A DESCRIPTION OF SLEEP PATTERNS AND SLEEP HYGIENE PRACTICES FOR ADULTS IN CARDIAC REHABILITATION PROGRAMS IN SOUTHERN MONTANA

by

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TABLE OF CONTENTS

TABLE OF CONTENTS-CONTINUED

LIST OF TABLES

Table Page

DEFINITIONS

1. *Acute Coronary event.* Any cardiac occurrence leading to cardiac cell damage such as with unstable angina or a myocardial infarction (American Heart Association [AHA], 2008).

2. *Cardiac Rehabilitation.* Services that are "comprehensive, long-term programs involving medical evaluation, prescribed exercise, cardiac risk factor modification, education and counseling" (Thomas et al., 2007, p. 1615).

3. *Coronary Heart Disease (CHD).* Narrowing or blockage of the arteries and small vessels that provide nutrients and oxygen to the heart and usually primarily a result of atherosclerosis (AHA. 2008).

4. *Modifiable behavior*. A behavior that can be changed or modified through the process of continually learning and reinforcement.

5. *Reciprocal determinism.* The continual and dynamic interaction of the person, the environment in which the behavior is performed, and the behavior itself.

6. *Self-efficacy.* The individual's confidence in their ability to perform a specific behavior.

7. *Self-regulation.* The individual's ability to regulate goal directed behavior and performance.

8. *Sleep*. A natural restorative state of rest in which the eyes are closed and the body is able to repair and rejuvenate.

9. *Sleep hygiene practices.* Environmental conditions and behaviors that facilitate continuous and effective sleep.

10. *Vicarious learning.* The changes in an individual's behavior brought about by observing the actions of others and the consequences of those actions.

ABSTRACT

Despite the importance of coronary heart disease (CHD) as a major health problem and cardiac rehabilitation as a means of secondary prevention, no previous studies have been found which describe sleep patterns and sleep hygiene practices in this population. Sleep is essential for mental and physical well being and good sleep hygiene practices promote high quality sleep. Poor sleep quality can increase the risk of a myocardial infarction in persons with CHD. The purpose of this descriptive study was to describe sleep patterns and practices of adults diagnosed with CHD and participating in a cardiac rehabilitation program. Two survey tools, the Pittsburgh Sleep Quality Index and the Sleep Hygiene Index, were used to collect data on a convenience sample of 31 adults participating in cardiac rehabilitation programs located in southern Montana. The questionnaires were returned with a response rate of 69.3%. Study results indicate poor sleep quality in this sample population which was primarily due to poor sleep efficiency and sleep disturbance. Sleep hygiene practices of this sample were relatively good, with only a few areas of deficiencies observed. The findings from this study provide a basis for future research. Future research needs to approach the cardiac rehabilitation population on a larger scale and determine if specific sleep hygiene practices correlate with poor sleep quality. Nurse practitioners and other providers can incorporate this knowledge into interventions to promote sleep and sleep hygiene practices.

CHAPTER 1

INTRODUCTION

Sleep is a vital component of health. It is essential for mental and physical well being and is crucial for rejuvenation of the body. Impaired sleep quality can result in harmful effects on mental and physical well being. Impaired or disrupted sleep has been shown to cause poor concentration, reduced energy levels, altered immune function, poor wound healing, mood changes (increased impatience and irritability), increased risk of depression or anxiety, and a higher occurrence of accidents and falls, especially in the elderly (Lee, 2003; Hill, Cumming, Lewis, Carrington & Couteur, 2007). Sleep and sleep hygiene practices can be self-managed by each individual.

Sleep hygiene is a broad concept which has been described as "practicing behaviors that facilitate sleep and avoiding behaviors that interfere with sleep" (Maston, Bryson & Corwyn, 2006, p.223). Sleep hygiene practices can comprise behavioral and environmental factors. Behaviors conducive to sleep include regular exercise, regular bed times and arising times, and no daytime napping. (Brown, Buboltz & Soper, 2006; Maston, et al., 2006). Behaviors not conducive to sleep are use of stimulants such as caffeine or tobacco, engaging in exciting or emotionally upsetting activities prior to bed time and the use of alcohol (Brown, et al., 2006; Maston, et al., 2006). Sleep hygiene practices also include environmental factors conducive to sleep. Environmental factors include a mattress and pillow that are comfortable as well as sleeping in an environment that has the proper darkness, sound and temperature levels based on a persons' individual

comfort level. Even though sleep can be managed, it can still be problematic, particularly for those with CHD.

Several studies have indicated a strong association between inadequate sleep qualities with the development of coronary heart disease (CHD) (Ayes, White, Manson, Stampfer, Speizer, Malhortra, et al., 2003; Edéll-Gustafsson, Svanborg, Swahn, 2006; Schwartz, Cornoni-Huntley, Cole, Hays, Blazer & Schocken, 1998). Conversely, other studies have indicated those with CHD have a higher prevalence of sleep disturbances and problems initiating sleep (Redeker, Tamburri, & Howland, 1998; Schwartz, et al., 1998).

Promoting healthy behaviors is a driving force for healthcare practitioners attempting to decrease disease incidence and the mounting costs of healthcare. The United States government program, Healthy People 2010: Understanding and Improving Health (2000), focuses on the three objectives of health promotion, health protection and disease prevention. The primary goal for Healthy People 2010 in regards to CHD is to reduce mortality rates up to 20% by the year 2010. This reduction can be partially accomplished by targeting health promotion and behavioral modification (Centers for Disease Control and Prevention [CDC], 2004).

Even with the high incidence of CHD, intervention and risk modification usually does not occur until after a life threatening event such as a myocardial infarction (MI). Percutaneous coronary angioplasty (PCTA) or coronary artery bypass graft (CABG) surgeries are the frequent procedures following a MI, with the expected outcome of improved functional status in patients with this disease. Following an MI, a cardiac

rehabilitation (CR) program is usually initiated as a secondary prevention to help ensure recovery and to aid with specific behavior modifications that will reduce the risk of a future cardiac event.

According to the American Heart Association (AHA) (2007), CR programs are to provide counseling on nutrition, risk factors, disease process, and medications and also to encourage and provide weekly, monitored exercise for improved health. Major contributors to patient outcomes while in CR are self-efficacy and self-care behaviors. Significant declines in self-care behaviors have been noted following a major cardiac event (MacInnes, 2006; Rodeman, Conn & Rose, 1995). CR provides continual follow-up and coaching to improve self-care behaviors and decreases future hospital readmissions and death rates.

Background and Significance

Many researchers have attempted to define "normal" sleep. Normal sleep is dependent upon the individual, but all sleep patterns have been shown to have two distinct categories of sleep, non-rapid eye movement (NREM) and rapid eye movement (REM) (Honkus, 2003). The NREM stage is further subdivided into 4 separate stages with stages 3 and 4 being the ultimate restorative stages of sleep (Honkus, 2003). In these stages blood pressure, heart rate and temperature decrease and metabolic demands of the body are at their lowest (Honkus, 2003). Stage 4 is when a person is in the deepest sleep and metabolism is at its lowest point allowing for hormonal release, restoration, and healing (Honkus, 2003). During REM sleep, blood pressure and heart rate increase,

accompanied with rapid jerking eye movements (Honkus, 2003). This is the more active stage of sleep which is characterized by extreme sympathetic activation causing an increase in cerebral perfusion and peripheral vasoconstriction (Herscovici, Pe'er, Papyan & Lavie, 2007). Peripheral vasoconstriction in the REM phase has been related to increased premature ventricular contractions (PVCs) and ischemic cardiac events during sleep (Herscovici, et al., 2007).

