

CHAPTER TWO

LITERATURE REVIEW

2.1 Overview of Shift Work

Shift work is characterised as a schedule of work which comprises irregular hours that vary from the usual schedule of daytime work, and involves rotating or fluctuating patterns between early morning, evening and night schedules (Finnigan & Hale 2018). Council Directive 93/104/EC describes shift work as any form of scheduling jobs in shifts in which workers are successful at similar work locations in congruence with a definite arrangement, for instance a rotating pattern that may be continuous or discontinuous, indicating the demand for workers to work at various times over a given duration of days or weeks (European Parliament and Council of European Union 2000). Nevertheless, there is no consensus definition of the term in the scholarly literature that has been published. Stated, shift work is usually specified as working mainly beyond regular working hours during the day or on a schedule other than the average working week. Shift arrangements differ based on the shift timing (early morning, afternoon, evening, and night), the period of rotation (number of days between two similar orders), the rotation direction (forward or backward rotation) and the stability of the scheduled time slots (permanent shifts or rotating shifts) (Arlinghaus et al. 2019).

Each country has different working hours, such as relatively 35 hours in a week in France, 37 hours in a week in Denmark, and more than 40 hours in a week in the United States (US) (The Japan Institute 2012). The Association of Southeast Asian

Nations (ASEAN), consisting of Brunei, Cambodia, Indonesia, Laos, Malaysia, Singapore, Philippines, Myanmar, Thailand and Vietnam, also have more than 40 hours of working hours a week (The Japan Institute 2012; ASEAN Briefing 2019), in conjunction with the US. In the overall global workforce, approximately 20% is active in a pattern of shift work, while one-third of the Malaysian population is listed as shift workers (Sun et al. 2018). Meanwhile, in Europe, there is nearly 17% of the workforce involved in this form of work duties (Ohlander et al. 2015).

In the modernised world, the magnitude of shift work is rising regularly due to an increasing financial system and enhanced global transport (Faraut et al. 2013). The night shift is specified by any shift that has a minimum duration of seven hours between twelve o'clock at night and five o'clock in the morning. Besides, shift work enables certain industries to operate continuously by creating a timetable of work rotation among the workers. In terms of period and timing for each shift and the pace of shift rotation, shift work schedules differ significantly. It is generally known; however, that extended risk to a shift work duties is correlated with a greater consequences of health issues in comparison to regular daytime hours (Caruso 2014). Previous research showed that most employees did not want to work in non-standard hours, but they were left with minimal job market opportunities during normal office hours. The high concentration of low-education workers in non-standard hours indicates that most of those working in shifts have restricted opportunities for jobs. The higher exit rates from positions involving shift hours revealed that the working time for many workers is not ideal (Gracia & Kalmijn 2016).

2.2 Consequences of Shift Work

Irrespective of the alarming job hazards, the working paradigm of shift hours is fundamental for optimal services to satisfy national demands. Overall, the emphasis on the hazards is based on the misalignment of circadian rhythm due to the rotation of night shifts. Demir et al. (2016) definitely stated that the workers with night shifts display higher levels of oxidative stress, thereby raising the risk of multiple chronic diseases. Recent studies still discover the undesirable impacts of working in shifts in spite of all the debates over the past two decades, including depression (Kim et al. 2017), cognitive function (Marquié et al. 2015), cancers (Travis et al. 2016), heart diseases (Yong et al. 2015), burn out (Steiner 2018) and others. All of these studies suggest that serious consideration needs to be paid to the current shift work policy. Nevertheless, in order to prepare for preventive measures and to design an ergonomic shift work timetable, the psychosocial well-being factors, physical activity and eating habits must be collectively studied together as a whole.

