at the hospital. Univariate analysis was used to identify factors related to sick leave and significant factors combined into a linear regression model.

Results

The online questionnaire was completed by 202 participants (response rate=42.5%). Of those, 143 were classified as being at low risk and 59 at high risk for SWD. Participants were aged between 21-65 years and had 0-45 years of shift work experience. Descriptive statistics are outlined in Table 1. SWD was the only factor related to depression symptoms (Table 2). Anxiety severity was related to SWD, the number of night shifts worked in the past month and alcohol consumption on non-work days (Table 2). Participants at high risk of SWD had higher average depression scores (M=7.54 ± SD=4.28 vs M=3.78 ± SD=3.24; t(200)=6.80, p<.001) and higher average anxiety symptom scores (M=5.66 ± SD=3.82 vs. M=2.83 ± SD=3.33, t(200)= 5.26, p<.001), than participants at low risk of SWD. Moreover, a total of 23.7% of participants at high risk for SWD had either moderate/severe or severe symptoms of depression (moderate/severe=16.9%; severe=6.8%) compared to only 3.5% at low risk for SWD (moderate/severe=3.5%; severe=0%; χ^2=37.45, p<.001). Furthermore, 13.6% of those at high risk for SWD had either moderate/severe or severe anxiety (moderate/severe=13.6%; severe=0%) compared to only 2.8% of those at low risk of SWD (moderate/severe= 2.1%; severe= 0.7%;χ^2=19.85, p<.001) (Figures 1 and 2).

Separate backward linear regression models were then conducted with depression and anxiety severity as the dependent variables. Only variables with significant relationships from the univariate analysis were included, plus age. SWD alone explained 18.8% of the variance in depression (R^2=.188, adjusted R^2=.184, F (1, 200)= 46.20, p<.001).SWD risk, number of night shifts and number of alcoholic drinks on non-work days accounted for 49.7% of the variance in anxiety scores (R^2=.497, adjusted R^2=.453, F (3, 35)=11.51, p<.001. Regression coefficients, squared semi-partial correlations and C.I for each step in the model predicting depression (PHQ-9) and anxiety (GAD-7) are outlined in Tables 3 & 4. There was no significant difference between clusters (wards) for depression (p=.133) but one ward had slightly higher anxiety scores than the others (p=.022).

Univariate analysis was undertaken to assess factors related to sick leave (Table 5). Participants took on average 14.11 days of sick leave per annum (M=112.84 hrs ± 100.65). Individuals at high risk of SWD took on average 17.02 days (M=136.17 hrs ± SD=113.11), while those at low risk took 12.99 days (M=103.98 hrs ± SD=94.46), however this difference was not significant (p=.057). Depression, age and years of shift work experience were significantly associated with the rate of sick leave taken (Table 5.). These variables were entered into a backward linear regression model. Depression and years of shift work experience accounted for 18.9% of the variance in sick leave taken (R^2=.189, adjusted R^2=.180, F(2, 175)=20.36, p<.001, 95% C.I=.01-.04).

Discussion

This study found that impaired mental health is strongly associated with SWD risk. Depression and anxiety severity were higher in those at high risk of SWD compared to those at low risk, and previous general population estimates, with nearly a quarter having moderate/severe depression and 13% moderate/severe anxiety. Depression, in particular, was strongly related to high SWD risk, even after accounting for other personal and work-related variables that could have affected depression. SWD explained ~20% of the variance in depression scores. These findings support past work that showed an association between depression and impaired sleep in shift workers (Ardekani et al., 2008; Kalmbach et al., 2015; Lee et al., 2016; Oyane et al., 2013). Anxiety was associated with more alcohol consumed on non-work days, fewer night shifts in the past month and high SWD risk in the current study. A difference in shift schedules (permanent nights vs rotating shift workers with fewer nights), might explain why more nights was associated with less anxiety. Rotating too quickly between shifts has been shown to increase anxiety (Chang et al., 2014) and nurses who changed from night work to day work reported a significant decrease in symptoms of both anxiety and depression (Bjorvatn, Torsheim, Moen, Magerøy, & Pallesen, 2014). In the current study, night shifts were undertaken in 2-4-week blocks, possibly reducing the amount of rotation for that period and thus anxiety, but other factors may have contributed to this finding. These include natural selection, whereby individuals who do not cope with night shift work leave the industry, differences in work tasks, quieter work environment and the absence of managers on night shifts (Ahasan, Lewko, Campbell, & Salmoni, 2001).