Sleep deprivation, disorders and poor sleep quality have been linked with several conditions such as hypertension, CHD, obesity and diabetes (National Center on Sleep Disorder Research [NCSDR], 2003; Redeker, et al., 1998). Conversely, several conditions such as CHD and chronic lung disease can have negative effects on sleep quality (Hill, et al., 2007; Redeker, et al., 1998; Schwartz, et al., 1998). Several studies have also indicated that following a coronary event, people report fatigue, exhaustion and sleep disturbances (Edéll-Gustafsson & Hetta, 2001; Myrtek, Kaiser, Rauch & Jansen, 1997).

Many factors contribute to sleep patterns including sleep hygiene practices. Maintaining consistent bed times and awakening times have been shown to promote the circadian rhythm of sleep enabling the brain and body to know when to sleep and when to awaken (Brown, et al., 2006; Stepanski & Wyatt, 2003). Regular exercise can promote increased total sleep time and depth of sleep (increased slow-wave sleep) as well as decreasing sleep onset latency (Stepanski & Wyatt, 2003). Conversely, exercise within 2 to 3 hours of sleep may delay sleep onset (Youngstedt, O'Connor & Dishman, 1997). Caffeine and nicotine are both considered stimulants that will cause the release of

neurotransmitters, which, in turn, can cause a longer sleep onset latency (Brown, et al., 2006; Zhang, Samet, Caffo & Punjabi, 2006). Additionally, heavy smokers can experience acute withdrawal during sleep resulting in decreased slow-wave sleep and subsequent daytime sleepiness (Zhang, et al., 2006).

Several studies have linked good sleep practices with good sleep quality (Brown, et al., 2006; Petit, Azad, Byszewske, Sarazan & Power, 2003). Recently, there has been increased attention in the areas of sleep quality and poor sleep practice. This is largely in part, due to the billions of dollars spent annually on sleep problems, but also due to the increased awareness of the negative effects on health and disease states (Hill, et al., 2007). Sleep has been given little consideration in persons with CHD but current research indicates poor sleep quality and patterns can have a direct effect on CHD (Ayes, et al, 2003; Edéll-Gustafsson, Svanborg & Swahn, 2006; Schwartz, et al., 1998).

The increasing incidence of persons with CHD continues to be of foremost concern. The prevalence of CHD in the United States in 2005 was 16,000,000 adults over the age of 20 and it was further calculated that someone would die every minute from a coronary event (AHA, 2008). In 2006, adults with CHD required more than 4.2 million emergency room visits, 71 million practitioner visits, and over 2 million hospital readmissions (AHA, 2008).

In 2008, direct and indirect costs for CHD were estimated at $156.4 billion in the United States (AHA, 2008). According to the Agency for Healthcare and Research Quality (AHRQ) (2005), due to CHD, over 227,774 CABG surgeries and 749,577 PTCA procedures were performed in the year 2005. Included in indirect costs are items such as

diagnosis and treatment of hypertension, hyperlipidemia and depression, loss of productivity and mortality and morbidity (Desiderio, Whaddy, Gersh, Soares & Oliveira, 2003; Gallo, Male, Gilbertson & Moore, 2005).

Modifiable behavioral risk factors that contribute to CHD are diets high in fat and cholesterol, smoking tobacco, physical inactivity, alcohol consumption, and dysfunctional sleep (CDC, 2007). At least 90% of patients with CHD have at least one modifiable behavioral risk factor (CDC, 2007). These preventable risk factors have not only been addressed in Healthy People 2010 but have also been the target of other credible organizations such as the AHA and the CDC in attempt to reduce the cost, mortality, and morbidity of CHD. Reducing these behavioral risk factors has been one of the primary goals in the treatment and prevention of CHD (Bankier, Littman, Rees, Ebrahim, & Ades, 2002; Kang, Koh, Cha, Park, Baik, & Chang, 2005).

CR programs are aimed at secondary prevention with target areas of exercise, nutrition, risk behavior modifications, medication adherence, stress management and monitoring blood pressure and cholesterol levels (Child, 2004; Rodeman, et al, 1995). CR programs are typically divided into 3 distinct phases. Phase I begins in the hospital following an acute coronary event and is considered inpatient CR (Thomas, King, Lui, Oldridge, Piña & Spertus, 2007). Phase II occurs in the outpatient setting directly following an event and is considered the main CR program (Thomas et al., 2007). The average length of this phase is 10 to12 weeks with participants attending 1 to 2 hour sessions three times per week. Phase III usually consists of preventative and rehabilitation follow-up by the patient's primary care provider and is considered the long-

term outpatient CR (Thomas et al., 2007). Currently the bulk of patient information in regards to areas of behavioral change and health improvement is delivered in Phase II (Thomas et al., 2007). Several studies have indicated that patient adherence to recommended behavioral modifications decreases after the completion of Phase II if continual assessment, coaching and education are not done (Child, 2004; Rodeman, et al., 1995; Sin, Snaderson, Weaver, Pemberton & Klapow, 2004; Thomas et al., 2007).

Two important components of health behaviors addressed by most CR programs in Phase II are weight management and exercise (Child, 2004; Thomas et al., 2007). Weight management is usually individualized and education and behavioral modifications are directed towards dietary changes and exercise. Exercise is an important aspect of a person's rehabilitation following a cardiac event. Regular exercise of at least 30 minutes per day for 3 to 4 days per week will result in a 25% reduction in having another cardiac event and a 25% reduction in overall mortality following a cardiac event (Moore, Charvat & Gordon, 2006). Participation in regular physical activity not only improves fitness, but also improves cardiac performance and reduces weight as well as lowers blood pressure and cholesterol levels and promotes good sleep quality (Sin, et al., 2004; Stepanski & Wyatt, 2003).

Good sleep quality is vital for health maintenance and promotion. Previous research has identified poor sleep quality and fragmented sleep in persons with CHD and in persons who have experienced an acute coronary event. CR programs facilitate self-care behaviors to promote health in those with CHD and sleep is an essential component

of health that can be managed by each individual. Little research is available in regards to sleep patterns and sleep hygiene practices of adults in CR programs.

Purpose

With the primary focus of CR on improving self-care behaviors, it was intended for this study to provide an overview of sleep patterns and sleep hygiene practices in this population. The purpose of this research study was twofold. The first purpose was to describe the sleep patterns and quality of persons who are near completion of Phase II in a CR program. The second purpose is to describe the sleep hygiene practices of this same population. Very little research is available in the area of sleep patterns and practices of CR participants. With the primary focus of CR on improving self-care behaviors, this study will provide an overview of sleep patterns and practices for this population.

Theoretical Framework

The theoretical framework used for this study is Bandura's Social Cognitive Theory (SCT). The SCT was developed in 1977 by Bandura from the Theory of Social Learning by adding the self-efficacy factor (Perry, Baranowske & Parcel, 1990). Bandura recognized that human behavior was complex, multifaceted, and could be easily shaped by outside factors (Perry et al., 1990). This theory describes a process called reciprocal determinism in which the person, environment, and behavior are continually interactive with each affecting the other (Bandura, 2001). Personal factors affecting human behavior could be in the form of cognition, affect, or biologic events. Environmental factors could

be either the social environment, which includes family and friends, or the physical environment (Bandura 2001).

