



Effects of chronotype, age, and shift preference on nurses tolerance of night shift
by Connie Sue Johnson

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Abstract:

The ability to tolerate night shift is an ongoing difficulty for nurses who work night shift. For most night shift workers, the inversion of the usual daytime working pattern with one of nighttime wakefulness and activity, followed by daytime sleep, is disruptive to their biological circadian rhythms. The purpose of this study was to evaluate the effects of chronotype, age, and shift preference on the tolerance of night shift in nurses working permanent night shift at Bozeman Deaconess Hospital to ascertain if similar to those in other populations. Circadian factors, sleep factors, as well as social factors have a role in the degree of tolerance experienced by the night shift employee. The difficulties related to working at night are well documented in the literature.

Eighty-seven percent of the 30 permanent night shift nurses at Bozeman Deaconess Hospital participated in the study. The participant demographics in this study describe nurses working night shift at Bozeman Deaconess Hospital and may be characteristic of nurses in Bozeman, Montana. The majority of the population consisted of white females. These women were well educated with most having a Bachelor of Science in Nursing, no dependents at home, and working in a variety of nursing specialties. Their mean age was 35.5 years. The majority of nurses working night shift reported night shift was their preferred shift. Although, when given an opportunity to select one reason for working night shift, few indicated they liked working night shift. Most nurses reported they worked night shift because it was the only shift available.

The first aim was to describe the population's chronotype and all circadian rhythm types were present in this group. An equal number of morning and evening types were represented, with the bulk of participants in the "neither" category. The normal distribution in this population strengthens the analysis.

Tolerance was measured by the subjective health indicators (fatigue, sleep disturbance, gastrointestinal disturbance, cardiac symptoms, and psychological well-being) (Aim 2). Because the scales of each health indicator differ they cannot be readily compared or prioritized. A comparison can be made between subjective health indicators from this present study with norms reported by the Barton, Spelten, Totterdell, Smith, Folkard, & Costa (1995) for permanent night shift nurses and industrial workers in England and Wales. Fatigue was much more prominent in the females and males in the Barton et al. (1995) study than in this study even though sleep disturbances were much more frequent in this present study. Variation in sleep disturbances, psychological well-being, gastrointestinal disorders, and cardiac symptoms experienced by the nurses in the present study were much greater than in the Barton et al. study. Variation in fatigue was smaller.

No relationship between morningness / eveningness and tolerance of night shift was evident in these nurses (Aim 3). These results are contrary to previous research study findings that evening types tolerate night shift better than morning types (Kerkhof & Van Dongen, 1996) and may be the result of the small number of individuals in this population.

The association between preference for night shift and tolerance was nil (Aim 4). Fifty-six percent of

nurses had reported they preferred to work night shift. The lack of association between preference for night shift and tolerance may reflect the adaptation that occurs over time with working night shift. Neidhammer, Lert, & Mame (1994) theorized that night shift nurses learned to cope with shift work over time and appeared to suffer from sleep disorders less frequently.

Correlational was used to evaluate the relationship between age and tolerance of night shift. The results indicated there was no association between age and tolerance in this group of nurses. The results of an independent sample t test comparing the group means for tolerance between nurses ages ≤ 35 years of age and ≥ 36 years of age were not statistically significant, which also showed no association.

When the relationship between chronotype and age was evaluated (Aim 5), the results were statistically significant. The positive relationship between chronotype and age are reflective of other previous studies indicating that an advancing age results in a morningness tendency (Harma, 1993; Carrier, Monk, Buysse, & Kupfer 1997).

Contrary to previous studies, this study failed to demonstrate a relationship between chronotype, age, or shift preference with tolerance of night shift for night nurses at Bozeman Deaconess Hospital. The relationship between chronotype and age was significant. However, the intent of this study was to identify the effects of circadian rhythm type, age, and shift preference on tolerance of nurses working night shift at Bozeman Deaconess Hospital. The high percentage of nurse participation in this study may reflect an increased awareness or interest on the nurses' part in learning more about the difficulties associated with night shift, though the level of awareness or interest was not measured in this study.

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This thesis has been read by each member of the thesis committee and has been found to be satisfactory regarding content, English usage, format, citations, bibliographic style, and consistency, and is ready for submission to the College of Graduate Studies.

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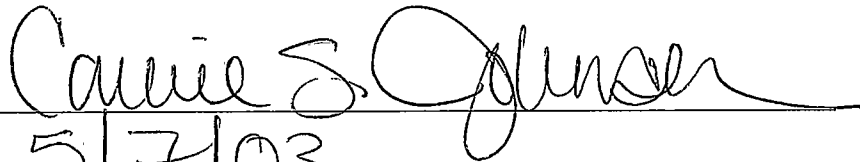
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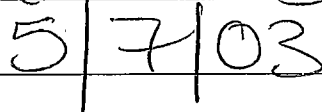
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CHAPTER 1

INTRODUCTION

The natural sleep wake rhythm of the human body was never in question until 1833 with the invention of the light bulb. This advancement in technology allowed people to work at all hours of the day and night. Along with the Industrial Revolution came a tremendous influx in industry and technology requiring more and more people within the United States to work at night. Human beings are accustomed to being active and awake during the day and asleep at night. With the development of the light bulb permitting individuals to work around the clock came the question "what happens to the worker's sleep while working at night?" Research has demonstrated over time that being active at night and asleep during the day poses difficulties for the night shift worker.

All individuals have a natural sleep wake rhythm that cycles regularly in a circadian pattern, or about every 24 to 25 hours. The typical human social rhythm is one of daytime activity, evening leisure, and night time sleep. This circadian rhythm is governed by an internal pacemaker that responds to internal and external stimuli. Timing is controlled by the suprachiasmatic nucleus (SCN) within the brain. The SCN contains approximately 20,000 neurons located in the anterior aspect of the hypothalamus dorsal to the optic chiasm. The specialized receptors in the retina sense external stimuli, such as sunlight and darkness, and in turn trigger nuclei within the SCN, the pacemaker. This pacemaker, with a rhythmic pattern, governs many of the body's physiological,

biochemical, and behavioral functions including the sleep wake cycle, core body temperature, digestive enzyme secretions, mood, and hormonal rhythms (e.g., growth hormone, cortisol, and melatonin), (Minors & Waterhouse, 1981; Costa, 1996). Melatonin is secreted from the pineal gland and thought to be the mechanism for controlling the sleep wake cycle (Rivest, Schulz, Lustenberger, & Sizonenko, 1989; Dumont, Benhabrou-Brun, & Paquet, 2001). Melatonin secretion is initiated just before the onset of darkness and levels remain high throughout the night and begin to fall upon exposure to the light of day when people typically awaken. This synchronization with environmental light activates the body during daylight hours and promotes sleep during darkness. A change in light exposure will, in turn, induce an internal desynchronisation between circadian rhythms and sleep (Van Cauter & Turek, 1995).

Circadian rhythm types or chronotype, (i.e., morning type or evening type) is a descriptive label that represents distinct behavioral patterns (Horne & Ostberg, 1976). For example, a morning type person naturally wakes early in the day without the assistance of an alarm. These people are alert, energetic, and active very early in the day. By early evening, the energy level of a morningness type person begins to wane. In contrast, evening types wake later in the morning if left to their own free-will. Eveningness people often peak to a full stride in late afternoon and begin sleep later into the night. Many people resemble neither a strong morning or evening type (McEnany & Lee, 2000).

For most night shift workers, the inversion of the usual daytime pattern to one of nocturnal wakefulness followed by daytime sleep disrupts their biological circadian rhythms. The disruption with night shift work results from a mismatch between their

scheduled work hours and their biological sleep wake circadian rhythm. Night shift workers are required to be awake and active during the late evening early morning hours, a time period when their biological sleep rhythms are preparing them for sleep and attempt to sleep during the daytime hours, a time period when their biological rhythms are preparing them for activity and wakefulness.

The asymmetry of the sleep wake circadian rhythm with the inversion of a night shift workers daily routine leads to decreased alertness, impaired performance, worsening mood, and physical fatigue (Tepas & Monk, 1987). The sleep deficit and fatigue that results from the disruption in the sleep wake circadian rhythm with working night shift significantly decreases work efficiency during the night for the night shift worker (Colquhoun, Costa, Folkard, & Knauth, 1996). The night shift worker is more vulnerable to errors and accidents due to this disruption (Hildebrandt, Rohmert, & Rutenfranz, 1974; Colquhoun et al., 1996).

Some people are able to tolerate night shift work better than others and some cannot tolerate it at all (Moore-Ede, 1986; Tepas & Monk, 1987). Tolerance refers to an individual's ability to adapt to night shift work and must be assessed in a complex framework incorporating interrelationships of biological, social, family, work and schedule demands that influence individual differences in a shift workers ability to adapt. Many individual biological characteristics such as age, sex, chronotype, and physical fitness influence the sleep wake circadian adjustment and shift work tolerance (Grossman, 1997).

One of the most common problems for many night shift workers is the inability to

tolerate a sleep - wake routine of daytime sleep and nocturnal activity. Individuals who are eveningness types often adapt to night shift work considerably easier than do morningness types (Patkai, 1970; Pettersson-Dahlgren, 1976; Gallwey & McEntee, 1997). As an individual ages the frequency of sleep disturbances increase and may lead to a decrease in shift work tolerance for older workers (Oginska, Pokorski, & Oginska, 1993; Marquie & Foret, 1999). Men and women adapt to night shift in the same manner (Harma, 1993), although female night shift workers complain of sleepiness more often than males primarily due to increased household and child care responsibilities (Harma, Ilmarinen, & Knauth, 1988). High to moderate physical fitness seems to reduce sleepiness during night shifts (Harma et al., 1988). Physical conditioning does not change the circadian alignment to night work but increases the sleep length during daytime hours which decreases the sleepiness experienced during the night shift (Harma et al., 1988). Chronic diseases such as diabetes, epilepsy, asthma, and hypertension are often aggravated by night shift work and also decrease tolerance for night shift work (Van Cauter & Turek, 1990). An inability to tolerate night shift is manifested by symptoms related to chronic fatigue, sleep disturbances, gastrointestinal upset, cardiovascular symptoms, and poor psychological health (Barton & Folkard, 1991; Barton, 1994).

The process of adjustment for the night shift worker has been likened to a salmon leaping up a waterfall; adjustment to a nocturnal orientation is difficult to achieve (i.e., reach the top of the waterfall), as it is easier to return to a daytime schedule. In view of the fact that returning to a daytime schedule is much easier, many night shift workers are never able to achieve a complete reversal of their sleep wake rhythm and, consequently,

their circadian processes are never able to fully adjust to night time work (Tepas & Monk, 1987).

Altogether, nocturnal wakefulness and job performance followed by daytime sleep disrupts the sleep wake cycle for the night shift worker. The disruptive influence of night shift work results from the reversal of the typical work sleep pattern. Night shift workers are required to stay awake when their body rhythms are preparing them for inactivity and sleep and to sleep when their body rhythms are preparing them for activity and wakefulness (Akerstedt & Gillberg, 1981, Van Cauter & Turek, 1995). The effects of night shift work are recognized as significant factors that negatively affect job performance, workers' health, and job satisfaction (Efinger, Nelson, & Walsh-Starr, 1995, Scott, 2000).

Background & Significance

Sleep is essential to life and to one's physical and emotional well being. Sleep is a reversible behavioral state of perceptual disengagement, decreased responsiveness to stimulation and decreased movement with a stereotypic recumbent position. Normal sleep is characterized by a general decrease in body temperature, blood pressure, and breathing rate. While asleep, the brain activity continues.

Throughout a typical sleep cycle of 90 to 110 minutes, an adult normally alternates between two very different states, non-rapid eye movement (Non-REM) and rapid eye movement (REM) sleep. The Non-REM state consists of stages 1, 2, 3, and 4, which are defined by electroencephalogram (EEG) patterns. REM sleep is also defined by

EEG patterns, along with muscle flaccidity, and rhythmic bursts of rapid eye movements. During stage 1, light sleep begins as a person drifts off to sleep. Eye movement and muscle activity slows. People are easily awakened during stage 1 and often remember fragmented visual images. Many experience sudden muscle movements that are often preceded by a sensation of falling. During stage 1, an EEG reading indicates fast theta waves at 3 to 7 cycles per second. When entering stage 2, eye movements stop and brain waves become slower with occasional bursts of rapid waves called sleep spindles and K complexes. In stage 3, extremely slow brain waves called delta waves ($1\frac{1}{2}$ to 2 cycles per second) appear, interspersed with smaller, faster waves. In stage 4, the brain produces delta waves in more than 50% of each epoch. During stages 3 and 4, which together are called deep sleep, awakening the individual is very difficult. During deep sleep there is very little, if any eye movement or muscle activity. People awakened during deep sleep do not adjust immediately and often feel groggy and disoriented for several minutes after awakening. The first REM period usually occurs 70 to 90 minutes after falling asleep. During REM sleep respirations become more rapid, irregular, and shallow, eyes jerk rapidly in various directions, heart rate increases, and limb muscles become temporarily paralyzed. Non-REM and REM sleep alternate cyclically through the sleep period. A typical night of sleep begins with about 80 minutes of Non-REM sleep, followed by a REM period of about 10 minutes. This 90 minute Non-REM - REM cycle is then repeated about 3 to 6 times during the night. During successive cycles throughout the night the amount of stages 3 and 4 decrease and the REM proportion of the sleep cycle tends to increase.

The actual functions of sleep still remain a biological mystery. One possible function of sleep is to restore or reverse physiological processes that are degraded during prior wakefulness. Another hypothesis is that sleep serves to conserve energy with a reduced metabolic rate and body temperature (Kryger, Roth, & Dement, 2000). Sleep is vital to human performance and is disrupted by working during the night.

Night Shift Work

Historically, night work has been regarded as undesirable and only permissible when strictly necessary. In the 1800's child labor laws prohibited persons under age 18 from working at night. Women were also prohibited from working at night except in certain professions such as midwifery. The work force in the United States currently consists of approximately 33 million full-time night shift workers with 1.6 million working in health care according to the United States Bureau of Labor Statistics (2001). Today, night shift has become an established labor pattern for a significant portion of businesses and the workforce (Akerstedt, 1991).

Shift work is an inescapable reality in nursing because of the 24-hour patient care needs in acute and long term care settings. To fulfill staffing needs many nurses are required to work night shift or rotate between day and night shift. Approximately 75% of all registered nurses with active licensure work in hospitals and nursing homes that require staffing 24 hours a day. Specific numbers are not available; however, in 1995 Alward & Monk estimated that 18% of nurses worked a fixed night shift and approximately one-third worked a rotating shift schedule. According to the Montana State

Board of Nursing (February, 2003), 9,926 licensed RN's and 3,007 licensed LPN's were currently active in the state of Montana (active status indicates the minimum licensure standards for nursing practice have been fulfilled and maintained). The number of nurses working night shift in Montana is unknown, but if the proportion is consistent with the 1995 Alward & Monk study, an estimated 2,300 nurses in Montana work night shift. These estimates suggest that a large number of nurses in Montana, as elsewhere in the United States, have the potential for difficulties related to working night shift.