Circadian disruption, induced by the reversal of working time, sleep and also meal timing, describes the correlation between shift work and cardiovascular disorders (Lowden et al. 2019). Other variables like alteration in meal quality, social life as well as social support at work, may be linked to this association. Changes in lifestyle such as low physical activity levels, smoking and alcohol intake, may also be involved (Buchvold et al. 2015). The worrying part is the prevalence of overweight and obesity among shift workers from various global regions that are rising in trend as shown in Table 1. Besides, the underlying mechanisms for this relationship between shift work and cardiovascular diseases remain uncertain regardless of 10 years of research into the

correlation. In addition, cardiovascular diseases are also linked to metabolic disorders, sleep deprivation and stress (Liu & Chen 2019).

Table 1: Prevalence of Overweight and Obesity among Shift Workers from Different Parts of the World (Azmi et al. 2020)

Study & Country	Sampling Frame	Method	Sample Size (<i>n</i>)	Criteria Used	Prevalence of Overweight/Obesity
Zhao et al. (2011) (Australia)	Nurses and midwives	Cross-sectional study	1235	WHO	32.9% overweight; 27.4% obesity
Canuto et al. (2014) (Brazil)	Shift workers in poultry-processing plant	Cross-sectional study	580	WHO	11.2% obesity
Kubo et al. (2010) (Japan)	Shift workers manufacturing industry-based corporation	Retrospective cohort study	920	Obesity (BMI \geq 25.0 kg/m ²)	21.1% obesity
Guo et al. (2015) (China)	Shift workers in motor corporation	Cross-sectional study with retrospective assessment	9088	Obesity (BMI \geq 28.0 kg/m ²)	13.5% obesity

Note: WHO, World Health Organisation with BMI (body mass index) cut-offs for underweight (BMI < 18.5 kg/m²), normal (BMI 18.5 to 24.9 kg/m²), overweight (BMI 25.0 to 29.9 kg/m²), and obesity (BMI \geq 30.0 kg/m²).

There are some theoretical models, such as the effort-reward imbalance and the work demands-resources models that propose that well-being and motivation at work could be viewed as two sides of the same coin. Work design that offers the correct balance of psychosocial job measures such as optimum time pressure and decision-making authority could help in improving work engagement, productivity and well-being. On the contrary, if the design was not ideal such as excessive time pressure and minimal decision-making authority, it might lead to stress reactions and burn out (Pisanti et al. 2017). Steptoe et al. (2015) found that the psychological and social well-being of the workforce has a tremendous impact on gross domestic product and the progress of society. This is due to the hypothesis that psychosocial well-being is related

to worker health status, therefore, more studies must be carried out to stratify the risk and model the association of both domains (Steptoe et al. 2015).

2.3 Physical Activity of Shift Workers

Studies have recorded negative effects, a positive effect or no effects on the shift workers' physical activity levels (Marqueze et al. 2014; Barbadoro et al. 2013; Gram et al. 2012). The meaning of physical activity used, however, can contribute to these equivocal outcomes, at least in part. Occupational activity, leisure-time activity, habitual activity or total activity are various measures used.

Differences in outcomes have been noted even though studies have examined both leisure-related and occupational activity. Some indicated that shift workers had substantially greater occupational activity, contributing to significantly greater overall total activity (Peplonska et al. 2014), whereas others recorded that shift workers had less occupational activity, but more leisure-related activity (Barbadoro et al. 2013).

The occupational heterogeneity of participants in these studies is one factor possibly leading to these inconclusive outcomes. In general terms, participants were recruited from sectors such as manufacturing (Marqueze et al. 2014), transport (Barbadoro et al. 2013), security (Peplonska et al. 2014) or healthcare (Loef et al. 2018), with positions which may differ extensively in aspects of occupational operation. Other drawback is the fact that most studies are cross-sectional and relies on self-reported

results. Meanwhile, a study by Marqueze et al. (2014) utilised actigraphy, a technique for determining sleep/wake cycles and physical activity based on the amount of wrist movement measured by digital devices called actigraphs to differentiate the levels of activity between shift workers and day workers (Marqueze et al. 2014; Fekedulegn et al. 2020). Objective interventions like this would provide data that is more accurate. However, the inconsistencies in the nature of the research mean that no conclusive outcomes can currently be concluded regarding the impacts of shift work on physical activity, regardless of the number of studies in this area.