Bandura viewed human functioning as a constant interplay between person, environment, and behaviors and believed they were a continual influence upon each other. His view of human functioning takes into account that people are vicarious learners and can be proactive, self-regulating, and self-reflective (Bandura, 2001). Bandura theorized people have a strong capacity to evaluate and postulate outcomes of actions based on prior experience and by observing behaviors of other people (Perry et al., 1990). People are able to reflect on their experiences and, depending on their internal values and beliefs, persuasion from others and self logic, they will either repeat the behavior or change it (Bandura, 2001). Through this self-regulatory process, acceptable behaviors are usually reinforced by peers, friends, and family, and behaviors will typically be repeated. Bandura, believed vicarious learning was continually reinforced through this means of social persuasion until mastery of the behavior was obtained. Within this theory Bandura expressed the importance of self-efficacy.

Self-efficacy is the individual's confidence in their ability to perform a specific behavior. Self-efficacy is a strong determinant for behavioral change and influences personal performance in people, despite obstacles that may be present (Bandura, 2001). Self-efficacy and self-care behaviors are the primary targets for goal achievement in CR. Sleep can have a significant effect on self-efficacy and personal performance goals (Eden, 2006). Excessive sleepiness has been linked to a decrease in self-regulating behaviors, increased procrastination, and decreased motivation to obtain goals (Eden,

2006). It is essential to identify intentional or unintentional self-care behaviors regarding sleep in persons with CHD in order to promote self-efficacy for self-care in sleep. By utilizing SCT in CR, providers can promote self-efficacy in sleep.

CHAPTER 2

LITERATURE REVIEW

Introduction

A review of the literature was performed using the Cumulative Index to Nursing and Allied Health Literature (CINAHL) and Public/Publisher MEDLINE (PubMed) as the primary search engines. The purpose of this literature review is to investigate current knowledge of sleep patterns and sleep hygiene practices in persons with CHD who are participants in a CR program. The intent is also to examine current literature in regard to risk behaviors addressed in CR programs and how they have an impact of sleep. CR programs are goal directed to improve self-care behaviors and increase self-efficacy. Sleep is an important behavior that has many effects on other areas addressed in CR and, conversely, can be affected by those areas. The literature review contains a summary of research on sleep, sleep hygiene practices, CR and modifiable behaviors addressed in CR and how they may affect or be affected by sleep.

Sleep

Sleep Patterns

Sleep deprivation, dysfunction, and fragmentation have been linked to chronic disease states, one being CHD, and therefore the risk of MI or reoccurrence of MI increases (Edéll-Gustafsson, et al., 2006; Hayashi, Fujimoto, Uchikawa, Imamura, & Kubo, 2003; Leineweber, Göran, Janszky, Åkerstedt & Orth-Gomér, 2003; Redeker,

Ruggiero, & Hedges, 2004; Schwartz,et al., 1998). Minimal research has been done on sleep patterns prior to an acute coronary event such as an MI. In the Framingham study, Eaker, Pinsky & Castelli, (1992) reported on 749 women between the ages of 45 and 65 years old, free of CHD at baseline and followed for 20 years. If women reported trouble initiating sleep, there was a relative risk of 3.9 of having an MI or dying from CHD, after adjusting for age, cholesterol, diabetes, smoking tobacco, and increased BMI.

Other researchers have indicated the critical need to assess sleep disturbances and complications following an MI (Edéll-Gustafsson & Hetta, 2001; Redeker, et al., 2004). The complications of sleep disturbances can become cyclic with sleep disruptions contributing to health issues such as increased stress, obesity, and fatigue and in reverse, health issues contributing to sleep disruptions (Edéll-Gustafsson & Hetta, 2001; Redeker, et al., 2004). Edéll-Gustafsson & Hetta (2001) performed a descriptive comparative study in which 92 participants were assessed on sleep habits and quality of life six months and one year following a PCTA. This study discovered that maintaining sleep was listed as the greatest problem following a PCTA with pain, palpitations, or respiratory problems causing the shortened durations in sleep. The outcome of fragmented sleep in this study was excessive tiredness and fatigue which resulted in a decrease in reported quality of life.

Leineweber et al. (2003) conducted a 5 year case-control study with 292 female participants, under the age of 65 years, who had experienced an acute coronary event and were diagnosed with CHD. This study evaluated sleep problems such as early awakening, delayed sleep onset, snoring, and disturbed sleep on the prognosis of CHD. Women with

poor sleep quality had a higher risk (2.5 times) of a new coronary event during the 5 year period as compared with women with good sleep quality even after controlling for depression (Leineweber, et al., 2003).

Edéll-Gustafsson et al. (2006) conducted a comparative-correlation study of 135 individuals (47 women and 88 men) with a history of stable angina. Structured interviews with the Uppsala Sleep Inventory (USI) were used to assess habitual sleep, sleep disturbances, and daytime distress due to poor sleep over the 30 days prior to coronary intervention. This study indicated women were at higher risk than men for poor sleep quality and sleepless behaviors the month prior to having a coronary procedure such as stent placement or PCTA. Data, also, indicated that 41% (n=40) of the male sample reported similar sleepless behaviors as the women, but not necessarily the poor sleep quality. The researchers were unable to identify specific reasons for this difference. These researchers also concluded that clinical practice may benefit from further research in the area of sleep prior to cardiac events.

Sleep Hygiene Practices

Sleep hygiene practices encompasses a variety of behaviors and environmental factors that may affect sleep quality. Inadequate sleep hygiene was introduced as a diagnostic category in the International Classification of Sleep Disorders (ICSD) in 1991 with the new definitions appearing in the 2005 edition by the American Academy of Sleep Disorders. A person must have a sleep complaint and exhibit only one of the listed behaviors in order to qualify for this diagnosis (Table 1). Currently, several sleep hygiene practice studies, in varying populations, have been based upon or have referenced these

diagnostic criteria (Brown, et al, 2006; Lebourgeois, Giannotti, Cortesi, Wolfson & Harsh, 2005; Stepanski & Wyatt, 2003).

Table 1. Features of Inadequate Sleep Hygiene Practices

1. Daytime napping at least two times each week.
2. Having variable bedtimes and awakening times.
3. Experiencing frequent periods (2-3 times per week) of extended amounts of time spent in bed.
4. Routinely using products containing alcohol, tobacco, or caffeine in the period preceding bedtime.
5. Scheduling exercise too close to bedtime.
6. Engaging in exciting or emotionally upsetting activities too close to bedtime
7. Frequently using the bed for activities other than sleep (e.g., watching TV, reading, studying).
8. Sleeping on a uncomfortable bed (e. g., poor mattress, inadequate blankets).
9. Allowing the bedroom to be too bright, too stuffy, too cluttered, too hot, too cold, or in some way not conducive to sleep.
10. Performing activities demanding high levels of concentration shortly before bed.
11. Allowing mental activities, such as thinking, planning, and reminiscing to occur in bed.

Minimal research has been conducted linking sleep quality and sleep hygiene practices. Lebourgeois et al. (2005) conducted a study with 776 Italian and 572 American adolescents, between the ages of 12 to 17 year old, to examine the relationship between self-reported sleep qualities and sleep hygiene practices. Italian adolescents had better sleep hygiene practices and substantially better sleep quality as compared with the American adolescents. The results of this study indicated a moderate relationship for both

the Italian participants ($r = 0.40$, $p < .001$) and the American participants ($r = 0.46$, $p < .001$) between sleep quality and sleep hygiene practices.