The varying hours of nurses' work schedules are disruptive to their biological circadian rhythms (Scott, 2000). Nursing schedules require working irregular hours and changing the days worked, which create problems that a person doing a similar job with a regular day schedule does not encounter (Kemp, 1984). Nurses working night shift commonly work two days in a row, have two days off, then work three days in a row. The irregularity of such a schedule makes establishing a regular sleep pattern difficult.

Sleep deprivation secondary to working nights leads to decreased alertness and impaired judgement for the individual, thus making the worker more vulnerable to errors and accidents (Colquhoun et al., 1996; Monk, 1990). The routine pressures, demands, and stresses for nurses caring for patients in today's hospitals are considerable. Diligence and attention to detail, as well as intellectual and manual skills, are necessary to fulfill the minimum requirements for daily nursing demands. Patients admitted to hospitals are generally acutely ill requiring an array of therapeutic nursing interventions. Nurses working night shift have a much greater level of responsibility for patient care than do nurses on other shifts due to the increased patient to nurse ratio and lack of ancillary staff

on night shift. Because the consequences of human error can be severe in the health care industry, disruptive effects of sleep wake circadian rhythms in nurses who work night shift deserve attention.

The ability to choose to work either day or night shift, i.e., shift preference, increases the degree of tolerance experienced by night shift nurses (Barton & Folkard, 1991; Barton, Smith, Totterdell, Spelten, & Folkard, 1993). By choosing to work at night, individuals are more likely to structure their lives to account for the unusual work hours, and in turn, decrease the problems experienced with night shift work (Barton & Folkard, 1991; Barton et al., 1993; Barton, 1994). Night shift workers who prefer to work night shift experience fewer difficulties related to chronic fatigue, digestive symptoms, cardiovascular symptoms, domestic disruption, sleep disturbances, and psychological health than nurses who prefer to work another shift (Barton & Folkard, 1991; Barton, 1994).

Ability to Adapt to Night Shift

The ability, or inability, to adapt to night shift work stems from factors within the individual as well as factors related to the work system and can be compounded by an illness (Tepas & Monk, 1987). Many personal factors likely cause an individual's intolerance of night shift. These factors include: over the age of 50 years, working a second job, heavy domestic work, and morningness type. Several illnesses are likely to increase the individual's intolerance to night shift as well. Some of these illnesses include: sleep disorders, psychiatric illness, drug or alcohol abuse, epilepsy,

cardiovascular disease, diabetes mellitus, and gastrointestinal disorders.

Many work system factors are likely to cause coping difficulties with shift work, these

factors include:

1. more than five 8 hour nights shifts in a row
2. more than four 12 hour night shifts in a row
3. first-shift starting time earlier than 7:00 am
4. rotating hours that change once per week
5. less than 48 hours off after sequential night shifts
6. excessive overtime
7. backward rotating schedules (first shift to third shift to second shift)
8. 12 hour shifts that involve critical monitoring tasks
9. 12 hour shifts involving a heavy physical workload
10. excessive weekend work
11. long commuting times
12. split shifts with inappropriate break lengths between shifts
13. shifts lacking appropriate break times
14. 12 hour shifts with exposure to harmful agents and substances
15. overly complicated schedules (Tepas & Monk, 1987).

Night shift work may lead to health hazards that are both physiological and psychosocial in nature. Some of the physiological consequences of night shift work include an increased risk of cardiovascular illness, gastrointestinal disorders, upper respiratory and pulmonary problems, infertility, weight gain, and substance abuse

(Vancauter & Turek, 1990; Costa, 1996). Shift workers are more likely to have a poorer sense of well being (Lahaie, 1991) and suffer from symptoms of anxiety and depression than daytime workers (Jung, 1986). These health problems coupled with irregular work hours can lead to psychosocial problems in job and family relationships with missed social activities causing suffering for the shift worker themselves and their families (Bosch & DeLange, 1987).

The difficulties that some people experience with night shift work are gaining acceptance and regarded by some health care providers as a disorder in need of medical treatment (Kryger, Roth, & Dement, 2000). In the *Diagnostic and Statistical Manual of Mental Disorders* shift work is listed as a subtype of circadian sleep disorder. Although shift work intolerance is regarded as a sleep disorder related to a circadian rhythm disruption, this problem is more complex and should not solely be considered a sleep disorder according to Tepas & Monk (1987).

Problem Statement

Working night shift disrupts nurses' sleep wake circadian rhythm resulting in the possibility of enhanced fatigue, sleepiness, and sleep disturbances; decreased vigilance and attention; irritability; gastrointestinal dysfunction; cardiovascular disorders; and depression or other mood disturbances (McEnany & Lee, 2000). This disruption in the circadian rhythm may lead to chronic sleep deprivation, which in turn may be associated with diminished levels of alertness, efficiency and productivity, and increased rate of mishaps (Grossman, 1997). Sleep deprivation secondary to night shift work leads to

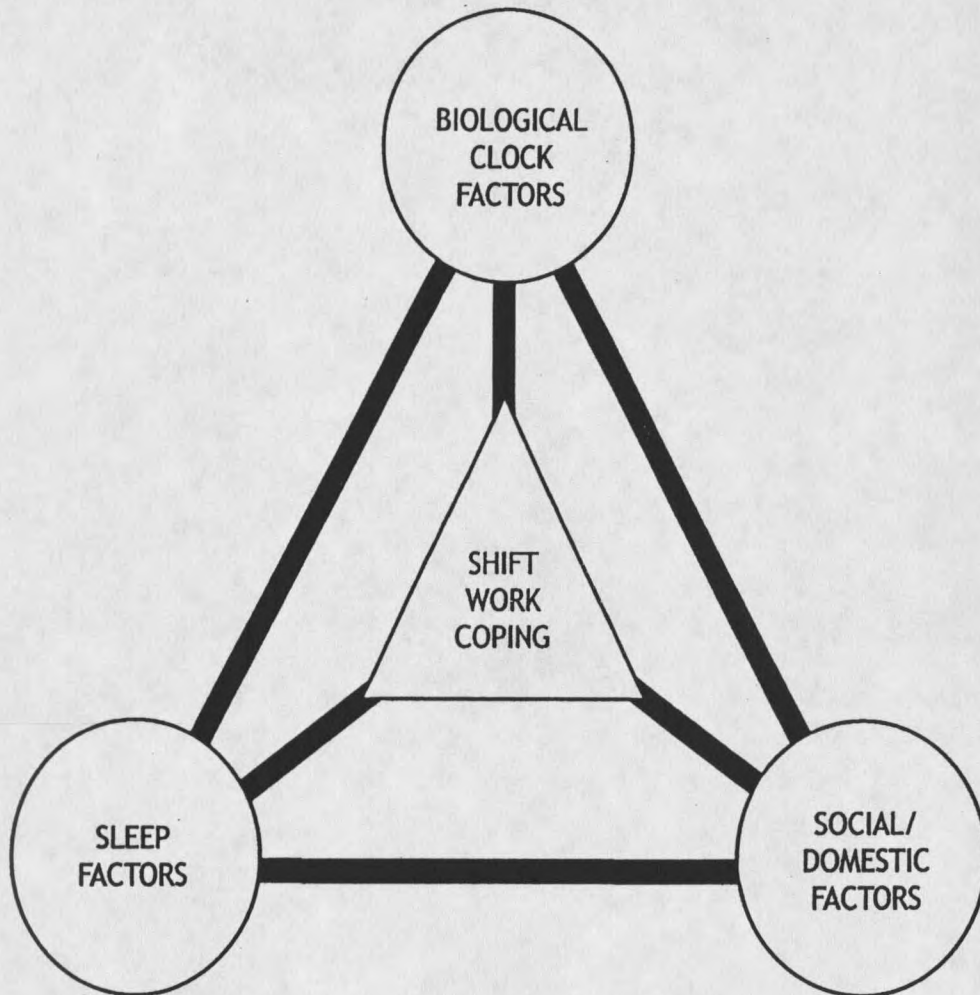
situations in which decreased alertness may threaten individual or public safety (Scott, 2000).

The ability to tolerate night shift is an ongoing struggle for nurses who work at night. Personal and work system factors effect the ability of an individual to adapt to night shift work. Some of these factors are fixed (e.g., age, chronotype, and chronic illness) and some are adjustable (e.g., family demands, social or business commitments, and shift work schedules). Chronotype, age, and shift preference are three important factors influencing tolerance of night shift. Individual variations in circadian rhythm types, i.e., morningness, eveningness, or neither (Horne & Ostberg, 1976) effect the tolerance of night shift work (Harma, 1993). Individuals who are morningness types have more difficulty adapting to night shift work than do eveningness types (Gallwey & McEntee, 1997). With advancing age, the frequency of sleep disturbances increases and may also lead to a shift work intolerance for older workers (Harma, 1993; Oginska, Pokorski, & Oginska, 1993; Marquie & Foret, 1999). Nurses are less tolerant of night shift work if night shift is not their preferred shift (Barton & Folkard, 1991; Barton et al., 1993). Many factors influence the tolerance of night shift.

Conceptual Framework

The ability to tolerate shift work can be viewed as an interaction of three mutually interdependent factors: circadian factors, sleep factors, and domestic factors (see Figure 1) (Monk, 1988). The circadian system lacks the ability to adjust instantaneously to the changes in routine that shift work requires.

Figure 1. Conceptual Framework Model for the Triad of Factors Influencing Shift Work Coping Ability (Monk, 1988)



Circadian factors, i.e., recurring patterns, such as an individual's chronotype and are closely linked to sleep factors, which in turn are impacted by domestic factors that include family, social, and environmental responsibilities. Sleep factors pertain to the quality and quantity of sleep and are dependent on the circadian system and environmental conditions. A shift worker's domestic life is an important element of shift work tolerance. Domestic and social factors include an individual's household responsibilities, such as child care, food preparation, grocery shopping, and school meetings, which must be managed regardless of scheduled work hours. The interaction of all three factors - circadian, sleep, and domestic - is complex with each factor influencing the other two factors. For example, changing the hours of sleep (circadian disruption) while working night shift and caring for a sick child (domestic obligations) interferes with the quality and quantity of sleep (sleep factors) (Tepas & Monk, 1987). The interdependence of circadian, sleep, and domestic factors is important in determining an individual's ability to cope with shift work.

Purpose

This study addressed the effect of chronotype, age, and shift preference on tolerance of night shift in nurses working permanent night shift at Bozeman Deaconess Hospital. Previous studies have demonstrated tolerance of night shift is related to chronotype (Patkai, 1970; Pettersson-Dahlgren, 1976; Harma, 1995; Gallwey & McEntee, 1997; Harulow, 2000), age (Harma, 1993; Oginska, Pokorski, & Oginska, 1993), and shift preference (Barton & Folkard, 1991; Barton, Smith, Totterdell, Spelten,

& Folkard, 1993). This study specifically questioned the effects of chronotype, age, and shift preference on tolerance of night shift in nurses working at Bozeman Deaconess Hospital, a rural hospital (85 beds) in Bozeman, Montana, and whether the relationships in Montana are consistent with previous studies.

The specific aims of this study were to: (1) identify the circadian rhythm type of nurses working permanent night shift at Bozeman Deaconess Hospital in Bozeman, Montana, (2) describe the nurse's tolerance of night shift using subjective health indicators (fatigue, sleep disturbance, gastrointestinal dysfunction, cardiac symptoms, and psychological well being), (3) evaluate the relationship between morningness / eveningness type and tolerance of night shift, (4) evaluate the relationship between preference for night shift and tolerance of night shift , and (5) evaluate the relationship between age and tolerance of night shift. To evaluate specific aims 3, 4, and 5, the following hypotheses were tested: (1) Night shift nurses self-assessed as morningness types will experience less tolerance of night shift than night shift nurses self-assessed as eveningness types. (2) Night shift nurses who indicate that night shift is their preferred shift will experience more tolerance of night shift than night shift nurses who indicate their preferred shift is days or evenings. (3) Night shift nurses who are self-assessed as morningness types will on average be older than night nurses self-assessed as eveningness types.

Definitions

The definitions used in this study are the following:

Adjustment - to settle or arrange rightly; to adapt oneself.

Chronobiology - study of biological rhythms.

Chronotype - the propensity for an individual's biologic processes to be expressed in a repeating pattern, often circadian.

Circadian - 24 hours from the Latin meaning "about a day" (Efinger et al., 1995).

Circadian rhythm - endogenously generated pattern that oscillates approximately every 24 hours.

Circadian rhythm type - behavioral pattern that is used to describe a morning or evening tendency.

Diurnal - relating to the hours of daylight

Eveningness Type - a circadian rhythm behavioral pattern characterized by a person naturally waking later in the morning if left to their own free-will. Eveningness people often peak to a full stride in late afternoon and begin sleep later into the night.

Infradian rhythm - a pattern that oscillates with less frequency than 24 hours.

Morningness Type - a circadian rhythm behavioral pattern characterized by naturally waking early in the day without the assistance of an alarm; being alert, energetic, and active early in the day; and by early evening, the energy level begins to wane.

Period - the time interval between successive occurrences.

Phase - an instantaneous state of the oscillating circadian rhythm within a time period represented by the value of the variable and all its time derivatives.

Phase shift - the rhythm is displaced along the time axis.

Rhythm - a flow or movement characterized by a regular recurrence

Shift - a unit of work time, typically 8 or 12 hours in length.

- (a) day shift is a work period that typically begins about 7:00 am,
- (b) evening shift is a work period that typically begins about 3:00 pm,
- (c) night shift is a work period that typically begins after 7:00 pm.

Shift Preference: working the shift (day, evening, or night) of choice

Shift work - any work schedule in which half of the scheduled work hours are not daytime hours; types include:

- (a) permanent (or fixed) - assigned to work steadily on one shift
- (b) rotating - assigned to alternate periodically on different shifts
- (c) continuous - all the days of the week are worked
- (d) discontinuous - interruption of work on the weekend or Sunday.

Synchrononize - to represent arrangement according to dates or time.

Tolerance - an individual's ability to cope with night shift work

Ultradian rhythm - a pattern that oscillates at a frequency greater than 24 hours.

Zeitgeber - environmental cues that helps to regulate the circadian rhythm cycles.