Sleep loss can affect resilience to stress, accelerating the development of cognitive consequences and the ability to utilize strategies to manage anxiety (Chang et al., 2014; Kalmbach et al., 2015). Furthermore, the more an individual is affected negatively by stress,

the greater the impact on their sleep (Adriaenssens et al., 2012; Kalmbach et al., 2015). Sleep reactivity is a concept that looks at how sleep is affected by an individual's ability to cope with stress. Individuals who cope better with stress are less likely to have impaired sleep as a result of the stress (Kalmbach et al., 2015). This helps to explain the association seen in this study between SWD risk, anxiety and night shift. Alcohol consumption may also be used to self-medicate and manage anxiety symptoms and as a sleep aid (Samaha, Lal, Samaha, & Wyndham, 2007), therefore finding a relationship between anxiety and alcohol consumption was not surprising.

Overall, our project supports the concept that sleep-related impairment from shift work is a strong risk factor for impaired mental health. This relationship is not isolated to the healthcare industry. It has previously been found in other industries, including oil rig workers (Waage et al., 2009), factory workers (Kaneko et al., 2004) and hotel workers (Moon, Lee, Lee, Lee, & Kim, 2015). However, previous research on SWD has been inconsistent due to the variability in parameters used to measure shift work related sleep impairment, such as excessive sleepiness, sleep latency, sleep duration and insomnia symptoms, making results hard to compare. A variety of tools have been used to assess these parameters, including sleepiness and insomnia questionnaires, sleep diaries and actigraphy, however they had not been validated specifically for assessment of SWD (Wright, Bogan, & Wyatt, 2013). Validated measurement tools to screen for SWD were not developed until 2012, enabling clearer definition of SWD evaluation of its impact (Barger et al., 2012).

Further work is needed, to unravel the causes of the association between SWD and mental health. Circadian disruption has been shown to be a contributing factor, helping to explain the reason for the high prevalence rate of impaired depression and anxiety observed in shift workers with sleep-related impairment (Boivin & Boudreau, 2014; Boudreau et al., 2013). Depression and anxiety could be seen as both a consequence and/or a risk factor for SWD, however there are few longitudinal studies, with one solitary study published by Waage et al. (2014) finding that depression and anxiety were significant predictors of SWD risk over a 2-year period, with a 16% and 11% (OR=1.16 & 1.11) increase in risk respectively. The study was limited in determining causality, however, because of the lack of information about participants' mental health prior to starting shift work. Future cohort studies should therefore include workers early in their shift work career. To our knowledge, no studies have assessed

objective measures of circadian misalignment to investigate any biological connection between SWD and mental health in shift workers.

The prevalence rate for SWD was 29% in this study, which is consistent with previous studies both in the same profession and from other shift work sectors (Di Milia et al., 2013; Waage et al., 2009; Waage et al., 2014). We found that participants took, on average, 14 days of sick leave per annum. This is higher than previously recorded for shift workers in general (11.5 days) and for the healthcare industry specifically (13.6 days) (Australian Bureau of Statistics, 2011; Merkus et al., 2012; Rajaratnam et al., 2013; Sleep Health Foundation, 2017). Additionally, we found that those at high risk for SWD took more sick leave days in a 12 month period, but this difference was not statistically significant. However, if the prevalence rate of SWD, in this workforce, is approximately 30%, then from an organisational perspective, the influence of SWD on costs through employee back-fill and reduction in productivity could be substantial. This is reflected in other studies, from different industries, that found sleep impairment predicted risk of sick leave (Merkus et al., 2012). Depression and years of shift work experience however, were the predominant factors related to sick leave in linear models in this study, showing that shift workers who are depressed take more sick leave. Past studies have not factored in years of shift work experience when looking at the associations between shift work and sick leave (Merkus et al., 2012), however a possible explanation might be that once sick leave is accrued over time, individuals then use it as a coping mechanism. This study showed that SWD was strongly associated with depression and that depression was significantly related to sick leave.