Brown, Buboltz, & Soper (2006) conducted a study of 124 undergraduate psychology students to determine if there was a relationship between sleep hygiene knowledge, sleep hygiene practice, and sleep quality. The findings of this study suggested sleep practices are moderately related to overall sleep quality ($r = 0.49$, $p < .001$), but there was a weak association between sleep hygiene knowledge and sleep hygiene practices ($r = 0.30$, $p < .001$).

Cardiac Rehabilitation

In 2007 the American College of Cardiology (ACC) teamed up with the American Heart Association (AHA) to develop a multi-faceted approach to improve CR programs by developing and implementing performance measures for CR referral and delivery of care (Thomas et al., 2007). The reasoning, in part, for this was the need for standardization in order to guide patient care and improve patient outcomes. The primary goal of standardization was to improve self-efficacy in this population. Standardization occurred in the focus areas for secondary prevention which include exercise and diet, along with management of weight, smoking cessation, stress reduction, blood pressure, and high cholesterol management (Balady, et al.,2000; Bankier et al., 2002; Child, 2004; Leon, et al., 2005; Lisspers, Sundin, Öhman, Hofman-Bang, & Nygren, 2005; Thomas et al., 2007).

Several studies have shown self-efficacy improves during CR and continual coaching in CR can improve self-care behaviors (Child, 2004; Gardner, et al., 2003; Moore, et al., 2006; Scholz, Knoll, Sniehotta, & Schwarzer, 2006; Vale, et al., 2003). Gardner et al. (2003) conducted a study on self-efficacy with 472 participants (358 male and 114 female) who were enrolled in a CR following a MI, surgical revascularization, or a percutaneous coronary intervention. Self-efficacy was measured at the initiation of CR and at the end of the program. It was concluded that both male and female self-efficacy improved by the end of the CR program for all diagnoses.

In a randomized controlled trial, Vale et al. (2003) studied the effects of the use of "Coaching Patients on Achieving Cardiovascular Health" (COACH) methods for 792 cardiac patients. They randomly assigned patients who had been hospitalized for a CABG, MI or unstable angina to two groups. During the study, the patients in the COACH group received regular personal coaching via mail and telephone, weekly, in an attempt to reach their target goals for their individualized cardiac risk factors. The usual care consisted of a 2 week and 6 month follow-up appointment with their primary care provider. Based on the results, the researchers concluded coaching was a highly effective strategy in reducing modifiable risk factors using continual behavioral modification support.

Modifiable Risk Behaviors and Sleep

Persons with CHD have several modifiable risk behaviors. By addressing these behaviors, patient outcomes improve and the risk of having a repeat coronary event

decreases (Edéll-Gustafsson, et al., 2006; Hayashi, et al., 2003; Leineweber, et al., 2003; Redeker, et al., 2004; Schwartz, et al., 1998). Those modifiable behaviors which influence sleep in a positive way are smoking cessation, regular exercise, weight control, and stress management. Sleep can be negatively affected by tobacco use, lack of regular exercise, increased BMI or excessive stress.

Smoking

Research has indicated smoking tobacco can lead to sleep fragmentation, decreased total sleep time, and delayed sleep onset latency (Wetter & Young, 1994; Zhang, et al., 2006). In a longitudinal, epidemiologic study of 3,516 adults, Wetter & Young (1994), determined smokers had fragmentation of sleep, difficulties initiating sleep, and decreased restorative sleep due to either the stimulant effects of nicotine or the possibility of early withdrawal symptoms. Sleep fragmentation resulted in excessive complaints of daytime sleepiness, decreased energy, and lack of concentration. In a longitudinal study, the Sleep Heart Health Study (SHHS), Zhang et al. (2006) determined smokers, when compared with non smokers, had less total sleep time, longer latency to sleep onset, and lower sleep efficiency due to prolonged stage 1 sleep and less time spent in the restorative sleep stages of 3 and 4.

Smoking cessation has been targeted as a modifiable risk behavior to improve outcome goals in CR programs. Smoking increases other risk factors and disease states which are addressed in CR such as hypertension, lipids, and obesity (Bankier et al., 2002; Child, 2004; Holtrop, Corser, Jones, Brooks, Holmes-Rovner & Stommel, 2006; Htoo, Talwar, Feinsilver & Greenberg, 2004; Tzou, Vitcenda & McBride, 2004; Zhang, et al.,

2006). Tobacco use is considered the most important cause of preventable heart disease and disability in the United States (AHA, 2008).

Exercise

Routine exercise, 30 minutes per day, 3 to 4 days a week can improve sleep duration, sleep onset latency, and quality of sleep (Montgomery & Dennis, 2002; Moore, et al., 2006; Morin, Black & Reid, 2000; Resnick, et al., 2006). Routine exercise is a vital component of CR programs and is used primarily to improve cardiac function and also to reduce weight, and control blood pressure, and lipids levels (Moore, et al., 2006; Morin, et al., 2000; Sin et al., 2004; Sniehotta, et al., 2005).

Several studies have been done, in a variety of populations in regards to sleep quality and regular exercise. In a 16 week, randomized control trial of healthy adults between the ages of 50-76 years old, King, Oman, Brassington, Bilwise, and Haskell (1997) had participants exercise 4 days a week, with 30 minutes of exercise that induced a 60% increase in heart rate. The researchers concluded older adults, with moderate sleep complaints, can improve their self-rated sleep quality and duration by initiating a regular moderate-intensity exercise program.

Weight Control

Decreased activity and obesity have been linked to sleep disturbances (Gary & Lee, 2007) and, in turn, sleep deprivation has been linked to obesity and fatigue resulting in decreased desire to exercise (American Thoracic Society, 2006; Gary & Lee, 2007). Some studies indicate metabolic hormone function may be affected by a shortened sleep

duration (Spiegel, Tasali & Penev, 2004; Taheri, Lin, Austin, Young & Mignot, 2004). Taheri, et al. (2004) conducted a study of 1,024 volunteers from the Wisconsin Sleep Cohort Study between the ages of 30 and 60 years old. They collected data from overnight studies, mailed sleep surveys, and 6 day sleep diaries. Polysomnographic measures of acute sleep were taken prior to the fasting blood draws. The authors concluded, persons with short sleep duration (< 8 hours) had reduced leptin and elevated ghrelin levels. Reduced leptin, a neuroendocrine factor, signals the brain to increase feeding and decrease energy expenditure (Taheri, et al., 2004). Increased ghrelin levels result in increased hunger and decreased fat utilization therefore resulting in an increased body mass index (BMI).

Other studies have also indicated an association between short sleep duration and increased body weight, increased risk for obesity, and increased abdominal adipose tissue (American Thoracic Society, 2006; Patel, Malhotra, White, Gottlieb & Hu, 2006; Stranges, et al., 2008). Based on the 30 year Nurses' Health Study, in 2006, the American Thoracic Society (ATS) released a statement reporting that, on average, women who reported less than 5 hours of sleep in 1986 were 32% more likely to experience a major weight gain (defined as more than 33 pounds) and had a 15% chance of becoming obese over the next 16 years compared to the women who slept 7 hours or more. The women with less sleep weighed more on average at the end of 16 years than the women who slept 7 hours or more.

Stranges et al. (2008) conducted a prospective cohort study of 10,308 white-collar British civil servants between the ages of 35 to 55 years old. This study was known as the

Whitehall II study and ran in 2 phases in which data was collected in 1997 to 1999 and 2003 to 2004. They looked at the incidence of obesity (BMI ≥30) as compared with non-obese persons at baseline. In the cross-sectional analysis, a short duration of sleep (≤ 5 hours) was associated with a higher body mass index, higher waist circumference, and increased risk for obesity.