Summary

Many factors determine whether an individual will or will not adapt to night shift work. Several of these factors are inter-related with some specific to the individual night shift worker and others related to social and family situations and shift work schedules.

Literature related to the relationships between chronotype, age, shift preference, and tolerance of working night shift will be reviewed in the next chapter.

CHAPTER 2

LITERATURE REVIEW

The study of human sleep and chronobiology has been documented as early as 1845 and has progressed steadily since. The basic sleep concepts and discoveries that stimulated investigation were developed in the mid to late 1950's (Dinges, 1995). During this time period, rapid eye movement sleep was discovered (Aserinsky & Kleitman, 1953; Dement & Kleitman, 1957), and the terms "circadian" and "zeitgeber" were developed. The studies that followed were further developments and expansions of these first pioneering researchers' ideas. In this chapter, the literature reviewed pertains to the following areas: sleep factors, circadian factors, domestic factors, consequences of night shift work, and preference for night shift.

Sleep Factors

For most night shift workers, there is typically very little sleep before the first night shift worked in a sequence (Knauth, Rutenfranz, Schulz, Bruder, Romberg, Decoster, & Kiesswetter, 1980). This is in view that on days off from work most night shift workers return to a daytime activity schedule. Thus, before the first night of work, the night shift worker will sleep the night prior, be awake all day, then stay up all night during the first night shift worked. This means that almost 24 hours may be spent awake before the first daytime sleep is taken. Consequently, the first night shift is often more

affected by sleepiness than subsequent night shifts (Czeisler, Moore-Ede, & Coleman, 1982; Gillberg, 1998).

Early studies showed that daytime sleep of night time workers is reduced. Sleep after night shift work is shortened by as much as one-third compared with normal night time sleep (Tilley, Wilkinson, Warren, Watson, & Drud, 1982; Torsvall, Akerstedt, & Gillberg, 1981). On average, night shift workers sleep three hours less per day than daytime workers (Kogi, 1982; Monk & Folkard, 1985; Puhek, 1990). Night shift workers obtained an average of four to six hours of sleep per day, compared to seven to nine hours per night for daytime workers (Akerstedt & Froberg, 1976; Tepas, Stock, & Maltese, 1978).

In addition to being shorter than night time sleep, daytime sleep is less restorative and of poorer quality than night time sleep for those who work night shift (Carskason & Dement, 1979; Monk & Folkard, 1985). Daytime sleep is shorter and lighter with many more interruptions than night time sleep (Rosa et al., 1990). This is due in part to frequent awakenings from disturbances in the sleep environment (e.g., high temperatures, noises, telephone, children crying, door bell ringing, etc). A survey of 9,000 night shift workers demonstrated that 20% had difficulty adapting to night shift work due to the lack of sleep (Thiis-Evenson, 1989). Seventy-eight percent of the respondents' major complaint for decreased daytime sleep was related to noise. Children's noise was mentioned 77.9%, traffic noise 63.2%, telephone ringing 54.4%, and aircraft noise 53.4%. In comparison, when sleeping during the night, the same people had no complaints related to children's noise, telephone ringing, or traffic noise, although 40% still mentioned aircraft noise

(Thiis-Evenson, 1989). Other factors that contribute significantly to sleep problems for night time workers include domestic responsibilities (child care, grocery shopping, etc), social meetings (family or friends), individual characteristics (age, health), and schedule requirements (doctor appointments, fulfill banking needs, or conferences with teachers) (Ahasan, Lewko, Campbell, & Salmoni, 2001).

Night shift workers often suffer from sleep difficulties related to fatigue and stress (Neidhammer, Lert, & Marne, 1994). These sleep problems include difficulty getting to sleep, premature awakening (Akerstedt, Torsvall, & Gillberg, 1982; Rahman, 1988), shorter duration of sleep (Knauth et al., 1980; Akerstedt & Torsvall, 1981), and a higher use of hypnotics and tranquilizers (Gordon, Cleary, Parker, & Czeisler, 1986). In a longitudinal study conducted with female nurses from 1980 to 1990, the effects of shift work and sleep were examined at 10 public hospitals in France (Neidhammer, Lert, & Marne, 1994). In 1980, the sample consisted of 50 nurses on day shift system and 50 nurses on night shift from each hospital (N=469). In 1980 the mean age of the nursing sample was 30 years old. Most of the nurses were married (55%), lived with someone (8%), single (32%), separated or divorced (3%), and widowed (1%). Fifty-four percent had children (26% with one child, 20% with two children, and 8% had three or more). In 1980, 1985, and 1990, nurses completed a self-administered questionnaire which consisted of questions about personal characteristics, job description, working conditions, work organization, time schedules, sleep, nutrition, leisure, health, and home activities. Nurses who had left hospital work were interviewed at home or via telephone. From 1980 to 1985, 15% of the sample had left hospital work for reasons related to shift schedules,

changes in marital status, and children. From 1985 to 1990, 11% had left hospital work. Nurses who were 40 or older (20%) in 1985 were more likely to resign from hospital work in 1990 than younger nurses (9%). Nurses with three children or more (27%) in 1985 had left hospital work more frequently than others with less children or no children (10%). Nurses on permanent night shift (24%) in 1985 had left hospital work more frequently than those on permanent days (14%). This study demonstrated that (1) nurses who rotate to all shifts suffered more sleep disorders, (2) history of sleep disorders predicted a transfer to a permanent day shift schedule between 1980 and 1985, (3) sleep disorders decreased significantly after leaving shift work, and (4) sleep disorders also decreased among the nurses who remained on shift work in 1985. Sleep disorders decreased among the nurses who transferred to day shift and the nurses who continued to work shifts other than permanent day shift appeared to adapt to shift work and suffer from sleep disorders less frequently. These results agreed with previous studies finding a relation between shift work and sleep quality (Frese & Harwich, 1984; Rahman, 1988; Estryon-Behar, Kaminski, Peigne, Bonnet, Vaichere, Gozlan, & Giorgi, 1990).

Maintenance of a nocturnal routine with night time activity and daytime sleep on days off from work may enhance the circadian rhythm adjustment. Nurses on a full-time permanent night shift rotation (four nights on, three nights off) demonstrated better adjustment to night work than part-timers (two nights on, five nights off) as measured by oral temperature variance and subjective ratings of alertness and psychological well being (Folkard, Monk, & Lobban, 1978; Minors & Waterhouse, 1985). The improved adjustment was attributed to the greater sense of commitment to a nocturnal lifestyle with

daytime sleep from the full-time permanent night nurses. Although maintaining a nocturnal orientation on days off may help the circadian adjustment, such a proposal is unappealing to most persons due to the social isolation that occurs with a routine that is opposite your friends and families (Folkard, Monk, & Lobban, 1978; Smith & Folkard, 1992).

The causes of sleep difficulties of night workers are multi-factorial. Reasons include the lack of sleep obtained during the first 24 hours which includes the first night shift worked and environmental disruptions that occur with daytime sleep. In addition, daytime sleep is shorter and less restorative than night time sleep. These sleep difficulties may lead to chronic sleep deprivation that may effect a night shift worker's alertness and efficiency. Work and sleep schedule irregularities significantly effect the sleep wake circadian rhythm.

Circadian Factors

Our world has evolved with many patterns of rhythmicity. Human beings, as well as other living organisms, have physiologic systems that are timed rhythmically (Kleitman, 1963). A biological rhythm is a self-sustaining oscillation that occurs within a specific period. The amount of time required to complete a single repetition of the rhythm is termed the period (Moore-Ede, Sulzman, & Fuller, 1982). The length of time for one period to occur is very diverse ranging from a fraction of a second (as in the electrical activity of the brain) to about one second (the rhythmic beating of the heart) to approximately one month (the human menstrual cycle and the hibernation behavior of

some mammals) (Minors & Waterhouse, 1984). Many biological rhythms have a cycle length of approximately 24 hours. These rhythms are termed circadian rhythms (from the Latin: *circa*, about; *dies*, a day). Rhythms that oscillate more than once a day are termed ultradian and those that oscillate less than once a day are infradian. Many physiologic and metabolic functions, such as body temperature, sleep wake cycle, hormone secretion, urine production, digestive secretion, and changes in blood pressure have a circadian rhythm (Moore-Ede, Sulzman, & Fuller, 1982; McEnany & Lee, 2000). Each of these rhythms has their own unique and stable temporal relationship in respect to other internal cycles and the light, dark cycle (Minors & Waterhouse, 1981).

Secretion of many hormones takes place during night time sleep. The natural biological rhythm for secretion of melatonin, along with corticosteroids and adrenaline, is lowest during the night with higher levels of adrenaline secreted during the day. Night shift work impinges on the normal time spent sleeping thereby affecting many biological rhythms. This means that night shift workers trying to sleep during the day may still produce high levels of adrenaline, reducing the restorative value of their sleep. Conversely, low levels of adrenaline and corticosteroids during the night can cause night shift workers to be less efficient (Oswald, 1980). Melatonin is produced during periods of darkness and decreases during daylight. Melatonin secretion at night promotes sleep, though the specific mechanism is uncertain (Van Cauter & Turek, 1995).

Circadian rhythms are internally controlled (endogenous) and their timing synchronizes with external (exogenous) cues in our environment (Aschoff, 1954; Conroy, Elliot, & Mills, 1970; Minors & Waterhouse, 1983; Costa, 1996). These environmental or

exogenous stimuli are termed zeitgebers. The most powerful zeitgeber that resets the internal pacemaker is the light-dark cycle (Wever, 1979). This resetting occurs in plants, animals, and humans. Other zeitgebers include temperature, an alarm clock, noise, and mealtimes.

Both physical (e.g., daylight and darkness) and social (e.g., meal times, traffic noise) zeitgebers help realign the circadian system (Aschoff, 1981; Scott & Ladou, 1990). The social rhythm begins soon after birth with the synchronization of an infant's eating and sleep schedules. Later these social influences include the schedules of television programs, recreational activities, friends, and the school system. Once established, these social rhythms are not only important for structuring the individual's day, but also as zeitgebers that maintain daily circadian rhythms (Aschoff, 1981). Until recently, social time cues derived from social rhythms were considered to be the major zeitgebers (Wever, 1979), but recently the emphasis has shifted to the physical zeitgebers of daylight and darkness (Czeisler, Allan, & Strogatz, 1986). For the night shift worker, physical zeitgebers, as well as most of the social zeitgebers of a day oriented society, are opposed to nocturnal alignment (Scott & Ladou, 1990). Individuals who are evening types often find shift work easier to adapt to than morning types and the reason may be that zeitgeber influences are less potent for evening types than morning types (Monk & Folkard, 1985; Monk, 2000).

If people sustain a pattern of daytime sleep and night time activity the body's biological rhythms become synchronized to new cues. The time period for acclimation to a new circadian pattern is extremely variable. Some individuals can reverse their

physiological circadian rhythms in about five to seven days (Folkard, Monk, & Lobban, 1978); others up to 14 days (Rahman, 1988); and some individuals may never achieve a complete reversal of their circadian rhythm (Hawkins & Armstrong-Esther, 1978; Monk, Folkard, & Wedderburn, 1996). The circadian adjustment to night shift work takes place by a phase delay. The earlier the shift worker's phase position, the longer it takes to adjust to night shift (Costa, Lievore, & Casaletti, 1989). Morningness type people have an earlier phase position that decreases their circadian adjustment to night shift work (Breithaupt, Hildebrandt, Dohre, Josch, Sieber, & Werner, 1978; Costa et al., 1989) and is associated with the rigidity in their sleeping habits (Breithaupt et al., 1978; Costa et al., 1989; Harma et al., 1988; Ostberg, 1973).

Morning and evening type individuals exhibit differences in the response of their circadian system to night work (Patakai, 1971; Ostberg, 1973). Morning types are sleepier than non-morning types during a typical night shift. In a study conducted by Breithaupt et al. (1978), bedtimes were varied over four consecutive nights with bedtimes ranging from 9:00 pm to 3:00 am. Participants in the study included six female subjects between the ages of 22 and 30 years (3 morning types and 3 evening types). A second study was conducted by Breithaupt with eight males, ages ranging between 24 and 31 years (4 morning types and 4 evening types). Results from both studies demonstrated that evening types were able to adapt to the changing bedtimes by maintaining a longer sleep length into the morning hours. Morning types were unable to obtain their normal amount of sleep with later bedtimes due to spontaneous early morning awakenings leading to a shortened sleep time. Over the course of four nights morningness type people became

sleep deprived due to their inability to maintain a longer sleep length into the morning hours with later bed times (Briethaupt et al., 1978). The sleep patterns of 'morningness' people are more greatly affected by working night shift with a shorter sleep time and decreased tolerance to change as evident by their inability to adjust sleep length with later bedtimes when compared with eveningness type individuals. The conclusions of these two studies demonstrate that sleep patterns of morningness people are more greatly disturbed when working night shift than the sleep pattern of eveningness people.

Morningness-eveningness tendency helps predict tolerance to night work. Morningness has been found to be related to a decreased tolerance to shift work (Bohle & Tilley, 1989; Harma et al., 1988; Vidacek, Kaliterna, & Radosevic-Vidacek, 1987). In a study of 15 subjects (4 men and 11 women, mean age 41, age range 32-53 years) conducted by Jenkins-Hilliker, Muehlbach, Schweitzer, & Walsh (1992), morning types were sleepier earlier in the night than non-morning types and also demonstrated less tolerance for night shift. In this study morningness types began to demonstrate signs of sleepiness as measured by the multiple sleep latency test (MSLT) beginning at 2:30 am. Eveningness types did not demonstrate signs of sleepiness until 6:30 am. Physiological sleep tendency and subjective sleepiness overall were greater for morning type individuals during a typical night shift. The morningness type group reported significantly less daytime sleep than the non-morning type group. On average the morning type group reported sleeping approximately 1½ hours less per day than evening types. Subjective statements suggested that sleep quality may be poorer for morning types (i.e., more awakenings) than evening types. Similar results were obtained in a survey study

conducted with 957 emergency room residents (718 males and 239 females) with ages ranging from 30-33 years (Steele, Ma, Watson, & Thomas, 2000). Residents who were more evening oriented were more tolerant of night shift work. In addition, the emergency room residents with a greater night shift tolerance had an ability to overcome drowsiness, more sleep flexibility, no children at home, and were younger (Steele et al., 2000). The Steele study found that emergency room residents reported tolerating night shifts well. This tolerance of night shift was suspected to be a result of the young age of residents studied and a shorter period of time with practice experience. These two studies demonstrate that eveningness type individuals experience a greater tolerance of night shift work.