Strengths and Limitations

This project used cross-sectional data, hence it is not feasible to establish causal relationships. Arguably depression and anxiety could be seen as both a consequence or a risk factor of circadian rhythm sleep-wake disorder such as SWD. Due to the voluntary nature of the study, recruitment bias should also be acknowledged. Participants already struggling with shift work might have been more motivated to volunteer than others and the response rate was modest at 42.5%. Finally, the sick leave rate was calculated based on contracted work hours for each employee, not the actual hours worked. This means that the figures used are estimates and do not include work such as overtime. This could have resulted in an underestimate of the total hours worked for each group. Only 88% of participants had over 12 months shift work experience at time of recruitment, meaning some participants could not be

included in the sick leave analysis. Nonetheless, this study highlights the need for further explorations into the risk factors associated with SWD and the relationship with mental health. Longitudinal research would help establish directional causation between mental health and SWD over time and the use of validated tools across studies would help with consistency and comparability of results.

Conclusion

This study found that individuals at high risk for SWD were at substantially higher risk of impaired mental health, with both depression and anxiety having strong positive associations with SWD risk. Furthermore, depression had a negative bearing on sick leave. Longitudinal studies are needed from the beginning of an individual's shift work career to better understand the development and relationship between SWD risk and mental health. This study highlights the importance of assessing and managing mental health and SWD within an organisation to help alleviate impaired mental health and improve sleep amongst shift workers. Trials of strategies to improve sleep in those with SWD are required including optimizing rosters and training staff to use timed naps, caffeine, light therapy and good sleep hygiene practices. While SWD appears to contribute to a component of impaired mental health in this population direct psychological support needs to be considered to address factors beyond SWD.

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Table 1. Descriptive statistics of the sample population (n=202).

Descriptive variables	Mean (SD)
Age	35.28 (±12.02)
Sex (% female)	96 (n=192)
High SWD (%)	29 (n=59)
BMI (kg/m^2)	26.07 (±6.34)
Shift work experience (years)	10.20 (±8.43)
PHQ-9	4.88 (±3.96)
GAD-7	3.66 (±3.70)
Number of day shifts (prior month)	8.69 (±6.21)
Number of evening shifts (prior month)	7.48 (±4.58)
Number of night shifts (prior month)	5.97 (±3.61)
Number of caffeine drinks-work days (daily)	1.29 (±.79)
Number of caffeine drinks-non-work days (daily)	1.10 (±.76)
Duration before bed that last caffeinated drink is consumed-work days (hours)	4.38 (±3.72)
Duration before bed that last caffeinated drink is consumed-non-work days (hours)	4.11 (±3.62)
Number of alcoholic drinks consumed (weekly)	1.36 (±1.42)
Number of alcoholic drinks-work days (daily)	.53 (±.61)
Number of alcoholic drinks-non-work days (daily)	1.66 (±.91)
Hours worked per week	35.57 (±8.82)
Hours worked per month	132.38 (±34.57)

Table 1. Univariate analysis comparing depression and anxiety severity scores against possible predictor variables (n= 202)

		Depression		Anxiety	
Variables		**Mean ±SD / r value**	**Sig.**	**Mean ±SD / r value**	**Sig.**
SWD risk	High	**7.54 (±4.28)**	**<.000*[b]**	**5.66 (±3.82)**	**<.000*[b]**
	Low	**3.78 (±3.24)**		**2.83 (±3.33)**	
Age		-.068	.334 [a]	-.063	.375 [a]
Sex		-.039	.578 [a]	.033	.636 [a]
BMI		.097	.172 [a]	.034	.628 [a]
Total hours worked per week		.073	.310 [a]	.04	.641 [a]
Number of day shifts (prior month)		-.087	.227 [a]	-.072	.317 [a]
Number of evening shifts (prior month)		-.019	.798 [a]	.029	.694 [a]
Number of night shifts (prior month)		-.151	.159 [a]	**-.235***	**.028*** [a]
Total number of shifts (prior month)		.002	.979 [a]	.041	.588 [a]
Shift work experience (years)		-.015	.828 [a]	-.050	.479 [a]
Number of alcoholic drinks consumed (weekly)		-.125	.130 [a]	-.099	.232 [a]
Number of alcoholic drinks-work days (daily)		-.141	.157 [a]	-.067	.504 [a]
Number of alcoholic drinks-non-work days (daily)		.074	.464 [a]	**.201***	**.043*** [a]
Number of caffeine drinks-work days (daily)		-.037	.658 [a]	.006	.939 [a]
Number of caffeine drinks- non-work days (daily)		-.026	.758 [a]	-.001	.987 [a]
Duration before bed that last caffeinated drink is consumed-work days (hours)		.040	.627 [a]	.012	.889 [a]