Stress

Stress when paired with sleep can be complex and bi-directional (Edéll-Gustafsson, et al., 2006; Hall, Buysse, Reynolds, Kupfer & Baum, 1996; Meerlo, Sgoifo, & Suchecki, 2008). Stress and insufficient sleep often make up a vicious circle in which inability to sleep may cause an increase in a person's perception of stress and increased stress may delay sleep latency onset (Meerlo, et al., 2008). Edéll-Gustafsson et al. (2006) conducted a comparative-correlation study of 47 women and 88 men with CHD, who were scheduled to undergo coronary angiography. Structured interviews using the Uppsala Sleep Inventory, the Epworth Sleepiness Scale, the Vicious Cycle of sleeplessness scale, and the Reaction to Sleep Loss scale, were used to assess sleep quality, sleep habits, and effects of sleep loss. Stress management was assessed using the Perlin's sense of mastery, self-esteem scale and self-denigration. The results of this study indicate a low sense of mastery was associated with increased cognitive behavioral fatigue ($r = 0.41$, $p < .0001$) and physical symptoms were related to stress ($r = 0.33$, $p < .0001$). The authors concluded that "poor sleep quality reduces the patient's resilience to stress through a diminished ability to cope (p.84)".

Knudson, Ducharme, & Roman (2007) conducted telephone interviews in a random sample of 1715 American full-time employees to assess poor sleep quality over the past month with the primary focus on 3 areas of sleep quality. The three areas they compared with job stressors were total sleep time, sleep onset, and sleep efficiency. Self reported job stressors were positively associated with sleep problems for all 3 areas of sleep quality.

Summary

A review of the literature indicates poor sleep quality increases the risk of MI or reoccurrence of MI in individuals (Edéll-Gustafsson, et al., 2006; Hayashi, et al., 2003; Redeker, et al, 2004). Sleep directly or indirectly affects risk factors for CHD such as smoking tobacco, exercise, weight, and stress which are addressed in CR programs. Despite the importance of CR for persons with CHD, few studies were found that looked at sleep patterns and no studies were found about sleep hygiene practices of this population. Therefore, it would be valuable to determine the sleep patterns and sleep hygiene practices of this population.

CHAPTER 3

METHODS

Introduction

The purpose of this study was to describe sleep patterns and sleep hygiene practices in persons who are near completion of phase II in a CR program. Two questionnaires, the Pittsburgh Sleep Quality Index (PSQI) and the Sleep Hygiene Index (SHI), were distributed to a convenience sample of participants at three separate CR facilities. This design was chosen to provide a broad overview of sleep practices and patterns of persons in CR programs in southern Montana. The methods for this study are explained in detail in the following sections of this chapter.

Design

In order to evaluate the sleep patterns and sleep practices of persons in cardiac rehabilitation, a descriptive, cross-sectional survey was conducted. Two survey tools, along with a demographic questionnaire, were used to collect data on CR participants. This design allowed for confidentiality of the participants without information being skewed by interviewer bias. The surveys and the demographic questionnaire are appropriate for this descriptive study and will provide data on the quality of sleep and recommended sleep practices.

Sample

The target population was adults, diagnosed with CHD who are active participants in a cardiac rehabilitation program located in Southern Montana. There are a total of 25 CR facilities located in Montana with five of those located in the Southern portion of the state. Due to the vast size of the state, a convenience sample of persons participating at a CR facility located in Billings, Bozeman and Livingston, Montana constituted the study sample sites. Three sites were chosen to obtain adequate numbers of participants and as a matter of location convenience for the researcher. Eligibility criteria for this study included persons who were: 1) adults 21 years or older, 2) able to speak, read, and write in English, 3) diagnosed with CHD, and 4) participating in a CR program for a minimum of 9 weeks. Participants were excluded if they 1) participated in CR less than 9 weeks or 2) were diagnosed with Alzheimer's disease, insomnia, or dementia.

Instruments

Pittsburg Sleep Quality Index

The Pittsburg Sleep Quality Index (PSQI) was selected from numerous instruments available to assess sleep patterns. Devine, Hakim, & Green (2005) identified six instruments to measure sleep: the Leeds Sleep Evaluation Questionnaire, Basic Nordic Sleep Questionnaire, Medical Outcomes Study-Sleep Problems Measures (MOS-SPM), the Sleep Dissatisfaction Questionnaire, Pittsburgh Sleep Diary, and the Pittsburgh Sleep Quality Index (PSQI). Of these six, it was determined the MOS-SPM and the PSQI both had undergone psychometric evaluation on multiple populations. Both of these

instruments have been used in diverse clinical populations, are similar in length and ease of administration, and assess sleep over the past 28 to 30 days (Devine, et al. 2005). The PSQI had a stronger established validity, reliability, responsiveness and interpretability, whereas the MOS-SPM has minimal data on responsiveness and no available data on interpretability (Buysse, Reynolds, Monk & Timothy, 1989; Devine, et al., 2005). For these reasons the PSQI was chosen for this study.

The PSQI (see Appendix A) is a self-rated, 19-item instrument intended to assess sleep quality and sleep disturbance over the previous 30 day period in clinical and nonclinical populations (Buysse, et al., 1989). The 19 items which evaluate subjective sleep duration, efficiency, disturbances, quality, and latency along with sleeping medication use and daytime dysfunction generate seven component scores. According to specific scoring instructions, each of the seven component scores yields a score ranging from 0 to 3. These scores are totaled for a global PSQI score with a sum greater than 5 indicating sleep problems. The PSQI has internal consistency with a reliability coefficient (Cronbach's alpha) of 0.83 for its seven components (Buysse, et al.). The PSQI global score has been demonstrated to have good internal reliability (Cronbach's $\alpha = .83$) and equally good test-retest reliability ($r = .85$). Buysse, et al. reported an overall sleep quality index score of 5 or more correctly identified 88.5% of all the patient controls ($\kappa = .75$, $p < .001$), indicating a specificity of 86.5% and a sensitivity of 89.6%. The PSQI has been used in several studies and is well regarded in the sleep research community as an accurate measurement of sleep quality (Brown, et al., 2006; Buysse, et al; Devine, et al., 2006).

The Sleep Hygiene Index

The Sleep Hygiene Index (SHI) (Mastin, Bryson, & Corwyn, 2006) was selected to measure sleep practices for this study (see Appendix B). Upon searching for reliable instrumentation in regards to sleep practices only two instruments were identified, the Sleep Hygiene Awareness and Practice Scale (SHAPS) and the SHI. The SHAPS contains three sections: sleep hygiene awareness, sleep hygiene practices, and caffeine knowledge. This questionnaire is lengthy, containing two sub-sections in the sleep hygiene awareness section. The first subsection has 13 items to measure participant knowledge of activities that are disruptive to sleep. The second subsection assesses caffeine knowledge and has 19 items to measure participant awareness of food, beverages, or drugs that are disruptive to sleep (Brown, et al., 2006). The practice section of the SHAPS contains an additional 19 items asking participants how many nights per week they engage in activities that promote or inhibit sleep (Brown, et al., 2006). The caffeine knowledge subsection and sleep hygiene practice section had modest internal reliability (Cronbach's $\alpha = .55$ and $\alpha = .47$ respectively). The sleep hygiene awareness section demonstrated an acceptable internal reliability (Cronbach's $\alpha = .78$) (Brown, et al., 2006). Since both of these instruments have been used minimally, the SHI was chosen due to its brevity and ease of administration.