Disruption in sleep patterns may lead to excessive fatigue and subjective complaints due to a cumulative sleep deficit for morningness type people (Kerkhof, 1985; Jenkins-Hilliker et al., 1992). These self-reported subjective complaints included greater incidents of headaches, loss of weight due to gastralgia, gastrointestinal disorders, nervousness and irritation, cardiovascular complaints, disturbance in appetite (Monk, 1986), irregularity of bowel movements, dyspepsia, heartburn, and the need for sleep medications (Costa, 1996). Morningness type people had more subjective complaints and deficits of sleep when compared to eveningness people, which demonstrated a lower tolerance of night work for morningness types (Kerkhof, 1985; Jenkins-Hilliker et al., 1992; Kerkhof & Van Dongen, 1996).

For the night shift worker circadian as well as sleep factors have an effect on tolerance of night shift. Eveningness type individuals tolerate night shift better than

morningness types. Social and domestic schedules have an effect on sleep and circadian factors. The relationship between social and domestic schedules and sleep and circadian factors is reciprocal, each having an effect upon the other.

Domestic Factors

Many domestic factors influence a person's tolerance of night shift work. These domestic factors include social and family situations, home working conditions, and home environment responsibilities (i.e., number of children, age of children, marital status, spouse's work schedule). Domestic factors of a night shift worker are greatly effected by the individual's shift work schedule i.e., number of nights worked consecutively, length of shift, overtime requirements, predictability of schedule (Costa, 1996).

Night shift workers who sleep during daytime hours may be compelled to reduce their sleep length in an effort to fulfill family and social obligations that occur during daylight hours. These activities often include (a) participating in day-to-day responsibilities such as food shopping, food preparation, banking, seeking medical care, (b) child care responsibilities, and (c) partaking in school or work related meetings or classes (Costa, 1997). Fulfillment of family obligations may be accomplished at the physiological cost of less sleep (Colligan & Rosa, 1990; Knauth, 1998). The Gadbois study (1981) revealed that the amount of sleep obtained by the nurses with two or more children averaged 1.33 hours less than those nurses without children. This sleep debt was due to the delay of sleep until parenting duties were completed in the morning.

Women who work night shift have additional demands related to family life and

domestic commitments than men who work at night (Gadbois, 1981; Colligan & Rosa, 1990). The added demands often pertain to nurses, because 97% of nurses are females (American Nurses Association, 1999). The role of a mother may include many daytime obligations such as food preparation, shopping, and school and family meetings. Young women in shift work report more disturbed sleep because of child care responsibilities related to coordinating the schedules of their children who function on a sleep wake cycle opposite of the women's (Lee, 1992).

A night shift work schedule often interferes with evening social and family activities. Membership in clubs and organizations are less frequent for night shift workers than day workers, because meeting times often conflict with the night shift work hours (Bosch & Delange, 1987; Robson & Wedderburn, 1990). Earlier studies found frequent complaints from permanent night shift workers of sexual dissatisfaction related to demands of work, child rearing, domestic and social obligations, and opposite sleep schedules that make it difficult coordinate time for privacy with a partner (Mott, Mann, McLoughlin, & Warwick, 1965; Rutenfranz, Colquhoun, Knauth, & Ghata, 1977). These early studies are dated, but the research content is valuable, and more recent studies have not been found. Night shift workers may often feel a sense of isolation because their work hours and daily activities are opposite most of their families and friends (Robson & Wedderburn, 1990; Efinger et al., 1995).

Human beings are social creatures with social and domestic activities being as essential as biological functions. If a night shift worker's domestic and social life is unsatisfactory, then the individual will not be able to cope well with night shift work, no

matter how well adjusted their sleep and circadian rhythms factors may be (Walker, 1985; Colligan & Rosa, 1990; Monk, 2000). Working night shift has both biological and social implications that effect a night shift workers' life.

Consequences of Night Shift Work

Prior to the Industrial Revolution little thought was given to the quality or accuracy of work that was performed during the night time hours. During the 1950's, one of the first studies was conducted in Europe to review the quality of work that occurred during night shift. Researches found that errors in reading gas meters peaked dramatically during the night shift (Bjerner, Holm, & Swenson, 1955). Since the 1950's multiple studies have found problems related to night shift work. The United States National Highway Transportation Safety study determined that truck drivers are 16 times more likely to have an accident between the hours of 4:30 am and 6:00 am than during daytime hours (Chollar, 1998). The Association of Professional Sleep Societies' Committee of Catastrophes, Sleep, and Public Policy indicated that the nuclear plant meltdown at Chernobyl occurring at 1:35 am was due to human error related to work scheduling (Efinger et al., 1995). Similarly, the nuclear reactor accident at Three Mile Island happened between the hours of 4:00 am and 6:00 am. The accident occurred due to a stuck valve that caused a loss of coolant, but more critically as a result of a workers' failure to recognize the problem and the impending meltdown of the reactor (Grossman, 1997). The fatal National Aeronautics and Space Administrator (NASA) Challenger space shuttle accident occurred as a result of a workers' error made in the early morning hours because of a lack of sleep and extended

night work prior to the launch (Akerstedt, 1988; Czeisler, Chiasera, & Duffy, 1991). These events demonstrate the severity of consequences related to impaired alertness levels of night shift workers.

The performance of the night shift worker in terms of efficiency and productivity is lower due to the disruption of the normal sleep wake circadian rhythm (Wyatt & Marriot, 1953; Folkard & Monk, 1979; Folkard, 1988; Barton, 1994). Studies have reported a decline in mental performance and decision making in a number of industries during the hours of midnight to 6:00 am which has lead to societal consequences (Folkard & Monk, 1979; Mitler, Carskason, & Czeisler, 1988; Akerstedt, 1990; Gordon, Cleary, Parker, & Czeisler, 1986; Borland, Rogers, & Nicholson, 1986). During a study conducted by Folkard & Monk (1979) of full-time and part-time nurses working night shift (N = 48, mean age 34.7 years, worked night shift on average for 3 years), the researchers realized that the frequency of minor accidents occurring to patients during their hospital stay peaked to their highest levels at midnight and again at 6:00 am. Many of these minor accidents occurred at hours that correlated with the patients need to urinate before going to sleep and upon awakening in the morning. The frequency of accidents may be due to the nurses' or patients' decline in performance, but was not ascertained. Although, the variation in the frequency of accidents observed during the night shift likely represents an interaction between mental performance and circadian rhythms of both the nurses and patients combined with the activity patterns of the hospital (Folkard & Monk, 1979). Additional studies involving industries other than healthcare have also demonstrated an increase in mishaps during night shift and these mishaps are often more serious in nature

(Hildebrandt, Rohmert, & Rutenfranz, 1975; Mitler et al. , 1988).

The disruption of the sleep wake circadian rhythm due to the inversion of the more common daily routine hampers a night shift workers physical and psychological well-being (Harma,1995). This sleep wake cycle disruption leads to a chronic sleep deprivation that acts as a stressor on the night shift worker causing a decreased alertness (Folkard, Spelten, Totterldell, Barton, & Smith, 1995), impaired performance, worsening mood, physical fatigue, gastrointestinal disorders (Folkard et al., 1995; Costa, 1997), cardiovascular disease (Koller, Kundi, & Cervinka, 1978; Koller, 1983), reproductive difficulties, breast cancer (Nakamura et al., 1997), hardening of one's attitude, and carelessness (Grossman, 1997). A 1996 study of 55 student nurses working night shift for the first time found that "concentration, interest, energy, sleep, and appetite were significantly disturbed with night work" (Novak & Auvil-Novak, 1996, p. 460).

Shift work intolerance is likely to occur in everyone when beginning night shift work, but many are never able to adjust. The term shift work maladaptation syndrome (SMS) has been used to describe the typical signs and symptoms seen in shift workers who are intolerant of shift work. This syndrome is characterized by the following: (1) sleep disturbances, (2) chronic fatigue, (3) gastrointestinal problems including heartburn, constipation, or diarrhea, (4) alcohol or drug abuse (usually related to the self-treatment of insomnia), (5) higher rates of accidents or near misses, (6) depression, mood disturbances, malaise, or personality changes, and (7) interpersonal relationship difficulties (Scott, Monk, & Brink, 1997). People who are at greater risk of developing shift maladaptation syndrome include those who are more than 40 years of age, those living with people who

have a daytime routine, or those with a poor tolerance to sleep wake rhythm disruption (Scott & Ladou, 1990). The worker with SMS is never able to adjust to shift work; the symptoms experienced are pronounced and typically get worse with time (Moore-Ede, Sulzman, & Fuller, 1982; Scott, Monk, & Brink, 1997).

Night shift produces greater strain on family members who must accommodate their life-styles to the worker's schedule (Colligan & Rosa, 1990). For example, the wives of fixed night shift workers were less satisfied than their husbands (144 married males with children who work permanent night shift) with the amount of time the men's work schedules allowed for companionship (Mott, Mann, McLoughlin, & Warwick, 1965). This dissatisfaction may reflect different perceptions within the marriage, but it may also indicate that the maintenance of the relationship involved higher costs for the wife than for the husband. The husband's satisfaction with the relationship may be a result of the wife working harder to support his adjustment to night time work (Mott et al., 1965). Lee, Moon, & Cho (1982) found that wives of shift workers expressed an interest for a nonshift schedule for their spouses, even if it meant lower wages. These wives indicated that family activities were restricted to ensure a quiet sleeping environment for the husbands on shift work. A more recent qualitative study, conducted with 45 intensive care nurses (43 women, 2 men, mean age 34.3 years), examined nurses' perceptions of difficulties associated with night shift work (Novak & Auvil-Novak, 1996). All nurses worked 12 hour night shifts at a large metropolitan hospital in the midwest participated in a focus group study. All nurse participants but one denied that night shift work had any impact on their social or family interactions. When asked questions regarding the attitudes of spouse

and children regarding their work schedule, the majority of nurses stated that they were frequently asked by their family members when they would be able to interact with them on a more regular basis and suggested that night work impaired their interactions with friends and neighbors (Novak & Auvil-Novak, 1996).

The most common health problem that has been most associated with night shift work is that of gastrointestinal (GI) disorders (Costa, 1996). Other common health complaints from people working night shift include sleep alterations (poor sleep quality, difficulty falling asleep or staying asleep), persistent fatigue, changes in behavior (irritability, poor performance), appetite disturbances, irregularity of bowel movements, constipation, dyspepsia, heartburn, abdominal pains, and flatulence (Reinberg, Motohashi, Bourdeleau, Touitou, Nougier, Levi, & Nicolai, 1989; Costa, 1996). These complaints are a major cause for increased absenteeism (Costa, 1996). Barton, Spelten, Totterdell, Smith, Folkard, & Costa (1995) conducted a study to examine the effects of different types of shift work schedules on the health and well-being of shift workers using the Standard Shiftwork Index (SSI) questionnaire. Two different occupational groups in England and Wales participated in the study: a group of nurses and midwives working in large hospitals (400 beds or more); a group of industrial service workers in varied occupations. Completed questionnaires were returned by 1532 nurses and midwives (female 1406 and 114 male) and 332 industrial service workers (female 23 and 308 male). Within the nursing sample, 39% worked permanent night shift and the remaining worked a rotational schedule. All the industrial service workers rotated between morning, afternoon and night shifts. The majority (85%) of the industrial workers were married or living with someone,

compared with only 66.4% of the nurses. The industrial service workers were on average older with a mean age of 39.2 years compared with 33.2 years in the nurses. The results of the study reflected the differences between males and females and examined the effects of shift work as measured with the mean (M) and standard deviation (SD) scores. The females, on average, reported higher outcome scores than the males in areas related to psychological well being (females M 12.49, SD 5.32; males M 11.38, SD 4.80), digestive problems (females M 13.98, SD 4.50; males M 13.88, SD 4.76), cardiovascular problems (females M 10.29, SD 2.67; males M 10.28, SD 2.80), sleep problems (females M 19.21, SD 5.09; males M 18.44, SD 4.87), and chronic fatigue (females M 25.12, SD 7.63; males M 24.77, SD 7.41). Although, it was the males who reported the most social (females M 3.10, SD 1.16; males M 3.27, SD 1.22) and domestic disruption (females M 2.63; SD 1.16; males M 2.80, SD 1.16). The differences between the two groups were very slight.

Night shift workers are known to have a higher morbidity rate related to cardiovascular dysfunction when compared with other day and evening shift workers (Monk, 1986). Early studies questioned the association of night shift work with cardiovascular disease (Buell & Breslow, 1960; Koller, 1983; Knutsson, Akerstedt, & Jonsson, 1988; Uehata, 1991; McNamee, Binks, Jones, Faulkner, Slovak, & Cherry, 1996); however, more recent studies have found shift workers are at increased risk of cardiovascular disease (Kawachi, Colditz, Stamper, Willet, Manson, Speizer, & Hennekens, 1995; Knutsson, Hallquist, Reuterwall, Theorell, & Akerstedt, 1999; Tuchsén, 1993). More than 10 years ago, a study by Waterhouse, Minors, & Folkard (1992) showed an increased incidence of ischemic heart disease (IHD), independent of age and smoking,

with a positive correlation of increased risk of IHD to the length of time in shift work. More recently a large cohort study of 79,109 female nurses concluded that six or more years of night shift work increased the risk of cardiovascular disease (Kawachi et al, 1995). Two recent studies of permanent night shift workers demonstrated an increased risk of cardiovascular disease (Knutsson et al 1999; Tuchsén, 1993). The case-control study conducted by Knutsson et al (1999) took place over 5 years with 3,225 males and 1,423 women ages 30 to 65 years, and studied the relationship between shift work, job strain, and myocardial infarction. The study was a population based case-referent design with 2006 cases defined as first myocardial infarction. Compared to the 2642 controls who were without symptoms of myocardial infarction. A four year cohort study looked at 1,293,888 men aged 20 to 59 years of age (Tuchsén, 1993). This register-based study compiled all occupations in Denmark with all hospitalizations over a four year period of time and comparing night time worker hospitalizations with non-night time worker hospitalizations. Both studies found a positive correlation between night shift work and cardiovascular disease. Although, one recent case control study found that permanent night workers were not at an increased risk for cardiovascular disease (Steenland & Fine, 1996). Findings were limited because of the small number of night workers (only 10 male case participants worked permanent night shift out of 163). The reasons shift work has been theorized to contribute to an increase in cardiovascular disease include the following:

- (1) the irregular work hours lead to a loss of sleep related to the mismatch of circadian rhythms with the hours worked
- (2) problems within the family life as the work hours often interfere with social

activities reducing the time available for both family and recreation, which may lead to social isolation and subsequent stress

(3) poor nutritional diets (cafeteria closed at night)

(4) smoke more cigarettes

(5) a greater alcohol consumption (Knuttsen, 1989; Knuttsen et al, 1998).