Duration before bed that last caffeinated drink is consumed-non-work days (hours)	.010	.907 [a]	.032	.702 [a]
Ward (1-16)	.106	.133 [a]	**.162***	**.022*** [a]

* Bold= Significant p<.05 level (2-tailed)

a= Pearson's correlation

b= t-test

Table 3. Unstandardized (B) *and standardised (β) regression c*oefficients for each step in the model predicting depression (PHQ-9).

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	sr^2	95% Confidence Interval for B	
		B	Std. Error	β				Lower Bound	Upper Bound
1	(Constant)	5.020	.784		6.405	.000		3.475	6.566
	SWD	3.845	.553	.443	6.957	.000	.442	2.755	4.935
	Age	-.036	.021	-.109	-1.706	.090	-.120	-.077	.006
2	(Constant)	3.783	.299		12.658	.000		3.194	4.373
	SWD	3.759	.553	.433	6.797	.000	.433	2.669	4.850

Table 4. *Unstandardized (B)and standardised (β) regression coefficients for each step in the model predicting* anxiety (GAD-7).

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	sr^2	95.% Confidence Interval for B	
		B	Std. Error	β				Lower Bound	Upper Bound
1	(Constant)	3.234	2.954		1.095	.281		-2.769	9.237
	SWD	5.305	1.024	.660	5.182	.000	.664	3.224	7.385
	Age	.014	.098	.018	.138	.891	.024	-.185	.212
	# night shifts	-.357	.124	-.377	-2.872	.007	-.442	-.610	-.105
	# alcoholic drinks (non-workday)	1.014	.446	.285	2.276	.029	.364	.109	1.920
2	(Constant)	3.609	1.156		3.123	.004		1.263	5.954
	SWD	5.284	.999	.657	5.291	.000	.667	3.257	7.311
	# night shifts	-.353	.118	-.371	-2.999	.005	-.452	-.591	-.114
	# alcoholic drinks (non-workday)	1.001	.429	.281	2.335	.025	.367	.131	1.871

B= unstandardized coefficients, β= standardised coefficients, sr^2= semi-partial correlations, #= number.

Table 5. Correlations between the proportion of sick leave taken (sick leave hours/contracted hours x 100) in a 12 month period against possible contributing factors (n=178).

Variables		**r value/ Mean (SD)**	**Sig.**
SWD risk	High (n=49)	.074 (.062)	.082 [b]
	Low (n=129)	.095 (.086)	
Age		**.247**	**.001*** [a]
Sex		.070	.361 [a]
BMI		.083	.278 [a]
Total hours worked per week		.032	.683 [a]
Number of day shifts (prior month)		-.116	.138 [a]
Number of evening shifts (prior month)		-.108	.173 [a]
Number of night shifts (prior month)		-.103	.393 [a]
Total number of shifts (prior month)		.008	.919 [a]
Shift work experience (years)		**.365**	**.000*** [a]
PHQ-9		**.184**	**.016*** [a]
GAD-7		.110	.151 [a]
Ward (1-16)		.014	.853 [a]

* Bold= Significant p<.05 level (2-tailed), a= Pearson's correlation, b= t-test, BMI=body mass index, SWD=Shift Work Disorder, PHQ-9= Patient Health Questionnaire-9, GAD-7= General Anxiety Disorder-7.

Figure 1. Depression severity categories between low (n=143) and high risk (n=59) SWD.

Figure 2. Anxiety severity categories between low (n=143) and high risk (n=59) SWD.

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