Questions on the SHI assess environmental and behavioral variables that could promote inadequate sleep (Mastin, et al., 2006). The SHI was originally developed by Mastin et al. (2006) and tested with 632 university students. Administration of the SHI occurred in conjunction with the Epworth Sleepiness Scale (ESS) and the PSQI and had a

low positive correlation with the ESS ($r = 0.244$, $p < 0.01$) and a moderate positive correlation with the PSQI total score ($r = 0.481$, $p < 0.05$) (Mastin, et al., 2006). The SHI showed positive correlation with all of the associated features of inadequate sleep hygiene as determined by the American Sleep Disorders Association (1990). There has been no published data on its usage since development of the tool.

The Sleep Hygiene Index (SHI) is a self-rated 13 item instrument which assesses sleep hygiene behaviors. These 13 items were derived from combining information obtained from sleep hygiene studies along with the diagnostic criteria defined in the International Classification of Sleep Disorders for the diagnosis of inadequate sleep hygiene (Mastin, et al., 2006). Participants are required to indicate how frequently they engage in specific behaviors and indicate the frequency: always, frequently, sometimes, rarely, or never. Each item is then coded with scores ranging from 5 (always) to 1 (never). The items are totaled yielding a global assessment score for sleep hygiene ranging from 13 to 65. Higher scores are indicative of more maladaptive sleep hygiene practices.

The SHI is a 13-item questionnaire pertaining to sleep practices in a broad overview. The questions assess environmental and behavioral variables that could promote inadequate sleep (Mastin, et al., 2006). The SHI was originally developed by Mastin et al., and tested with 632 university students as participants. It was administered in conjunction with the Epworth Sleepiness Scale (ESS) and the PSQI and had positive correlation with the ESS ($r = 0.244$, $p < 0.01$) and the PSQI total score ($r = 0.481$, $p <$ 0.05 or less) (Mastin, et al., 2006). It was also positively correlated ($p < 0.01$) with all of

the associated features of inadequate sleep hygiene as determined by the American Sleep Disorders Association (1990). There has been no published data on its usage since development of the tool.

Demographic Questionnaire

A demographic questionnaire containing 10 items was developed for assessing characteristics of participants in this study (see Appendix C). The first three items were gender, age, and marital status. The next four items addressed areas pertinent to CR participation. Respondents were asked questions about first time participation, length of participation, cardiac event or events leading to participation, and expected date of program completion. The final three items focused on length of CHD diagnosis, cardiac procedures done prior to participation in CR, and if participants had been diagnosed with other chronic diseases: congestive heart failure, asthma, sleep apnea, or insomnia.

Procedure for Data Collection

Prior to initiation of the study, approval was sought and obtained from the Montana State University Institutional Review Board (IRB) and the Billings Clinic IRB Executive Committee. Individual packets were then assembled containing a cover letter to participants, a demographic questionnaire, the PSQI, the SHI, and a return, self-addressed, stamped envelope. All questionnaires were pre-numbered before placement in individual packets. This was done in order to provide correlation amongst the three questionnaires for data analysis purposes.

Managers at the participating CR centers located in Livingston, Bozeman, and Billings were then contacted by the primary investigator (PI). CR program managers received a brief orientation from the primary investigator, with instructions on inclusion criteria, data collection, and packet distribution. Following the orientation at each of the CR centers, 40 packets were left with the Billings facility, 20 packets with the Bozeman facility, and 5 with the facility in Livingston. Managers then screened for eligible participants according to inclusion criteria and distributed the packets to participants, at the ninth to the eleventh week of the program, prior to complete discharge from the program. By distributing questionnaires at the end of the CR program disruptive sleep factors such as anxiety, stress or postoperative pain were decreased and some sleep hygiene practices such as smoking cessation, caffeine use, alcohol use, diet and exercise were initiated (Edéll-Gustafsson, et al., 2006; Edéll-Gustafsson & Hetta, 2001). Participants were encouraged to complete the PSQI and SHI along with the demographic questionnaire while at the CR but were allowed to complete them at home if desired. All forms were then mailed to the investigator. CR managers were contacted on a weekly basis via email or by telephone, to determine if participants had been enrolled, packets had been distributed, and if there were any needs or concerns.

Protection of Human Participants

Rights of human participants were protected in this study. The PI successfully completed the National Institutes of Health, Human Participants Protections: Education for Research Programs on February 5, 2007. Permission to proceed with the study was

approved by the Montana State University (MSU) IRB and the Billings Clinic IRB Executive Committee. Approval letters from both Institutional Review Boards were obtained (see Appendix D). The Bozeman CR facility honored the acceptance letter from the MSU IRB and Livingston CR facility is a satellite provider for Billings Clinic and, therefore honored the Billings Clinic IRB approval.

Possible benefits of participation included gaining knowledge in regards to sleep patterns and sleep practices for CR patients prior to discharge from a cardiac rehabilitation program. Since little research has been done in the area of sleep patterns and practices of persons in CR, this data may provide a foundation for future care of CR participants and provide a basis for future research studies.

Risks to individual participants were minimal, if any. One potential risk, if any, is minimal psychological stress due to participant perception of sleep and sleep practices. The time of approximately 10 to 15 minutes to complete all three questionnaires may be an inconvenience. Participation in this study was confidential and participants had the option to stop participation at any time or leave any question unanswered. Consent was implied by the completion and return of all questionnaires.

Data Analysis

As surveys were returned, participant responses were entered into Microsoft Excel® by the primary investigator. Descriptive statistics, including frequencies, percentages, means, and ranges, were calculated in order to summarize demographic variables obtained from the Demographic/Supplemental Information form (see Appendix

D). Frequency and percentage distributions were used to analyze demographic variables: gender (Question 1), marital status (Question 3), first time in CR (Question 4), length in current CR program (Question 5), time of CHD diagnosis (Question 8), and cardiac procedures (Question 9). Measures of central tendencies were used to analyze age (Question 2). Percentage distributions were used to describe co-existing conditions (Question 10).

The PSQI was scored for each participant as specified by Buysse, et al. (1989). Each of the 19-items was combined according to their specific category to form seven component scores, one each for sleep quality (Question 6), sleep latency (Questions 2 and 5a), sleep duration (Question 4), sleep disturbance (Questions 5b-5j), habitual sleep efficiency (Questions 1, 3 and 4), use of sleep medications (Question 7), and day time dysfunction (Questions 8 and 9). A score of 0 indicated no sleep difficulties and a score of 3 indicated severe sleep difficulties (Buysse, et al., 1989). The seven component scores were then totaled yielding a global score with a range of 0 to 21 and, again, 0 indicating no sleep difficulties and a score of 21 indicating severe difficulties in all areas (Buysse, et al., 1989). Frequencies, percentages, means, and ranges were determined for each component score and the global scores.

The SHI scores for each participant were totaled based upon the scoring recommend by Mastin et al. (2006). Questions pertained to the frequency of engagement in specific sleep practices (always, frequently, sometimes, rarely, never). These items are coded as always = 5, frequently = 4, sometimes = 3, rarely = 2 and never = 1. The scores

for the items are then totaled resulting in a global assessment score for sleep hygiene. Frequencies and percentages were determined for individual items on the SHI.