Numerous consequences due to night shift work affect the worker, such as increased rate of mishaps, decreased productivity and efficiency, physical fatigue, cardiovascular disease, and gastrointestinal disorders. Consequences of night shift work are related to disturbances of both circadian rhythm and sleep. Despite the consequences many nurses actually prefer to work this shift rather than other shifts for a variety of reasons.

Preference for Night Shift

The advantages of working night shift over day or evening shift are numerous, even though night shift disrupts family and social activities. A few of these advantages include: an easier commute to work in the evening due to less traffic, and uncrowded stores during the daytime hours. Some nurses prefer to work night shift to share childcare responsibilities with their partners who work day shift (Barton, 1994). In a study of 898 female nurses in 61 French Hospitals, Gadbois (1981) reported that 85% of nurses requested night shift because it allowed them time at home with their young children. Child care providers who will work night shift hours may be difficult to find and a particularly serious problem for households with only one parent who works night shift.

Relative to evening and rotating shifts, a fixed night shift schedule often offers more time for family and social activities in the evenings. Nurses who work night shift may be able to see their children and spouse when they return home from school or work and are able to have dinner together. Night shift workers have more time for themselves on days off to do solitary activities such as gardening, hunting, fishing, and home maintenance than workers on day shift (Mott, Mann, McLoughlin, & Warwick, 1965). Also, the workload on night shift can be less than day shift, often allowing for greater autonomy and camaraderie amongst colleagues (Costa, 1996; Efinger, 1995).

Many permanent night shift nurses chose to work a night shift schedule to accommodate their families or personal educational goals. In a study conducted by Alward and Monk (1990) with 38 permanent night nurses, 42% elected to work night shift. This decision was made in an attempt to establish a more tolerable, less stressful life style. The regularity of permanent night work allows one an opportunity to build a pattern of living that copes to some extent with the unusual hours to accommodate relationships, child care, and domestic chores (Alward & Monk, 1995). Folkard, Monk, & Lobban (1978) studying a group of permanent night shift nurses, highlighted the importance of effective organization within their lives in order to cope with the adjustment to night shift work.

An individual's choice to work night shift over day or evening shift influences the degree of tolerance / intolerance experienced. In a study conducted by Barton (1994), the relationship between individual control of work hours and tolerance of night shift was examined. Participants were nurses and midwives (N = 587, 530 females, 55 males, 2 gender unknown) who worked full-time (37+ hours per week) in hospitals with 400 or

more beds throughout Wales and England. The mean age of the permanent night shift nurses was 38 years. The permanent night shift nurses had spent on average 16 years in shift work. Seventy-five percent of the permanent night shift nurses were married, and had on average 1.33 persons in the home who needed to be cared for. Of the permanent night nurses, 81% indicated that they had specifically chosen to work their present shift system. In this sample those nurses who had chosen to work night shift by self-report experienced fewer difficulties than those who did not choose to work night shift. Those who had not chosen to work nights experienced greater difficulties related to chronic fatigue, digestive symptoms, cardiovascular symptoms, domestic disruption, sleep disturbances, and psychological health (Barton, 1994).

In summary, night shift work may lead to a disruption of circadian, sleep, and domestic factors for the night shift worker and their families. Understanding the effects of these three interrelated factors will increase awareness for the specific challenges that working night shift presents. Our knowledge and awareness of circadian rhythms continues to grow, however this study hopes to reaffirm the effects of chronotype, age, and shift preference on the tolerance of night shift in a population of nurses in a small rural hospital in Bozeman, Montana. An increased awareness of the challenges presented by night shift work may help to improve the job satisfaction and working conditions for those many nurses involved in night shift work.

CHAPTER 3

METHODS

This predictive/correlational study was designed to assess the chronotype (i.e., morningness, eveningness, or neither morningness or eveningness), age, and shift preference of nurses working night shift at Bozeman Deaconess Hospital and to evaluate the relationship of these three variables to the tolerance of night shift work. The survey instruments utilized measured the circadian rhythm type, age, shift preference and tolerance of working night shift, respectively, the independent and dependent variables. Demographic data was collected to describe the population by using a self-report survey. The following sections specifically address the participants involved in the study, the instruments utilized, and methods for data collection and analysis.

Participants

The study population included approximately 30 nurses who work permanent nights at Bozeman Deaconess Hospital, a small rural hospital with 85 beds, in Bozeman, Montana. The night shift at Bozeman Deaconess Hospital begins at 7:00 pm for those who work 12 hour shifts and at 11:00 pm for those working 8 hour shifts. All nurses (RN's and LPN's) males and females who work either eight or twelve hour permanent night shift (part-time or full-time) at Bozeman Deaconess Hospital were asked to complete the survey.

Instrumentation

This survey included three written questionnaires completed by participants to measure separate components: demographics, chronotype, shift preference, and tolerance of night shift. Demographics were measured with Demographic Information (see Appendix A). Chronotype was measured with the Horne-Ostberg Morningness / Eveningness Questionnaire (see Appendix B). The self-reported perceived tolerance of night shift was measured with the demographics questionnaire and tolerance of night shift was based upon subjective health indicators as measured with the Survey of Shiftworkers questionnaire (see Appendix C).

Demographic Information

The Demographics Information questionnaire consists of 11 questions pertaining to the participant's general characteristics (i.e., age, race, marital status, and number of dependents) and clinical practice information (i.e., level of education, years of clinical practice, and area of nursing practice as well as sleep habits). Other questions request information regarding the nurse participant's bedtime routine when working night shift, self-reported tolerance of night shift, preferred shift to work, and reasons for working night shift. This questionnaire was developed specifically for this study.

Horne-Ostberg Morningness/Eveningness Questionnaire

The Horne-Ostberg Morningness/Eveningness questionnaire was developed in 1976 to determine the specific circadian rhythm type of individuals (Horne & Ostberg, 1976). The questionnaire consists of 19 fixed-choice questions about sleep - wake cycle

habits, level of alertness or fatigue, established waking or bed times, dependence upon an alarm for waking, and the ability to perform activities at various hours of the day. Each question was scored individually. Five questions (1, 2, 10, 17, and 18) have a time scale that is divided into sections with an assigned value reflecting high eveningness (1) to high morningness (5). A score of 3 indicates neither morningness or eveningness. The multiple choice questions are structured and scored such that a higher score for a question indicates morningness and a lower score indicates eveningness. The scores for all questions were totaled and and this total score reflected the circadian rhythm type based upon the five tiered Horne-Ostberg Morningness-Eveningness Scale:

<u>Circadian Rhythm Type</u>	<u>Score</u>
Definitely Morning Type	70 - 86
Moderately Morning Type	59 - 69
Neither Type	42 - 58
Moderately Evening Type	31 - 41
Definitely Evening Type	16 - 30

External validation of the Horne-Ostberg Morningness / Eveningness

Questionnaire was initially verified by comparing individual differences in the circadian type with variations of oral temperature across 24 hours (Horne & Ostberg, 1976). The reliability of the Morningness/Eveningness Questionnaire was demonstrated by Kerkhof & Van Dongen (1996). The coefficient of reliability was found to be $r = .89, p < .001$ (Kerkhof & Van Dongen, 1996). The Horne-Ostberg Morningness / Eveningness Questionnaire is used frequently to measure chronotype.

(C). The Survey of Shiftworkers

The Standard Shiftwork Index is a questionnaire designed to identify problems people may experience as a result of working shifts and was created by an independent research team, Barton, Folkard, Smith, Spelten, & Totterdell (1995). One of the aims with the development of the Standard Shiftwork Index questionnaire was to produce a set of scores that would allow for comparison with other shift working populations (Barton et al, 1995). A downfall of the SSI questionnaire is its length, it is 24 pages long and takes between 30 to 60 minutes to complete. The lengthy Standard Shiftwork Index (SSI) was modified and shortened to the Survey of Shiftworkers (SOS) by the Folkard group. The reliability for the SSI questionnaire, as measured by internal consistency, was calculated as $r = 0.76$ (Barton, Folkard, Smith, Spelten, & Totterdell, 1995). Reliability for SOS has not been reported.

The Standard Shiftwork Index questionnaire measures different aspects of shift work within two broad categories. The first section is based upon variables which influence a person's response to shift work such as individual circumstances (age, marital status, children), and personality variables (morningness, eveningness, rigidity and vigor). The second section focuses on personal outcomes for the individual, such as physical and psychological health, sleep disturbances, and social and domestic disruptions. The Survey of Shiftworkers questionnaire was adapted for this study by omitting questions that pertained to day, evening, or rotating shift workers since the study population is exclusively permanent night shift workers.

The Survey of Shiftworkers was scored as established by Folkard. The questions

for the Survey of Shiftworkers were scored individually. Sections related to sleep disturbance, fatigue, gastrointestinal disturbance, cardiac symptoms, and psychological well being were each scored separately and a cumulative score calculated for total tolerance. A total score for sleep disturbance was calculated by tallying questions 2.4, 2.5, 2.6, 2.7, 2.8, and 2.11. A higher score indicates an increase in sleep disturbance. A score for chronic fatigue was totaled from question 2.12. A higher score indicates increased fatigue. The first eight questions in section 3.10 pertained to gastrointestinal disturbance and were tallied with a higher score representing an increase in gastrointestinal disturbance. Questions 9 - 16 in section 3.10 pertain to cardiac symptoms experienced. These questions were tallied with an increased score representing more cardiac symptoms. The questions in section 3.8 were tallied to determine psychological well being with a higher score representing poorer psychological health. Coping and psychological strategies in section 5 were omitted. An overall score for tolerance was tallied by summing the scores for sleep disturbance, fatigue, gastrointestinal disturbance, cardiac symptoms, and psychological well being. The higher the total tolerance score the less tolerance the individual has for working night shift. The highest tolerance score possible is 187, while the lowest possible score is 43.

Procedures

The investigator conducted this study at Bozeman Deaconess Hospital according to both university and hospital standards. After approval from Montana State University - Human Subjects Committee, the Vice President of Patient Services at Bozeman Deaconess

Hospital was contacted to make arrangements for conducting this research study at the hospital. The Vice President of Patient Services at Bozeman Deaconess Hospital approved the procedures for this study of nurses who work permanent night shift at the hospital (see Appendix D). The Vice President of Patient Services submitted the names of nurses who work permanent night shift in all areas of the hospital to the investigator and notified the managers of each nursing department about the planned survey. The investigator met with the night shift nurses to distribute a research study information. The investigator and the Vice President of Patient Services agreed that a letter with a brief summary of the study results would be shared with Bozeman Deaconess Hospital.

To facilitate communication with the nurses and provide for anonymity, a research packet and process for returning the questionnaires was developed to distribute to potential participants. The research packet included a cover letter, the three questionnaires, and an addressed stamped envelope for mailing the survey back to the investigator. The cover letter (see Appendix E) explained the purpose and importance of the study, and that participation in the study was voluntary, addressed confidentiality of the questionnaires, and the estimated time for completion of questionnaires, and included the name and phone number of the researcher who could be contacted with questions regarding the study or questionnaires. The names of participants or codes associated with the names were not requested on the questionnaires. Each questionnaire was coded with an identification number such that each participant's responses could be collated. Completed questionnaires were mailed directly to the researcher in an uncoded pre-addressed envelope.

Nurses were invited to attend an informational meeting about the study by placing

a flyer (see Appendix F) in each permanent night nurse's mailbox. These informational meetings took place on Tuesday, January 14, 2003 and Wednesday, January 15, 2003 at the hospital approximately 15 minutes prior to the beginning of the 12 hour and eight hour night shifts (at 6:45 pm and 10:45 pm, respectively). At each meeting, nurses were told the purpose of the study, inclusion criteria, study procedures, risks and benefits of participation, estimated completion time for questionnaires, that participation was anonymous, that consent was voluntary, and the process for mailing completed questionnaires to the researcher. The nurses were informed that no consequences (positive or negative) would result to hospital employees for participating or not participating in the study. The research study packet containing the informational letter and questionnaires was available for interested participants to review. After the nurses were given an opportunity to review the research packet and ask questions, they were invited to participate in the study. All information was presented in a non-threatening manner. Any questions from the nurses regarding the study were addressed after the presentation. After questions were addressed, the research packets were given to interested nurses. Mailing of completed questionnaires signified consent for participation in the study.

One final attempt was made to encourage participation in the study. A postcard (see Appendix G) was placed in all permanent night nurses mailboxes on January 26, 2003. The postcard served as a reminder of the study, voluntary participation, and the questionnaire deadline of February 3, 2003.

Data Analysis

A combination of descriptive and inferential statistics were used for data analysis. Descriptive statistics were used to describe the population's demographics. Correlational analysis was used to evaluate relationships between chronotypes and tolerance, shift preference and tolerance, as well as age and tolerance. Hypotheses testing was done using an independent-samples t test to compare group means. Data entry and statistical analysis were completed using the Statistical Package for Social Sciences (SPSS) software version 11.5.

To describe population demographics, frequency distributions and percentages were obtained for gender, race, marital status, dependents, education, specialty area, and years of night shift experience. The analysis also included the mean age of the population, mean number of dependents in the household, mean years of experience, and mean years of night shift work. Descriptive statistics were also used to describe the preferred shifts, reasons for working night shift, and perception of night shift tolerance.

Descriptive statistics were used to identify the circadian rhythm types of the nurses (Aim 1) and describe the tolerance of the night shift nurses as measured by subjective health indicators: fatigue, sleep disturbance, gastrointestinal disturbance, cardiac symptoms, and psychological well being (Aim 2). The scores of all of these indicators were tallied to obtain a total tolerance score. Correlation was used to evaluate the association between morningness or eveningness type and tolerance of night shift (Aim 3), and an independent samples t test was used to test Hypothesis 1. An independent-samples t test was also used to test Aim 4, and accept or reject Hypothesis 2. Correlation was used to

evaluate the association between age and the tolerance of night shift (Aim 5). To further evaluate the relationship between age and circadian rhythm type, an independent-samples *t* test was used to test Hypothesis 3.

Human Subjects Committee Approval

Montana State University - Bozeman Human Subjects Committee and Bozeman Deaconess Hospital approved conduction of this research study according to their specific standards. Montana State University - Bozeman Human Subjects Committee granted approval to conduct the research study prior to the data collection at Bozeman Deaconess Hospital. A letter from the Vice President of Patient Services at Bozeman Deaconess Hospital indicating approval for this research study was enclosed with the Human Subjects application. Bozeman Deaconess Hospital does not have an Internal Review Board, the Vice President of Patient Services made the determination. A letter of approval was received from the Human Subjects Committee (see Appendix H).