Physical activity and sedentary behaviour are influenced by the variety of shift work schedule. Low energy sitting, reclining, or lying during waking hours are referred to as sedentary behaviour (Tremblay et al. 2017). Rotating shift workers were more likely to participate in more light-intensity physical activity and less sedentary behaviour. Individuals who work in rotating shifts might have more work flexibility, and as a result, may have more chances to engage in movement-based behaviours. Moreover, a rotating shift may encourage more physical activity and reduce sedentary behaviour by increasing daytime alertness. The measures on the physical activity and sedentary intervention might need to be modified accordingly based on the shift work timetable (Loprinzi 2015).

Obstacles to be engaged in daily physical activity among this population have been discussed despite the lack of definitive evidence. The struggles faced by the shift workers to practice an active lifestyle are cited for reasons such as exhaustion in view of a challenging timetable, difficulty participating in team sports or various types of exercise, potential increased perceived exertion and exhaustion throughout the night or

early morning exercise (Loef et al. 2017; Fuzeki & Banzer 2018). There could also be a problem with a shortage of facilities accessible at times suitable for shift workers.

Physical inactivity may aggravate the hazard of chronic diseases among shift workers. Previous studies supported that there were association between moderate physical activity levels and and fitness with lower rates of morbidity and mortality (Brawner et al. 2016; Guthold et al. 2018). Regular physical activity and exercise have been shown to enhance health in a variety condition such as cardiovascular disease, diabetes mellitus, cancer, depression and anxiety. Physical activity and exercise are important parts of a healthy lifestyle in view of the contribution into multiple health benefits, promote society advance, improve overall health globally and provide long-term chronic disease prevention and treatment (Anderson & Durstine 2019).

2.4 Eating Habits among Shift Workers

In a 24 hours society, it could be explained that food becomes a 24 hours activity among the shift work society which consequently contribute to health effects. Circadian disturbance takes place at the time that the fast/feeding cycle are desynchronised with the temporal pattern defined by the central circadian clock, is routinely encountered by shift workers (Souza et al. 2019). In relation to this, several components of cognitive performance, wakefulness and emotional state are known to influence changes in food intake, especially among shift workers (Azmi et al. 2020).

Shift workers have been noted to have snacking habits, mostly high-carbohydrate food, during their night shifts. Nocturnal feeding mimics the symptoms of night eating syndrome (NES) which were discovered by Stunkard et al. in 1955 (Haus et al. 2016). NES is known as a disorder characterised by a delayed pattern of food consumption, in which frequent episodes of nocturnal eating and/or excessive food intake take place after the evening meal (Kucukgoncu et al. 2015). Research by St-Onge et al. (2017) and Cleator et al. (2012) have documented that obesity and cardio-metabolic health are correlated with late-night meals. The intake of foods rich in carbohydrates at night, relative to high-fat diets, causes a more significant decline in mental performance and an increase in the degree of sleepiness as compared to the physical act (Nehme et al. 2014). In addition, contrary to other macronutrient intakes, there was a connection between the consumption of protein and increased satiety, decreased feeling of hunger, and lower caloric intake. Because of the thermogenic effect, meals rich in protein stimulate greater satiety and alertness (Nehme et al. 2014). It is also recommended that shift workers take high-protein diets during night and decrease the consumption of carbohydrate-rich food to obtain a productive night shift duties (Azmi et al. 2020).

Bonham et al. (2016) stated in the systematic review and meta-analyses that it was confirmed that the energy intake among shift workers lasting 24 hours did not differ from normal day workers. Consuming meals precisely at the wrong timing during the 24 hours was suggested to be a pivotal determinant to the higher risk of metabolic disorders among shift workers (Moran-Ramos et al. 2016). Gifkins et al. (2018) showed that there was high food craving, intake of caffeine, and snacking habits during the night shifts, and unable to have sufficient fluids at work among shift nurses. The nurses

explained more on skipping meals during work and the relationship with a huge workload and alcohol intake as the approach to rest from shift work (Gifkins et al. 2018). Similarly, among the mine workers with fluctuating shift schedules, it was reported that they had trouble following common meal consumption patterns (Strzemecka et al. 2014). Meanwhile, because of fluctuating work schedules, the options on the food availability and meal timing were limited for other occupations such as long-distance truck drivers and flight attendants (Nyberg & Wiklund 2017; Azmi et al. 2020). Another research on chrononutrition stressed that those with more inconsistent meal routines had an increased tendency of getting metabolic syndrome and obesity, despite using less energy as compared to those with proper meal arrangement (Pot et al. 2014; Azmi et al. 2020).