Summary

A descriptive, cross-sectional study using the PSQI and SHI was chosen for this study. Upon approval from the Montana State University IRB and the Billings IRB, a convenience sample of men and women, diagnosed with CHD, was recruited from 3 participating CR centers in southern Montana. Rights of human participants were protected in this study. A descriptive, cross-sectional study using the PSQI and SHI was chosen for this study. Managers recruited participants at each of the chosen centers. Consent was implied by the completion and return of the questionnaire. As surveys were returned by mail, responses were entered into Microsoft Excel® by the primary investigator. Descriptive statistics included frequencies, percentages, means, and ranges and were calculated to summarize demographics and describe their sleep patterns and sleep hygiene practices.

CHAPTER 4

RESULTS

Introduction

The purpose of this research study was twofold. The first purpose was to describe sleep patterns of persons who are near completion of Phase II in a CR program. The second purpose was to describe sleep practices of this same population. This chapter addresses demographic characteristics, sleep patterns, and sleep hygiene practice results of adults in CR programs in southern Montana.

Sample Demographics

A total of 31 participants met inclusion criteria for this study. The three identified CR facilities distributed a total of 49 packets containing the questionnaires to participants they deemed eligible. Thirty four (n=34) questionnaires were completed and returned to the primary investigator for a 69.3% response rate. Three potential participants returning questionnaires did not meet inclusion criteria according to their self-report on the demographic questionnaire and were excluded. Two were excluded due to CR participation of less than 8 weeks and one was excluded for a previous diagnosis of insomnia. The sample was, therefore, 31 participants.

Of the sample (n=31), a large percentage (65%) were male (see Table 2). Participant ages ranged from 46 to 89 years old with a mean age of 69.8 (SD =8.40). All respondents reported they were or had been married or partnered.

Table 2. Demographics of the Sample of CR Participants

Demographics	**Participants (N=31)**	**(%)**
Gender		
Male	20	65
Female	11	35
Age in Years		
Less than 60	2	6
60 to 69	12	39
70 to 79	14	45
Over 80	3	10
Marital Status		
Married or living with partner	23	74
Divorced/ Separated	4	13
Widowed	4	13

Characteristics related to cardiac diagnosis and time in the program for the CR sample are shown in Table 3. The majority of respondents (90.3%) reported a first time participation in a CR program. Because of eligibility criteria all respondents had been in the CR program for over 9 weeks and were within 2 weeks of program completion. Reasons for entering the CR program varied. Myocardial infarction was reported as the primary cardiac event leading to CR participation by 77% (n=24) of the sample. Respondents additionally reported a variety of cardiac interventions and procedures prior to admission in the CR program. Cardiac stent placement was reported by 42% (n=13), 52% (n=16) underwent CABG surgery and 42% (n=13) had a mitral or aortic valve replacement. Several respondents indicated dual procedures, with 26% (n=8) reporting having both a CABG and a valve replacement, and 23% (n=7) indicated having both cardiac stent placement in conjunction with angioplasty. Of the 31 participants, seven

(22%) indicated a previous diagnosis of CHF, three (10%) a diagnosis of asthma, three (10%) a diagnosis of sleep apnea, and two (9%) a dual diagnosis of asthma and CHF.

Table 3. Sample Characteristics Related to Cardiac Diagnosis and CR Program

Characteristics	**Participants (N=31)**	**(%)**
Length of CHD Diagnosis		
Less than 6 months	13	42
7 to 12 months	0	0
Over 1 year	9	29
Unknown	9	29
Primary CR Diagnosis		
Myocardial Infarction	24	77
Valve replacement	7	23
Length of time in CR		
9 to 11 weeks	14	45
Over 11 weeks	17	55
First time participation in CR		
Yes	28	90
No	3	10

Sleep Patterns

Participants indicated their sleep patterns and quality over the last month by answering the self-rated questions on the PSQI. All 31 participants (100%) completed all questions on the PSQI. The total global PSQI scores ranged from 1 to 20 with a mean global score of 8.5 (SD=4.57). The majority of the respondents (71%) had global scores greater than 5 indicating “poor” sleepers. The ranges of global PSQI scores are shown in Table 4.

Table 4. PSQI Global Scores

PSQI Global Scores	Number (N=31)	Percent (%)
0-5	9	29
6-10	15	48
11-15	4	13
16-21	3	10

The mean total time to fall asleep, as reported on the PSQI, was 22 minutes (SD=14.3). Participants' reported time in bed ranged from 7 to 12 hours with a mean time in bed of 9 hours (SD=1.11). Hours of reported actual sleep ranged from 5 to 10 hours with a mean total sleep time of 6.8 hours (SD=1.26).

On a scale from 0 to 3, the mean subjective sleep quality on the PSQI was 1 (SD=0.80) indicating, on average, most participants reported their sleep as "fairly good". Sleep latency component scores averaged 1.2 (SD=.92), with a total mean time of 22 minutes to fall asleep. The calculated mean habitual sleep efficiency score was 78% (SD=14.61) and mean total score for sleep disturbance was 1.54 (SD=0.55). In the area of sleep disturbance, 55% (n=17) of the participants reported waking up in the middle of the night or early morning, three or more times a week and 26% (n=8) reported waking up in the middle of the night or early morning at least once or twice weekly. Of the 31 participants, all but 2 reported getting up to use the bathroom with the majority (65%) reporting this occurrence more than three times a week. Pain occurring three or more times weekly was reported by 32% (n=10) of the participants. Prescription or nonprescription sleep medications were used three or more times weekly by 36% (n=11) of the participants. In the final component of daytime dysfunction, the total mean score was 1.2 (SD=0.92). Almost all of the respondents (94%) denied problems staying awake

while driving, eating meals, or engaging in social activities. Problems keeping up enough enthusiasm to get things done was reported by only 10% (n=3) of the participants.

Sleep Hygiene Practices

The extent of sleep hygiene practices were measured by participants answering each statement on the SHI using a 5-point Likert-type scale. All 31 research participants completed all questions on the SHI. The participants' global SHI scores ranged from 14 to 39 with a mean of 23 (SD=3.8). The ranges of global SHI scores are shown in Table 5.

Table 5. SHI Global Scores

SHI Global Scores	**Number (N=31)**	**Percent**
13-25	22	71
26-38	8	26
39-51	1	3
52-65	0	0

In specific findings of the SHI, a score of 5 (always) was used only one time on one question. All of the other questions were scored by participants with scores ranging from 1 to 4 (never to frequently). With this taken into consideration, individual questions were examined. Over half of the participants (52%) planned or worried while in bed and 48% used their bed for things other than sleep, such as watching television, eating, studying, or reading. Other areas of maladaptive sleep practices were noted in time to bed (45%) and time getting out of bed (35%). Exercising within one hour of bedtime was reported as never or rarely by all of the participants. Frequent use of alcohol, tobacco, or caffeine within 4 hour of going to bed was reported by 2 (6%) respondents. Participants' responses to individual statements are summarized in Table 6.