Risks / Benefits to Participants

No risks or benefits were anticipated from participation in this study. This research study offered no direct benefits to participants; however, they may experience some satisfaction in assisting with research that helps to better understand the specific challenges of working night shift. Also, the night shift employee may benefit from participation by an increased awareness of circadian rhythmicity and how it pertains to them on an individual basis. No discomfort or adverse effects were anticipated from completing the questionnaires. Participants were asked personal questions, but could voluntarily choose whether to disclose information they considered private.

CHAPTER 4

RESULTS

Of the 30 eligible night nurses, 26 returned complete questionnaires for a response rate of 87%. A total of 29 questionnaires were distributed at the informational meetings held at Bozeman Deaconess Hospital and 27 questionnaires were received by the researcher in the mail. Two questionnaires were disqualified as one was completed by a hospital employee who was not a RN or LPN and another was returned unanswered. Therefore, a total of 25 questionnaires were used for the data analysis.

Description of Participants

The general demographics for the nursing population at Bozeman Deaconess Hospital were congruent with expectations for nurses in Bozeman, Montana. The majority of the participants were women ($n = 23$) (see Table 1). As expected, all participants were Caucasian. The mean age in years for the group was 35.5 with the largest majority of nurses in the 25 to 39 year age range. Most participants were married (68%). The greatest percentage (60%) of nurses did not have any dependents at home, while the remaining 40% had dependents ranging in age from 1 to 18 years. The mean number of dependents was 0.68 with the maximum number of dependents being three. In general, the participants included young white married women.

Table 1. Personal Demographics of Night Shift Nurses

<u>Characteristic</u>	<u>Frequency (N=25)</u>	<u>Percentage</u>
<u>Gender:</u>		
Female	23	92%
Male	2	8%
<u>Age in Years:</u>		
20 - 29 years	9	36%
30 - 39 years	9	36%
40 - 49 years	4	16%
50 - 59 years	3	12%
<u>Marital Status:</u>		
Married	17	68%
Separated/Divorced	1	4%
Widowed	1	4%
Single	6	24%
<u>Dependents:</u>		
None	15	60%
One or more	10	40%

All types of education and clinical specialities were represented in the study population (see Table 2). The majority of nurses were RN's with a bachelor's degree (64%). The majority of nurses worked in the medical/surgical area (40%) and Intensive Care Unit (24%). The mean number of years of nursing experience was 11.8 and the mean number of years working night shift was 8.6. The time these nurses worked night shift ranged from 5 months to 27 years. These demographics are congruent with expectations for nurses working night shift in Bozeman, Montana.

Table 2. Demographics related to Nursing Careers (N=25)

<u>Characteristic</u>	<u>Frequency</u>	<u>Percentage</u>
<u>Education:</u>		
RN - Bachelor Degree	16	64%
RN - Associate Degree	6	24%
RN - Diploma	1	4%
LPN	2	8%
<u>Specialty Area:</u>		
Labor & Delivery	3	12%
Intensive Care Unit	6	24%
Medical/Surgical	10	40%
Emergency Room	3	12%
House Supervisor	3	12%
<u>Years of Experience:</u>		
1 to 5	7	28%
6 to 10	8	32%
11 to 15	3	12%
16 to 20	2	8%
21 to 25	3	12%
25 to 30	0	0%
31 to 35	2	8%

The nurses were asked to select their preferred shift in the demographics questionnaire. Fifty-six percent of the nurses working night shift at Bozeman Deaconess Hospital stated that night shift was their preferred shift to work (see Table 3). Although, when asked to select one reason why they work night shift (see Table 4), only five nurses indicated they worked night shift because they liked working night shift. The most popular reason indicated for working night shift was that it was the only shift available.

More than half of the participants (52%) when asked directly on the demographics questionnaire perceived that working night shift was tolerated well, while no one indicated that night shift was not tolerated at all (see Table 5).

Table 3. Nurses' Self-Reported Preferred Shift (N=25)

<u>Preferred shift:</u>	<u>Frequency</u>	<u>Percentage</u>
Days	8	32%
Evenings	3	12%
Nights	14	56%

Table 4. Nurses' Self-Reported Reasons for Working Night Shift (N=25)

<u>Reasons:</u>	<u>Frequency</u>	<u>Percentage</u>
Child care	2	8%
Financial	3	12%
School	0	0%
Only shift available	15	60%
Like Night Shift	5	20%
Other job commitments	0	0%

Table 5. Nurses' Self-Reported Perception of Tolerance (N=25)

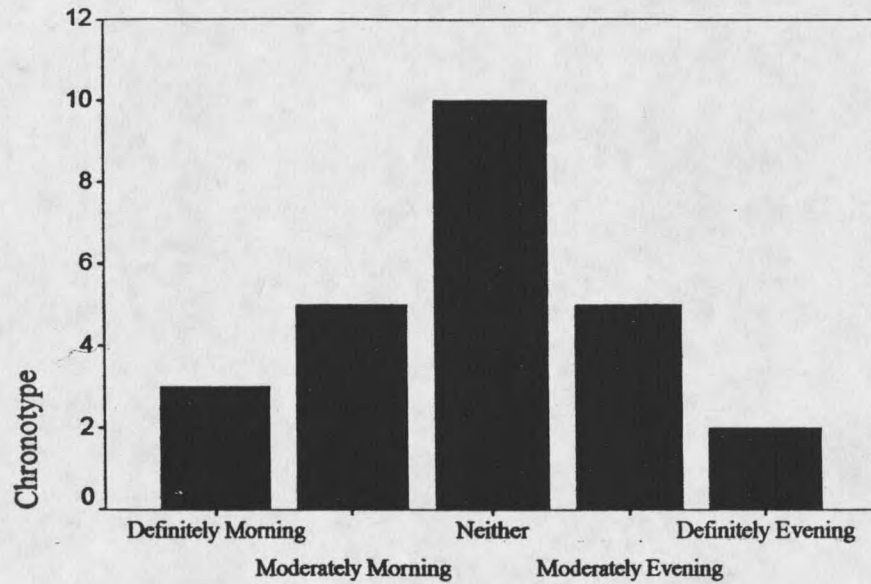
<u>Level of Tolerance:</u>	<u>Frequency</u>	<u>Percentage</u>
Tolerated Well	13	52%
Tolerated Fair	8	32%
Find it Difficult	4	16%
Not Tolerated at All	0	0%

Aim 1 was to describe / identify the nurses' chronotype or circadian rhythm type (see Table 6). The majority (40%) had no tendency towards either morningness or eveningness. Both morningness and eveningness types were represented. The distribution of circadian rhythm types was normally distributed in this population.

Table 6. Chronotype of Nurses at Bozeman Deaconess Hospital

<u>Chronotype</u>	<u>Frequency</u>	<u>Percentage</u>
Definitely Morning Type	3	12%
Moderately Morning	5	20%
Neither Type	10	40%
Moderately Evening	5	20%
Definitely Evening	2	8%

Figure 2. Bar Chart representing the Nurses' Chronotype



For Aim 2, tolerance of night shift was measured by totaling the subjective health indicators (fatigue, sleep disturbance, gastrointestinal disturbance, cardiac symptoms, and psychological well-being) (see Table 7). The highest possible score for each subjective health indicator is indicated in parentheses. Scores for sleep disturbances were relatively higher amongst these nurses and cardiac symptoms were the least prominent given the scales for each. The categories with the greatest variance in standard deviation (SD) were sleep disturbance and psychological well being. The categories with the least variance in SD were fatigue and cardiac symptoms. Measures of tolerance on SOS showed considerable variation as indicated by the SD.

Table 7. Nurses' Tolerance of Night Shift (N=25)

<u>Tolerance Type</u>	<u>Mean</u>	<u>SD</u>	<u>Range of Scores</u>
Sleep Disturbance (60)	33.40	9.10	16 to 56
Psychological Well-Being (48)	24.52	6.11	16 to 45
Fatigue (15)	7.92	3.58	3 to 13
GI Disturbance (32)	14.48	5.57	8 to 26
Cardiac Symptoms (32)	10.92	3.62	8 to 26
Total Tolerance (187)	91.24	21.63	53 to 143

A correlations analysis was first done to assess the association between morningness / eveningness type and tolerance of night shift (Aim 3). The correlation was very low with $r = .002$, indicating there was no association between the circadian rhythm type and tolerance of night shift in these nurses. A high or low degree of tolerance did not

correlate with any specific circadian rhythm type. The null hypothesis for Hypothesis 1 stating that night shift nurses self assessed as morningness types will experience less tolerance of night shift than night shift nurses self-assessed as eveningness types is, therefore accepted.

For Aim 4, an independent-samples *t* test was used to evaluate the differences in means for shift preference in nurses who reported preference for night shift and those who did not (see Table 8). Nurses who reported that day or evening shift was their preferred shift demonstrated more tolerance than nurses who stated that night shift was their preferred shift. The SD between the two groups was comparable. The *t* test was not statistically significant, $t = 1.424$, $p = .170$. The null hypothesis for Hypothesis 2, night nurses who indicate that night shift is their preferred shift will experience more tolerance of night shift than nurses who indicate their preferred shift is days or evenings, was accepted.

Table 8. Mean Tolerance of Night Shift according to Nurses' Shift Preference

<u>Variable</u>	<u>N</u>	<u>Mean</u>	<u>SD</u>	<u>Std error</u>	<u>p value</u>
Night Shift Preference	14	86.07	21.79	5.83	.183
Day & Evening Shift Preference	11	97.82	20.51	6.18	

For Aim 5 correlation and independent-samples *t* test were used to assess the relationship between age and tolerance of night shift. The correlation was very low, $r = -.042$, indicating no association between age and tolerance in these nurses. To further

evaluate the relationship, an independent-samples *t* test was used to compare mean tolerance between two groups: those individuals ≤ 35.5 years of age and those ≥ 35.5 years of age (see Table 9). Age 35.5 years was chosen because it was the nurses' mean age. Nurses 35.5 years and younger did not demonstrate any more or less tolerance than nurses age 35.5 and older. The nurses \geq age 35.5 demonstrated greater variance in SD than nurses \leq age 35.5. The results of that test were not significant further substantiating no relationship between the tolerance of night shift and age in this population.

Table 9. Mean Tolerance of Night Shift according to Nurses' Mean Age

<u>Variable</u>	<u>N</u>	<u>Mean</u>	<u>SD</u>	<u>Std Error</u>	<u>p value</u>
Age \leq 35.5 years	15	92.53	18.50	4.78	.723
Age \geq 35.5 years	10	89.30	26.62	8.42	

To test Hypothesis 3, that night shift nurses who are self-assessed as morningness types will on average be older than night nurses self-assessed as eveningness types, an independent-samples *t* test was done (see Table 10). The results of this test were significant, indicating that morning types were older than evening types. The null hypothesis was rejected.

Table 10. Mean Age of Night Shift according to Morning and Evening Types

<u>Variable</u>	<u>N</u>	<u>Mean</u>	<u>SD</u>	<u>Std.Error</u>	<u>p value</u>
Morning Type	8	41.19	8.46	2.99	.002
Evening Type	7	28.43	2.64	0.99	

Questionnaires from twenty-five nurses participated in answering the questionnaires and were used for this data analysis. The results indicated significant findings in the relationship between chronotype and age of nurses in this population. However, the relationships between chronotype, age, shift preference and tolerance were not significant in this population.

CHAPTER 5

DISCUSSION

The ability to tolerate night shift is an ongoing difficulty for nurses who work night shift. For most night shift workers, the inversion of the usual daytime working pattern with one of nighttime wakefulness and activity, followed by daytime sleep, is disruptive to their biological circadian rhythms. The purpose of this study was to evaluate the effects of chronotype, age, and shift preference on the tolerance of night shift in nurses working permanent night shift at Bozeman Deaconess Hospital to ascertain if similar to those in other populations. Circadian factors, sleep factors, as well as social factors have a role in the degree of tolerance experienced by the night shift employee. The difficulties related to working at night are well documented in the literature.

Eighty-seven percent of the 30 permanent night shift nurses at Bozeman Deaconess Hospital participated in the study. The participant demographics in this study describe nurses working night shift at Bozeman Deaconess Hospital and may be characteristic of nurses in Bozeman, Montana. The majority of the population consisted of white females. These women were well educated with most having a Bachelor of Science in Nursing, no dependents at home, and working in a variety of nursing specialties. Their mean age was 35.5 years. The majority of nurses working night shift reported night shift was their preferred shift. Although, when given an opportunity to select one reason for working night shift, few indicated they liked working night shift. Most nurses reported they worked night shift because it was the only shift available.

The first aim was to describe the population's chronotype and all circadian rhythm types were present in this group. An equal number of morning and evening types were represented, with the bulk of participants in the "neither" category. The normal distribution in this population strengthens the analysis.

Tolerance was measured by the subjective health indicators (fatigue, sleep disturbance, gastrointestinal disturbance, cardiac symptoms, and psychological well-being) (Aim 2). Because the scales of each health indicator differ they cannot be readily compared or prioritized. A comparison can be made between subjective health indicators from this present study with norms reported by the Barton, Spelten, Totterdell, Smith, Folkard, & Costa (1995) for permanent night shift nurses and industrial workers in England and Wales. Fatigue was much more prominent in the females and males in the Barton et al. (1995) study than in this study even though sleep disturbances were much more frequent in this present study. Variation in sleep disturbances, psychological well-being, gastrointestinal disorders, and cardiac symptoms experienced by the nurses in the present study were much greater than in the Barton et al. study. Variation in fatigue was smaller.

No relationship between morningness / eveningness and tolerance of night shift was evident in these nurses (Aim 3). These results are contrary to previous research study findings that evening types tolerate night shift better than morning types (Kerkhof & Van Dongen, 1996) and may be the result of the small number of individuals in this population.

The association between preference for night shift and tolerance was nil (Aim 4). Fifty-six percent of nurses had reported they preferred to work night shift. The lack of

association between preference for night shift and tolerance may reflect the adaptation that occurs over time with working night shift. Neidhammer, Lert, & Marne (1994) theorized that night shift nurses learned to cope with shift work over time and appeared to suffer from sleep disorders less frequently.

Correlational was used to evaluate the relationship between age and tolerance of night shift. The results indicated there was no association between age and tolerance in this group of nurses. The results of an independent sample *t* test comparing the group means for tolerance between nurses ages ≤ 35 years of age and ≥ 36 years of age were not statistically significant, which also showed no association.

When the relationship between chronotype and age was evaluated (Aim 5), the results were statistically significant. The positive relationship between chronotype and age are reflective of other previous studies indicating that an advancing age results in a morningness tendency (Harma, 1993; Carrier, Monk, Buysse, & Kupfer 1997).