Other research revealed lower diet quality among shift workers, for instance higher intake of sugar, saturated fat (Hemio et al. 2015), sweetened drinks (Tada et al. 2014), and less vegetables consumption (Hemio et al. 2015; Balieiro et al. 2014). In addition, due to circadian rhythm misalignment, obesity, hyperphagia and insulin resistance were observed. This was due to the control of circadian expression and metabolism-related activity of hormones and enzymes that was altered because of the clock regulation disturbance in the brain and peripheral tissues (Serin & Tek 2019). Strickland et al. (2015) emphasised that when working late shifts, the duration of time breaks has a major impact on healthy eating among shift workers. Time constraint hinders healthy food intake, decreases satiety, and increases binge eating (Strickland et al. 2015; Azmi et al. 2020).

2.5 Relationship of Physical Activity and Eating Habits with Psychosocial Well-Being

Physical activity is an efficient non-pharmacological method of improving sleep (Wang & Boros 2021). A systemic review by Flahr et al. (2018) has revealed that physical activity interventions may positively influence many aspects of the health of shift workers, including stress levels, mental health, musculoskeletal functioning, physical activity behaviour, body composition, sleep quality and productivity. Several randomized-controlled trial studies found that increasing moderate-to-vigorous physical activity (MVPA) could benefit the shift workers' mental health and sleep quality (Oftedal et al. 2019; Rayward et al. 2020). Besides, other studies also emphasised that aerobic physical activity and resistance training may improve sleep by alleviating the symptoms of depression or anxiety, alterations in energy expenditure, rise in body temperature or musculoskeletal pain relief (Murawski et al. 2019; Kovacevic et al. 2018).

Furthermore, the prevalence of eating disorders was high among those who were working in shifts and had severe job stress, indicating the interrelated association between psychosocial well-being and nutritional intake (Nea et al. 2015). Likewise, an earlier study reported a notable trend among shift workers who suffered from high stress of restrained or binge eating (Almajwal 2016). Researchers have recommended that operating on shift duties changes not only the normal timing of meals, but also the availability of nutritious meals, contributing to many health-related complications (Hemio et al. 2015). Shift workers working night shifts are likely to eat processed and fast food that are high in salt or sugar from pre-packaged meals or vending machines, because the food services are less readily available (Souza et al. 2019). Night shift

workers also encounter sleepiness and reduced stamina at the workplace. While this could be related to the high sugar content and food supply, it is primarily in view of the circadian effect of sleep pressure which is highest during the night. Moreover, the energy proportion from sugar consumed over a 24-hour cycle was considerably higher for night shift workers than for day shift workers (Bonnell et al. 2017; Azmi et al. 2020).

Meals consumed late at night and daytime sleeping interrupt the regulation system and influence the appetite and metabolism chronobiologically. In addition, humans are predisposed to promoting metabolism of glucose and storage of fat during the daytime, when they usually eat. In contrast, they are predisposed to sparing glucose and fat metabolism at night when they usually fast. As a result of this predisposition, shift workers demonstrate altered glucose and lipid tolerance continuously due to the shift from day to night shift work (Aslama et al. 2021). Research by Bandin et al. (2014) investigated the impact of the alteration of meal timing on energy expenditure, glucose tolerance, and circadian-related factors, where standardised meals were supplied to participants throughout the two weeks of meal intervention and were monitored with two lunch eating circumstances: early eating (lunch at 13:00) and late eating (lunch at 16:30). Reduced glucose tolerance, reduced resting energy expenditure, lowered fasting carbohydrate oxidation, blunted daily profile in free cortisol concentrations and decreased thermal effect on food were found to be associated with eating late. The consequences of the diverse impacts of meal timing on metabolic health were also emphasised in this study (Bandin et al. 2014).

According to a scoping review by Gupta et al. (2018), the emotional condition that comes with working a night shift is stated to affect the food intake, not only during

the shift but also on the following day. Shift workers can endure the work-related stress by eating more food than average intake, such as consuming more junk food (Han et al. 2016; Torquati et al. 2016). Junk foods are classified as foods that are high in energy, fat, sugar, and/or sodium but lack of vitamins and micronutrients. These low-quality food preferences are poor in terms of nutrition and consist of many more calories than nutrients like vitamins and minerals, also called calorie-dense food (Naeem 2012). Earlier research indicated that of several mood conditions, including alertness, mental slowing and boredom, was observed with the comparison of high-fat with high-carbohydrate meals, central post prandial effects of diet, or associations with a time of day (Souza et al. 2019; Azmi et al. 2020).

A common phenomenon is stress eating, and shift work is related to high severity of stress at work (Buss 2012). In this sense, it may be essential to eat during shift, though harmful for long-term health, as for surviving on shift. In connection with stressful working condition and struggles in social and family life, shift workers typically declare irritability, anxiety and nervousness. Continuous disturbance of circadian rhythm and sleep deprivation can be complicated by mood disorders, chronic anxiety, depression, chronic fatigue or neuroticism, resulting in greater employee absenteeism and the recurrent need for psychotropic drugs such as sedatives and hypnotics (Azmi et al. 2020).

Increased consumption of fast food and snacks among shift workers contributes to a high-fat and high intake of energy-dense meals. A study in Arizona University revealed that 60% of individuals confessed of having night-time snacking and inadequate sleep that result in a craving for more junk food (Science News 2018). The

researchers believed that poor sleep, intake of junk food, and unhealthy snacking at night reflected the truth that sleep plays important role in controlling the metabolism (Science News 2018). Sleep can make the person feeling better in order to overcome stress and assure from unhealthy eating. The body could not be able to digest adequate calories during the late-night food consumption, and they may be stored. All consumed food can cause harmful impacts unless there is an activity at night. Sedentary occupations particularly operating at the call centres or offices which limit the movement, mean that there is a greater chance of food being digested at a distinct pace. Diurnal and nocturnal variation are both hormone- and temperature-related, and it could affect the individual's metabolism (Azmi et al. 2020).

2.6 Psychosocial Well-being in Shift Workers

2.6.1 Mental Health

Working environments portray a progressively real part in mental health and psychological well-being in fluctuating social situations. Given its nature, psychosocial work circumstances might not be able to be described by direct assessments as compared to physical or chemical threats (Vogel et al. 2012). A study by Goetz et al. (2015) found that various burn out-related psychosocial factors such as increased cognitive stress symptoms, emotional demands and role-conflict, job-privacy conflicts, decreased general health, life satisfaction and emotion concealment demands.

There were a lot of mental health and psychological crisis reported by shift workers involved in the night shift workers. These include altered mood, anxiety, irritability, obsessive-compulsive disorder, somatisation, interpersonal sensitivity and paranoid disorders with a higher prevalence (Ferri et al. 2016). Lin et al. (2012) reported that rotating shifts were correlated with poor mental health. Hea Young et al. (2015) found that nurses with shift duties were more prone to develop severe depression.

Depressive symptoms have been attributed to night eating syndrome more frequently. Nevertheless, it can be influenced by the concurrence of binge eating disorder that is strongly related to psychological distress. Furthermore, in the obese population, there is a relationship between binge eating disorder and night eating syndrome and nocturnal snacking, although the description of the link remains vague (Nolan & Geliebter 2017).