Contrary to previous studies, this study failed to demonstrate a relationship between chronotype, age, or shift preference with tolerance of night shift for night nurses at Bozeman Deaconess Hospital. The relationship between chronotype and age was significant. However, the intent of this study was to identify the effects of circadian rhythm type, age, and shift preference on tolerance of nurses working night shift at Bozeman Deaconess Hospital. The high percentage of nurse participation in this study may reflect an increased awareness or interest on the nurses' part in learning more about the difficulties associated with night shift, though the level of awareness or interest was not measured in this study.

Strengths & Limitations

With any research study, strengths and limitations are important. One strength of the study was the rate of participation amongst the nurses at Bozeman Deaconess Hospital. Eighty-seven percent of the nurses working permanent nights returned questionnaires. Limitations of this project should be considered in evaluation of the methods and results. Limitations included (a) small population size limiting to hypothesis testing, which requires a substantial number of participants to detect a difference between groups that is significant, and (b) reorganization of the Survey of Shiftworkers questionnaire which may interfere with comparisons of results from other studies.

Implications and Recommendations

Identifying the effects of chronotype, age and shift preference on tolerance of nurses working night shift at Bozeman Deaconess Hospital, a small rural hospital in Montana, could be of benefit to the workers and employers in other rural areas in Montana and elsewhere in the United States. An improved understanding of the effects of chronotype, age, and shift preference on tolerance may help employees and employers to identify means of coping with the effects of night shift work. Similar studies evaluating these relationships have all taken place in large metropolitan hospitals (Barton, 1994; Barton et al., 1995). The effects of chronotype, age and shift preference on tolerance of night shift were not anticipated to differ between rural and metropolitan hospitals. Differences in the tolerance of night shift work in rural and urban populations suggest possible differences in nurses from a rural, western culture and has not been investigated thoroughly enough to know whether any differences are true. Further investigation into

these relationships in rural hospital nursing populations in Montana or other rural areas within the United States is a recommendation for future research.

Night shift work will always be a reality in nursing. Employers absorb the financial effects related to detrimental health effects through increased sick leave and accidents, decreased productivity, and higher turnover of employees. Tolerance of night shift will always be a challenge for nurses. The adjustment to night shift work, especially for morning chronotypes, needs to be an intentional and active process on the part of the employee with targeted measures focused on the development of a daytime sleep environment and proper sleep hygiene that promotes quality rest. An employer that provides an environment that respects circadian principles means improved quality of care for patients and improved personal and professional well-being for all night shift workers. An employer who understands the functioning of circadian rhythms can demonstrate their commitment to their employees by providing a work environment that promotes an adjustment to night shift work and acknowledges the challenges of working night shift. A work environment that promotes circadian rhythm adjustment, the health of night shift worker, and eases their adjustment to night shift includes the following suggestions: staff meetings and education course times that are convenient for attendance by employees working all shifts, ensure that night shift employees have access to healthy food during work hours when the cafeteria is closed, pay incentives that acknowledge the hardships associated with night shift work, develop a policy that allows napping during scheduled work breaks, offer access to a fitness center 24 hours a day, and prepare a tray of food on holidays or special occasions when a meal is served to the day and evening shift.

However, through studies like this one, nurses awareness of the detrimental health effects of night shift are increasing. An increased awareness and understanding of the effects of circadian rhythm types, age and shift preference and tolerance will help to acknowledge the specific challenges that night shift employees must incur. In the United States, many concerned employers are turning to chronobiologists for advice about improving their shift work schedules. Recognition of the dimensions of circadian rhythmicity will allow nursing administration, educators, and other health care leaders to better support and educate their employees regarding the adjustment to night shift and help improve the quality of each worker's health, job performance, and job satisfaction. With improved education either from nursing schools or employers of night shift workers, nurses may begin their careers with an understanding of circadian rhythm basics to allow them to develop a routine that incorporates methods for improved daytime sleep. Sleep wake circadian rhythm knowledge will help to promote habits that improve the long term adaptation to night shift work.

Summary

In summary, the difficulties related to night shift work are numerous. The disruption in the sleep wake circadian rhythm often leads to enhanced fatigue, sleepiness and sleep disturbances; decreased vigilance and attention; irritability; gastrointestinal dysfunction; cardiovascular disorders; and depression and other mood disturbances. The high percentage (87%) of nurses at Bozeman Deaconess who participated in this study may be an indicator of the developing awareness and interest in this area. All full or part time nurses at Bozeman Deaconess Hospital were asked to participate in this study by

completing three questionnaires that measured demographics, chronotype, age, shift preference and tolerance of night shift. The relationship between chronotype and age was found to be significant ($p = .002$) in these nurses, which is consistent with previous research. However, a relationship between chronotype and tolerance or shift preference and tolerance or age and tolerance was not established for these nurses, which is contradictory to previous research. A limitation is the small population of night nurses at Bozeman Deaconess Hospital. Continuing research into areas related to circadian rhythms types, age, shift preference and tolerance of night shift work may help to develop a better understanding and possibly improve advancements to ease the nurse's adjustment to night time work. Education from nursing schools or night shift employers such as hospitals and long term care facilities may help to make nurses more aware of the principles of sleep wake circadian rhythms, methods to enhance daytime sleep, and maintain harmonious relationships with family, friends, and co-workers.

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APPENDICES

APPENDIX A
DEMOGRAPHIC INFORMATION

Demographic/Supplemental Information

Please answer these questions by circling your response and/or writing in your answer (if indicated).

(1). Do you have difficulty sleeping? YES NO

If yes, please describe: _____

(2). After working night shift what is your bedtime routine?

Please describe: _____

(3). Which of the following best describes your racial/ethnic identification? Please circle.

American Indian or Alaskan Native

Asian or Pacific Islander

African American

Caucasian/White

Hispanic

Other? Please specify: _____

(4). What is your gender? FEMALE MALE

(5). What is your present marital status?

Never Married

Married or living with partner

Divorced/Separated

Widowed

(6). What is your birth date? ____/____/____

(7). How many years have you been in nursing? _____

(8). How long have you been working night shift? _____

(9). What area of nursing do you currently work? _____

(10). What is your preferred shift to work? Circle one please:

Days

Evenings

Nights

(11). How would you describe your tolerance to working night shift? Circle one please:

Tolerated well

Tolerated fair

Find it difficult

Not tolerated at all

(12). Which of the following reasons best describes your reasoning for working night shift? Circle one please:

- | | |
|-------------------|-----------------------|
| Child care | Only available shift |
| Financial reasons | Preferred shift |
| School | Other job commitments |
| Other? | _____ |

(13). Which level of education describes your nursing licensure? Do you have any degrees or education in a field other than nursing?

- LPN
 RN - Associates Degree
 RN - Bachelors Degree
 Other? _____
 Degrees/Education in a field other than nursing? _____

(14). Do you have any medical problems that effect your abilities to work night shift?

YES NO

If yes, please specify: _____

(15). Which of the following items do you experience working night shift?

- Irritability
 Fatigue
 Gastrointestinal Dysfunction
 Day time sleepiness
 Night time sleepiness
 Difficulty sleeping during the day time
 Poor concentration
 Poor work performance
 Feelings of depression
 Difficulty returning to a day time schedule
 Other? _____

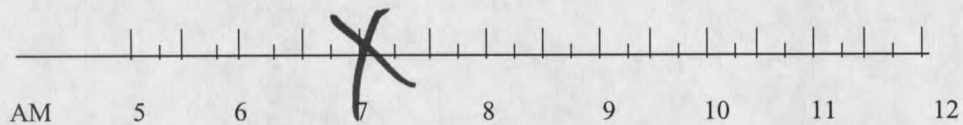
APPENDIX B

HORNE OSTBERG QUESTIONNAIRE

A). Some of the questions included in this questionnaire are psychological in nature and answering them is completely voluntary.

B). In order to correctly interpret your answers to this questionnaire, mark your responses in the following manner:

Example #1



Example #2

Not at all dependent	<input checked="" type="checkbox"/>
Slightly dependent	<input type="checkbox"/>
Fairly dependent	<input type="checkbox"/>
Very dependent	<input type="checkbox"/>

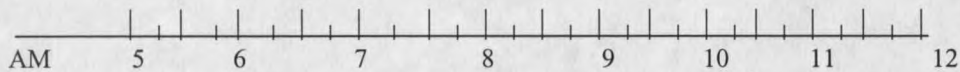
Horne - Ostberg Morningness/Eveningness Questionnaire

Instructions:

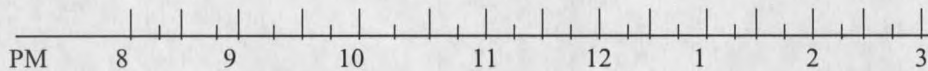
- (1). Please read each question very carefully before answering.
- (2). Answer ALL questions.
- (3). Answer questions in numerical order.
- (4). Each questions should be answered independently of others. Do NOT go back and check your answers.
- (5). All questions have a selection of answers. For each questions place a cross alongside ONE answer only. Some questions have a scale instead of a selection of answers. Place a cross at the appropriate point along the scale.
- (6). Please answer each question as honestly as possible. Both your answers and the results will be kept in strict confidence.
- (7). Please feel free to make any comments in the section provided below each question.

The Questionnaire

1. Considering only your own "feeling beat" rhythm, at which time would you get up if you were entirely free to plan your day?



2. Considering only your own "feeling best" rhythm, at what time would you go to bed if you were entirely free to plan your evening?



3. If there is a specific time at which you have to get up in the morning, to what extent are you dependent on being woken by an alarm?

Not at all dependent	
Slightly dependent	
Fairly dependent	
Very dependent	

4. Assuming adequate environmental conditions, how easy do you find getting up in the mornings?

Not at all easy	
Not very easy	
Fairly easy	
Very easy	

5. How alert do you feel during the first half hour after having woken in the morning?

Not at all alert	
Slightly alert	
Fairly alert	
Very alert	

6. How is your appetite during the first half-hour after having woke in the mornings?

Very poor	
Fairly poor	
Fairly good	
Very good	

7. During the first half-hour after having woken in the morning, how tired do you feel?

Very tired	
Fairly tired	
Fairly refreshed	
Very refreshed	

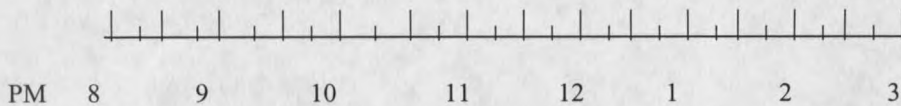
8. When you have no commitments the next day, at what time would you go to bed compared to your usual bedtime?

Seldom or never later	
Less than one hour later	
1 - 2 hours later	
More than 2 hours later	

9. You have decided to engage in some physical exercise. A friend suggests that you do this one hour twice a week and the best time for this is between 7:00 - 8:00AM. Bearing in mind nothing else but your own "feeling best" rhythm how do you think you would perform?

Would be on good form	
Would be on reasonable form	
Would find it difficult	
Would find it very difficult	

10. At what time in the evening do you feel tired and as a result in need to sleep?



11. You wish to be at your peak performance for a test which you know is going to be mentally exhausting and lasting for two hours. You are entirely free to plan your day and considering your own "feeling best" rhythm which ONE of the four testing times would you choose?

8:00 - 10:00 AM	
11:00 AM - 1:00 PM	
3:00 - 5:00 PM	
7:00 - 9:00 PM	

12. If you went to bed at 11:00 PM at what level of tiredness would you be?

Not at all tired	
A little tired	
Fairly tired	
Very tired	

13. For some reason you have gone to bed several hours later than usual, but there is no need to get up at any particular time the next morning. Which ONE of the following events are you most likely to experience?

Will wake up at usual time and will NOT fall asleep	
Will wake up at usual time and will doze thereafter	
Will wake up at usual time but will fall asleep again	
Will NOT wake up until later than usual	

14. One night you have to remain awake between 4:00AM and 6:00AM in order to carry out a night watch. You have no commitments the next day. Which ONE of the following alternatives will suit you best?

Would NOT go to bed until watch is over	
Would take a nap before and sleep after	
Would take a good sleep and nap after	
Would take ALL sleep before watch	

15. You have to do two hours of hard physical work. You are entirely free to plan your day and considering only your own "feeling best" rhythm which ONE of the following times would you choose?

8:00 - 10:00 AM	
11:00 - 1:00 AM	
3:00 - 5:00 PM	
7:00 - 9:00 PM	

16. You have decided to engage in hard physical exercise. A friend suggests that you do this for one hour twice a week and the best time for him is between 10:00 - 11:00 PM. Bearing in mind nothing else but your own "feeling best" rhythm how well do you think you would perform?

Would be on good form	
Would be on reasonable form	
Would find it difficult	
Would find it very difficult	

17. Suppose that you can choose your own hours. Assume that you worked a FIVE hour day (including breaks) and that your job was interesting and paid by results. Which FIVE CONSECUTIVE HOURS would you select?

12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11
 MIDNIGHT NOON MIDNIGHT

18. At what time of the day do you think that you would reach your "feeling best" peak?

12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11
 MIDNIGHT NOON MIDNIGHT

19. One hears about "morning" and "evening" type of people. Which ONE of these types do you consider yourself to be?

Definitely a "morning" type	
Rather more a "morning" type than an "evening" type	
Rather more an "evening" type than a "morning" type	
Definitely an "evening" type	

APPENDIX C

STANDARD SHIFTWORK INDEX

SURVEY OF SHIFTWORKERS (Adapted for Night Shift Workers)

Original Survey of Shiftworkers developed by the:

Shiftwork Research Team,
MRC/ESRC Social and Applied Psychology Unit

Professor Simon Folkard D.Sc.
Body Rhythms and Shiftwork Centre
Department of Psychology
University of Wales Swansea
Wales, U.K.

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**The original questionnaire has been adapted for the purposes of this study
pertaining to night shift workers by omitting questions that relate to day,
evening, or rotational shift workers.**

Survey of Night Shift Workers

Your General Biological Information

1.2 Age: _____

1.3 Sex: (circle one) Female Male

Your Domestic Situation

1.4 Are you: (circle one) partner

(a). Married/Living with partner

(b). Separated/Divorced

(c). Widowed

(d). Single

Your Shift Details

1.8 How many persons in your household are in each of the following age groups (exclude yourself)?

- (a). 0 to 5 years _____
- (b). 6 to 12 years _____
- (c). 13 to 18 years _____
- (d). 19 to 24 years _____
- (e). 25 to 60 years _____
- (f). 60 years + _____

1.9 How many of these need looking after by you? _____

1.10 How long have you worked altogether (i.e. total time)? _____

1.11 How long have you worked on your **present** shift system?
 _____ years _____ months

1.12. How long **altogether** have you been working shifts?
 _____ years _____ months

1.13 How many hours are you **contracted** to work for each week?
 _____ hours _____ minutes

1.14 How many hours do you **actually** work each week? (including overtime)
 _____ hours _____ minutes

1.18 For each of the shifts that you **normally work**, at what time do they start and finish? (Please use 24h time, e.g. 21:30 or clearly indicate "am" or "pm").