In terms of stress and anxiety, night shift workers who reported being extremely stressed at work were interviewed by Faseleh et al. (2013). Banakhar (2017) showed that nurses with 12-hour shifts demonstrated higher stress levels as compared to those involving in 8-hour shifts. Another study stated that female nurses who were involved with rotating shifts experienced more cognitive and somatic anxiety (Korompeli et al. 2014). In addition, Weaver et al. (2018) recorded about 21.6% were having depression or anxiety among 416 hospital workers.

2.6.2 Quality of Life

Health has been described as a state of complete physical, mental and social well-being and not simply the absence of disease or infirmity. Meanwhile, the World Health Organisation (WHO) defines quality of life as individuals' perceptions of their position in life in relation to the culture and value systems they live as well as their goals, expectations, standards, and concerns (World Health Organisation 2014). Quality of life refers to the physical, mental and social aspects of life and plays an important element in understanding the well-being of individuals (Tavakoli-Fard et al. 2016).

Soric et al. (2013) investigated the quality of life among shift workers using Quality of Life Questionnaire (WHOQOL-BREF) and found that shift workers had poor scores on quality of life. Significant predictors associated with poor quality of life among the shift workers included older age, low education and having no partner (Soric et al. 2013). Several research compared the scores of qualities of life and well-being through distinctive nature of shifts (Nena et al. 2018; Kim et al. 2016). Exposure to stressors at work is one of the consequences of the shift work schedule, which might have negative health effects physically and mentally. In addition, a demanding work environment and lack of social support from colleagues could influence the quality of life of the shift workers (Soric et al. 2013).

Estryn-Behar and Beatrice (2012) demonstrated that one-third of nurses involving 12-hour shifts, nurses working 10-hour night shifts and nurses with rotating shifts recorded dissatisfaction with work time and poor well-being. The nurses reported the factors of having to take over shifts at short notice, having to wake up early before five o'clock in the morning to go to work, and not having sufficient child care when at

work as the crucial contributors towards poor quality of life. The impact of shift work schedule, dissatisfaction with working environment, family conflicts and health problems appeared to be detrimental to the shift workers' well-being (Estryn-Behar & Beatrice 2012).

In addition, a condition namely "shift work disorder" has been suggested and is characterised by the occurrence of symptoms such as fatigue, insomnia, disturbed circadian sleep/wake cycle and excessive sleepiness during the day. As they cause sleep deprivation, the alertness and work performance during everyday setting are also disturbed by night shift work (Boivin & Boudreau 2014). The quality of life among the shift workers might also have negative impacts that include higher cases of suicide and divorce, bad morale, increased use of drugs and alcohol, as well as a feeling of despair triggered by the pleasure deficit in the domestic and social life (Vitale et al. 2015).

Previous studies documented significant factors associated with poor quality of life among the shift workers including marital status, sedentary lifestyle, smoking, alcohol consumption, psychological distress and poor sleep quality (Lim et al. 2020; Kim et al. 2016). Shift work tends to reduce the quality of marriage because it decreases the overlap of free time between family members. As a result, this might cause disruptions in social and family relationships, which lowers the quality of life. Unhealthy lifestyles among shift workers had been shown to be related with higher adverse health outcomes and loss of well-being (Kim et al. 2016). There are also bi-directional effects among shift work, sleep quality and psychological distress with quality of life (Lim et al. 2020).

2.6.3 Work Engagement

Work engagement is a positive and rewarding state of mind correlated with work which is generally described by vigour, dedication and absorption that is the opposite of burn out (Tan et al. 2017). Engaged workers have an active and productive link to their work tasks and manage to adapt well with the job demands (Tan et al. 2017). Engagement points out to a more permanent and systemic affective-cognitive state, rather than a momentary and specific condition that is not according to any particular object, individual, behaviour or event (Schaufeli 2012).

Rotating shift nurses demonstrated a poorer job satisfaction in a study by Dall'Ora et al. (2015). The rate of job satisfaction evaluated by the Index of Work Satisfaction tended to correspond to shift work in a Greek nursing study (Gouzou et al. 2015). Reduced job satisfaction for nurses is closely related to higher stress at work (McVicar 2016). Wisetborisut et al. (2014) recorded higher burn out scores among shift workers. Furthermore, shift workers who had 6 to 8 hours of sleep in a day and a minimum of 8 days off per month had less signs of burn out in this study.

Simunic and Gregov (2012) demonstrated that 12-hour shifts was correlated with lower cognitive-affective job satisfaction. Teclaw and Osatuke (2014) reported that total job satisfaction was poorer in evening and night shift workers. Meanwhile, Rodwell and Fernando (2016) highlighted that shift work itself was not correlated with reduced job satisfaction, but job satisfaction relied more on the context of work and other lifestyle variables as opposed to just shift type.

Ferri et al. (2016) emphasised that, in view of greater risk of job dissatisfaction and adverse health consequences, nurses with alternating night duties need special attention. This cross-sectional study revealed the correlation of risk factors predisposing night shift nurses to poor health outcomes and job satisfaction. The findings revealed that nurses with rotating night schedules had a statistically significant correlation, in which the lowest mean score was recorded in terms of job satisfaction, sleep quality, with more recurrent episodes of chronic fatigue, symptoms of psychological and heart diseases (Ferri et al. 2016).

2.6.4 Sleep Quality

The normal periodic state of relaxation for the body and mind is to have sufficient sleep, and the average time of sleep for an adult is seven to nine hours a day, as suggested by The National Sleep Foundation (Hirshkowitz et al. 2015). Deprivation of sleep can predispose to the vulnerability of typical viral infections, heart diseases, diabetes, obesity and depression (Jehan et al. 2017). The prevalence of insomnia among nurses with rotating shifts was high (Shen et al. 2016).

The overall sleep quality among night shift nurses was substantially low (Waage et al. 2014). Night shift duties contribute to deprivation of sleep which indirectly affects the alertness and job performance, and promoting fatigue (Boivin & Boudreau 2014). This condition often related to shifts is possible in view of the circadian rhythm desynchronisation or reduced sleep (Jehan et al. 2017). A Greek study indicates that sleep disturbance in shift work is closely related with chronic fatigue (Korompeli et al. 2013).

The fatigue symptoms, such as “sleepiness and lack of energy,” “impaired concentration,” and “feelings of discomfort,” were more extreme in the nurses working in night shifts (Eldevik et al. 2013). Researchers have found that night shift fatigue may lead to the incidents of human errors and injuries, and may have an adverse impact on the patient care. In addition, fatigue decreases performance and work satisfaction, encourages absenteeism because of illness, turnover and frequently causes psychotropic substance usage (Stimpfel et al. 2015). Fatigue remains the key cause of errors in the administration of medication by nurses (Vallieres et al. 2014).

Accidents and injuries have been associated with short sleep time and workers exhaustion, and have an effect on workers well-being that include the worsening of chronic diseases (Tucker & Folkard 2012). In all organisms, circadian rhythms are present, influenced by light and darkness, and regulated by the suprachiasmatic nucleus (a group of nerve cells situated in the brain influencing individuals in terms of physical, mental and behaviour) (Chokroverty & Avidan 2012). Meanwhile, circadian variability is much longer than 24 hours in humans, with bimodal increments in sleep drive late at night and little increment in the early to late afternoon (National Institutes of Health 2013).

Circadian rhythm has its part in the regulation of sleep-wake cycles, body temperature, release of the hormones (e.g., cortisol, ghrelin and leptin), and has been related to sleep disturbances, diseases, depression, as well as insomnia (National Institutes of Health 2013). Continuous or occasional interruption of sleep can give impact to the normal body clocks of employees, leading to circadian rhythm disorder.

A common circadian rhythm disorder that affects individuals who often involve in the

rotating shifts or night duties is known as shift work sleep disorder. Shift work sleep disorder is described by periods of sleep disruption that lead to extreme sleepiness and insomnia, problem in focusing, headaches, loss of energy, irritability, anxiety, nervousness and also depression (Cleveland Clinic 2013).