	START	FINISH
Night Shift	_____	_____
Other - Please specify	_____	_____

1.19 On average, how long does it take you to travel to and from work?

TO WORK **FROM WORK**

_____ min _____ min

1.21 Do you ever feel unsafe when traveling to and from work on the following shifts? (circle one)

	Almost never	Quite seldom	Quite often	Almost always
Night	1	2	3	4
Other (please specify)	1	2	3	4

1.35 Please rate your workload on night shift:

	Extremely Light	Quite Light	Average	Quite Heavy	Extre mely Heavy
Physical workload	1	2	3	4	5
Mental workload	1	2	3	4	5
Emotional stress	1	2	3	4	5

The pacing of the job I do is:

Entirely outside my control	Somewhat outside my control	In between	Somewhat under my control	Entirely under my control
1	2	3	4	5

1.29 How regular is the shift system you work?

- (a) **Regular** i.e. a fixed roster which is repeated when the cycle of shifts finishes, even if occasional variations occur to meet special requests. _____
- (b) **Irregular** i.e. the duty roster does not cycle or repeat in any regular manner and individual preferences are not taken into account. _____
- (c) **Flexible** i.e. where the individuals concerned are consulted about their preferred duty hours before the roster is drawn up. _____

1.36 What your main reasons for night working shift? (please circle one number for each)

	Not a reason for me		Partly a reason for me		Very much a reason for me
(a). It is part of the job	1	2	3	4	5
(b). It was the only job available	1	2	3	4	5
(c). More convenient for my domestic responsibilities	1	2	3	4	5
(d). Higher rates of pay	1	2	3	4	5
(e). Other (please specify)	1	2	3	4	5

1.37 All other things being equal, would you prefer to give up working shifts and get a day-time job without shifts? (circle one)

	Definitely not	Probably not	Maybe	Probably yes	Definitely yes
	1	2	3	4	5

1.40

Do you feel that overall the advantages of your shift system outweigh the disadvantages?

1	2	3	4	5
---	---	---	---	---

Your Sleep and Fatigue

2.10 At what time do you normally fall asleep and wake up at the following points within your shift system? Please use 24hour time (e.g. 22:30) or clearly indicate "am" or "pm".

	FALL ASLEEP	WAKE UP
Before your first night shift	_____	_____
Between two successive night shifts	_____	_____
After your last night shift	_____	_____
Between two successive days off	_____	_____

2.30 How many hours sleep do you feel you usually need per day? _____ hours _____ minutes

2.40 How do you feel about the amount of sleep you normally get? (Circle one number for each)

	Nowhere near enough	Could do with a lot more	Could do with a bit more	Get the right amount	Get plenty
Between successive night shifts	1	2	3	4	5
Between successive days off	1	2	3	4	5

2.50 How well do you normally sleep? (Circle one number for each)

	Extremely Badly	Quite badly	Moderately well	Quite well	Extremely well
Between successive night shifts	1	2	3	4	5
Between successive days off	1	2	3	4	5

2.60 How rested do you normally feel after sleep? (Circle one number for each)

	Definitely not rested	Not very rested	Moderately rested	Quite rested	Extremely rested
Between successive night shifts	1	2	3	4	5
Between successive days off	1	2	3	4	5

2.70 Do you ever wake up earlier than you intended? (Circle one number for each)

	Almost Always	Rarely	Sometimes	Frequently	Almost Never
Between successive night shifts	1	2	3	4	5
Between successive days off	1	2	3	4	5

2.80 Do you have difficulty in falling asleep? (Circle one number for each)

	Almost Always	Rarely	Sometimes	Frequently	Almost Never
Between successive night shifts	1	2	3	4	5
Between successive days off	1	2	3	4	5

2.11 Do you ever feel tired on: (circle one for each)

	Almost Always	Rarely	Sometimes	Frequently	Almost Never
Night shifts	1	2	3	4	5
Days off	1	2	3	4	5

2.12 The following items relate to how tired or energetic you generally feel, irrespective of whether you have had enough sleep or have been working very hard. Some people appear to "suffer" from permanent tiredness, even on rest days and holidays, while others seem to have limitless energy. Please indicate the degree to which the following statements apply to your own normal feelings. (Circle one number for each).

	Not at all	Some- what	Very much so		
I generally feel I have plenty of energy	1	2	3	4	5
I feel tired most of the time	1	2	3	4	5
I usually feel lively	1	2	3	4	5

The type of person you are

6.3 Please try to decide which response option represents your usual way of acting or feeling.

	Almost Never	Quite seldom	Quite often	Almost always
Does your mood go up and down?	1	2	3	4
Do you feel 'just miserable' for no good reason?	1	2	3	4
When you get annoyed do you need someone friendly to talk to?	1	2	3	4
Are you troubled about feelings of guilt?	1	2	3	4
Would you call yourself tense or 'highly strung'?	1	2	3	4
Do you suffer from sleeplessness?	1	2	3	4

Your Social and Domestic Situation

	Not at all		Some what		Very much
How much does your shift system interfere with your life?	1	2	3	4	5
How much does your shift system interfere with your domestic life?	1	2	3	4	5
How much does your shift system interfere with your non-domestic life (e.g. going to doctor, library, bank, hairdresser, etc.)?	1	2	3	4	5

Your Health and Well-Being

3.2 Have you suffered from any of the following (diagnosed by your health care provider)?

	Before starting shift work	Since starting shift work	Never
(a). Chronic back pain			
(b). Gastritis			
(c). Duodenal ulcer			
(d). Gallstones			
(e). Colitis			
(f). Sinusitis			
(g). Bronchial asthma			
(h). Angina			
(i). Severe Heart Attack			

	Almost Never	Quite seldom	Quite often	Almost always
How often do you complain of digestion difficulties?	1	2	3	4
How often do you suffer from bloated stomach or flatulence?	1	2	3	4
How often do you suffer from pain in your abdomen?	1	2	3	4
How often do you suffer from constipation or diarrhea?	1	2	3	4
How often do you suffer from heart palpitations?	1	2	3	4
How often do you suffer from aches and pains in your chest?	1	2	3	4
How often do you suffer from dizziness?	1	2	3	4
How often do you suffer from sudden rushes of blood to your head?	1	2	3	4
Do you suffer from shortness of breath when climbing stairs?	1	2	3	4
How often have you been told that you have high blood pressure?	1	2	3	4
Have you ever been aware of your heart beating irregularly?	1	2	3	4
How often do you feel "tight" in your chest?	1	2	3	4
How often do you suffer from minor infectious diseases, e.g. colds, flu, etc.?	1	2	3	4

3.80 The following questions deal with **how you have felt in general over the past few weeks**. Please circle the most appropriate answer for each question. Remember to concentrate on present and recent complaints, not those that you have had in the distant past.

Have you recently:

been able to concentrate on what you are doing?	Better than usual	Same as usual	Less than usual	Much less than usual
lost much sleep over worry?	Not at all	No more than usual	Rather more than usual	Much more than usual
felt that you are playing a useful part in things?	More so than usual	Same as usual	Less than usual	Much less than usual
felt capable of making decisions about things?	More so than usual	Same as usual	Less than usual	Much less than usual
felt constantly under strain?	Not at all	No more than usual	Rather more than usual	Much more than usual

felt you could not overcome your difficulties?	Not at all	No more than usual	Rather more than usual	Much more than usual
been able to enjoy your normal day to day activities?	More so than usual	Same as usual	Less than usual	Much less than usual
been able to face up to your problems?	More so than usual	Same as usual	Less than usual	Much less than usual
been feeling unhappy and depressed?	Not at all	No more than usual	Rather more than usual	Much more than usual
been losing confidence in yourself?	Not at all	No more than usual	Rather more than usual	Much more than usual
been thinking of yourself as a worthless person?	Not at all	No more than usual	Rather more than usual	Much more than usual
been feeling reasonably happy all things considered?	More so than usual	About the same	Less so than usual	Much less than usual

4.10 Are you satisfied with the amount of time your shift system leaves you for:

	Not at all		Some-what		Very much
(a). individual hobbies and/or sport activities	1	2	3	4	5
(b). group/team hobbies or sport activities	1	2	3	4	5
(c). your partner	1	2	3	4	5
(d). your close family	1	2	3	4	5
(e). friends and relations	1	2	3	4	5
(f). cultural events (cinema, theatre) / evenings out	1	2	3	4	5
(g). joining social organizations	1	2	3	4	5
(h). adult education classes	1	2	3	4	5
(i). your children	1	2	3	4	5
(j). going to the bank or post office	1	2	3	4	5
(k). going to the dentist/doctor	1	2	3	4	5
(l). shopping	1	2	3	4	5
(m). week-end outings	1	2	3	4	5

	Not at all		Some- what		Very much
(n). family outings	1	2	3	4	5
(o). yourself	1	2	3	4	5
(p). domestic tasks	1	2	3	4	5
(q). religious activities	1	2	3	4	5

GENERAL INFORMATION

Some people experience severe health, sleep or emotional problems as a result of working shifts. It is possible that completing this questionnaire may have drawn your attention to problems you experience as a result of shiftwork and/or other factors. If you feel that talking to someone might help with these problems we would strongly advise you to contact your GP. If they cannot help they should be able to put you in contact with someone who can.

**Can you please check that you have answered all the questions,
but please do not alter any of your answers.**

**If you have any comments or observations relating to your experiences as a shift
worker that have not been covered in this questionnaire we would be very
grateful if you would describe them on the back cover. Thank you!**

Thank you for filling in this questionnaire.

APPENDIX D

BOZEMAN DEACONESS HOSPITAL LETTER OF APPROVAL



Bozeman Deaconess
HOSPITAL

Atten: Research Proposal Committee
MSU College of Nursing
P.O. Box 173560
Montana State University
Bozeman, MT 59717-3560

November 18, 2002

Dear Research Proposal Committee,

I am writing on behalf of Connie Johnson, RN. Connie is a current employee at Bozeman Deaconess Hospital who has selected a research study that will include nursing staff at Bozeman Deaconess Hospital. I am in support of Connie's project; she has kept me closely apprised of her research plans.

The study that Connie is proposing does not require an internal review board to critique her project. Connie will be working with night shift crewmembers at Bozeman Deaconess Hospital and has agreed to conduct her research on non-worked time either meeting with staff before or after their shift. We look forward to the publishing of Connie's research and it's value to the furthering of the nursing practice.

Sincerely,

A handwritten signature in cursive script that reads "Susan Kerschen".

Susan Kerschen, MS, RN.
Vice President of Patient Services, Bozeman Deaconess Hospital

cc: Connie Johnson

APPENDIX E

COVER LETTER FOR QUESTIONNAIRES

January 2003

Dear Bozeman Deaconess Night Nurse,

I am seeking your voluntary participation in a nursing research study. The purpose of this study is to help us better understand the relationship between individual circadian rhythm types of nurses working night shift and whether they relate to the tolerance of working night shift. Circadian rhythm types include (1) morning type (2) evening type (3) or neither morning or evening type.

I am a graduate student at Montana State University - Bozeman (MSU) as well as a nurse at Bozeman Deaconess Hospital (BDH). As part of my master's degree requirements, I am conducting this nursing research study with nurses working night shift at BDH. For this study I am asking you to complete three questionnaires that address aspects of your work schedule, sleep patterns, symptoms experienced and general characteristics. Completion of all three questionnaires will take about 30 minutes. You are not asked to identify yourself on the questionnaires. All the information gathered on the questionnaires is kept confidential and will be handled solely by myself as the researcher and my supervising faculty committee.

A prompt response to the questionnaires is appreciated – please return the completed questionnaire by **Sunday, January 20, 2003**. Your participation is valuable. I recognize the importance of your contribution to the success of this study. I acknowledge the expenditure of your valuable time as well as the potential for apprehension by answering questions regarding issues that are very personal to you. Your participation is of no benefit to you directly other than the satisfaction in assisting with research that helps us to better understand the specific challenges of working night shift. There are no anticipated risks to you in participating. Please help me in this process by completing the attached questionnaires.

Completed questionnaires should be placed in the self addressed stamped envelope enclosed with the questionnaires and mailed directly to me. Participation in this study is strictly voluntary. Return of the questionnaires provides consent for your participation in this study.

All information that is collected will be reported in a group format without the use of names or other identifying information. A brief summary of group results will be shared with BDH; however, no individual responses will be reported. All questionnaires will be stored in a secure location for five years and then destroyed.

If you have any questions or concerns related to the study, please contact me at (406) 585-9627, or you may contact my committee chairperson, Dr. Rita Cheek, at MSU- Bozeman College of Nursing Missoula Campus, at (406) 243-2610.

Thank you for your support and participation.

Connie Johnson, BSN, RN
602 Nelson Story
Bozeman, Montana 59715

APPENDIX F

HUMAN SUBJECTS COMMITTEE LETTER OF APPROVAL



WWAMI Medical Program
 308 Leon Johnson Hall
 P.O. Box 173080
 Montana State University
 Bozeman, MT 59717-3080
 Telephone: 406-994-4411
 FAX: 406-994-4398
 E-mail: wwami@montana.edu



MEMORANDUM

TO: Rita Cheek, Connie Johnson

FROM: Mark Quinn, Chair *Mark Quinn CJ*
 Human Subjects Committee

DATE: December 27, 2002

SUBJECT: *Effects of "morningness/eveningness" type on tolerance of night shift in nurses working at Bozeman-Deaconess Hospital [RC122702]*

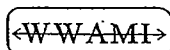
Thank you for submitting the revisions and clarifications requested by the Human Subjects Committee. This proposal is now approved for a period of one-year.

Please keep track of the number of subjects who participate in the study and of any unexpected or adverse consequences of the research. If there are any adverse consequences, please report them to the committee as soon as possible. If there are serious adverse consequences, please suspend the research until the situation has been reviewed by the human subjects committee.

Any changes in the human subjects aspects of the research should be approved by the committee before they are implemented

It is the investigator's responsibility to inform subjects about the risks and benefits of the research. Although the subject's signing of the consent form, documents this process, you, as the investigator should be sure that the subject understands it. Please remember that subjects should receive a copy of the consent form and that you should keep a signed copy for your records.

In one year, you will be sent a questionnaire asking for information about the progress of the research. The information that you provide will be used to determine whether the committee will give continuing approval for another year. If the research is still in progress in 3 years, a complete new application will be required.



MONTANA STATE UNIVERSITY - BOZEMAN



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