Table 6. CR Participants' Responses to SHI Items

SHI Statements	Never or Rarely	Sometimes	Frequently or Always
1. I take daytime naps lasting 2 or more hours.	22 (71%)	7 (23%)	2 (6%)
2. I go to bed at different times from day to day.	17 (55%)	10 (32%)	4 (13%)
3. I get out of bed at different times from day to day.	20 (65%)	9 (29%)	2 (6%)
4. I exercise within one hour of going to bed	31 (100%)	0 (0%)	0 (0%)
5. I stay in bed longer than I should 2 to 3 times a week.	22 (71%)	8 (26%)	1 (3%)
6. I use alcohol, tobacco, or caffeine within 4 hours of going to bed or after going to bed.	27 (88%)	2 (6%)	2 (6%)
7. I do something that may wake me up before bedtime (video games, internet or clean).	29 (94%)	2 (6%)	0 (0%)
8. I go to bed feeling stressed, angry, upset or nervous.	23 (75%)	6 (19%)	2 (6%)
9. I use my bed for things other than sleep or sex (watching television, read, eat or study)	16 (52%)	4 (13%)	11 (35%)
10. I sleep on an uncomfortable bed	30 (97%)	1 (3%)	0 (0%)
11. I sleep in an uncomfortable bedroom (too bright, too stuffy, too hot, too cold or noisy).	29 (94%)	1 (3%)	1 (3%)
12. I do important work before bedtime (pay bills, schedule or study).	27 (87%)	3 (10%)	1 (3%)
13. I think, plan or worry when I am in bed.	15 (48%)	10 (32%)	6 (20%)

Note. The values represent number (N=31) of responses and percentages.

Summary

This descriptive study resulted in a 69.3% response rate from the 3 participating CR facilities. Descriptive methods were used to analyze demographic information, sleep patterns, and sleep hygiene practices of this CR population. It was determined the majority of respondents in this study were married and of male gender. Global PSQI

scores indicated poor sleep quality with the majority of respondents' indicating poor sleep efficiency due to fragmented sleep of short sleep duration. Global scores from the SHI were relatively low indicating slight problems with sleep hygiene practices. Upon examination of individual areas in the SHI, the majority of respondents identified using their bed for things other than sleep as a primary area of poor practice with several participants underlining "watching television". Other areas of poor practice were different bed times and awakening times.

CHAPTER 5

DISCUSSION

This study was the first to describe sleep pattern and sleep hygiene practices in persons nearing the end of Phase II in a CR program. The theoretical framework for this study was the SCT which offers an explanation of human behavior using concepts of self-efficacy. The role of self-efficacy has been studied in relation to numerous health behaviors such as weight control and smoking cessation. CR programs are aimed at secondary prevention by focusing on behavioral change and self-efficacy. The primary focus areas of self-care behaviors in CR are exercise, nutrition, tobacco cessation, and stress management. Sleep can have a direct effect on all of these areas and conversely the behaviors addressed in CR can have a direct effect on sleep.

This small sample was representative of CR participants and was, therefore, a credible sample. There were 34 questionnaires completed and returned for a high response rate of 69%, with only 3 participants who returned questionnaires not meeting inclusion criteria.

The total included (N=31) CR participants who had similar characteristics to those of cardiac rehabilitation patients in general in terms of gender, age, and marital status. The sample was comprised of more male than female participants at a ratio of 2:1 with an age range of 46 to 89 years old. Several studies involving the CR population provided a demographic overview. A study aimed at examining participation in CR had 1,821 participants who had been diagnosed with a myocardial infarction to determine

characteristics of participation (Witt, et al., 2004). The researchers determined participation among women was only 38% as compared to men and the CDC (2008) reported men had a higher prevalence, as compared to women, of participating in a CR program. In another study performed in the United Kingdom, 202 participants who had a percutaneous coronary intervention completed questionnaires pertaining to demographic information, medical history, and CR participation (Fernandez, Salamonson, Griffiths, Juergens & Davidson, 2008). The aim of the study was to determine the demographic characteristics of patients who participate in CR. The age range of this study was 36-87 years old with more men participating than women. In the current study, the majority of respondents (74%) were married which is consistent with demographic information from other CR participation studies that listed 72-73% of the participants as married (Fernandez, et al., 2008; Pasquali, Alexander, Coombs, Lytle & Peterson, 2003). Through findings from the logistic regression analyses, Fernandez, et al., concluded family circumstance had a significant effect on CR participation and those who were married were more likely to participate.

In terms of CR participant characteristics, most respondents indicated they were first time participants in the cardiac rehabilitation program. The majority of the sample reported a MI as the primary reason for entering the CR program. There was a diversity of cardiac procedures performed in this sample. Procedures of cardiac stent placement, CABG surgery, angioplasty, and valve replacement were reported with several respondents reporting dual interventions. It is unknown if these findings are

representative of participants in other CR programs due to the lack of available research reports on these characteristics.

Sleep

The sample in this study had overall poor sleep quality as indicated by a mean global PSQI score of 8.5. A global score of greater than 5 indicates a person can be having moderate difficulties in more than three areas or severe difficulties in at least two of the seven areas of sleep on the PSQI (Buysse, et al., 1989). There are currently no published studies on sleep specific to the cardiac rehabilitation population. Several studies have indicated persons with CHD have sleep disruptions and dysfunctional sleep which can increase the risk of a recurrent MI (Edéll-Gustafsson, et al, 2006; Hayashi, et al., 2003; Leineweber, et al., 2003; Redeker, et al., 2004; Schwartz, et al., 1998).

In the seven areas of sleep, on average, respondents reported their subjective sleep quality as "fairly good". In this study, average time to sleep onset was slightly prolonged at 22 minutes. In healthy persons without sleep disorders the average time to fall asleep is 10 to 20 minutes (Buysse, et al., 1989). Other studies on persons who have experienced an MI or have CHD have indicated delayed sleep onset of 29 to 33 minutes (Edéll-Gustafsson, et al., 2006; Edéll-Gustafsson, Gustavsson, & Uhlin, 2003). A study conducted by Edéll-Gustafsson, et al. (2003) surveyed 145 patients who had a CABG surgery about sleep quality. The authors determined delayed sleep onset was due to excessive worrying and increased anxiety prior to bed time, but they did not investigate other sleep hygiene behaviors.

The calculated mean habitual sleep efficiency (77%) was low when compared to sleep efficiency scores of healthy individuals without sleep problems whose sleep efficiency is greater than 85% (Buysse, et al., 1989). In the current study respondents had a prolonged time in bed and short sleep durations. This data is similar to other studies of patients following cardiac surgery. Redeker, et al. (2004) performed a study on 72 people following cardiac surgery (CABG or valve replacement) and found, up to 8 weeks following the procedure, participants had a mean sleep efficiency score of 75% and mean sleep duration of 6.5 hours.

Fragmented sleep due to sleep disturbances such as awaking to use the bathroom and pain were reported by a large number of respondents. Pain is not that unusual in this population. Usually, initiation of CR is 2 to 4 weeks after stent placement or 3 to 4 weeks after open heart procedures such as a CABG surgery. Surgical pain should be subsiding by the time CR is started, but a few people will continue to report anginal type pain up to a year following surgery (Edéll-Gustafsson, et al., 2006). Pain can contribute to decreased sleep duration and sleep fragmentation (Edéll-Gustafsson, et al.). CABG surgeries have the highest incidence of pain (Ho, Royse, Royse, Penberthy & McRae, 2002). Studies have shown that pain should be resolving within 4 to 8 weeks and surgical pain occurring longer than 8 weeks after the procedure can lead to increased cardiac complications and morbidity (Ho, et al., 2002). The use of prescription and nonprescription sleep medications three or more times weekly was reported by one third of this sample in the current study and that may be a factor indicating poorer sleep quality in this group. Conversely, some may be reporting improved sleep due to pharmacological measures.

Daytime dysfunction was reported by very few people in CR in this study. Daytime dysfunction is usually increased following an MI, but appears to improve over 6 months (Redeker, et al., 2004). The low incidence of daytime dysfunction in the current study may be due to participation in a cardiac rehabilitation program.

Sleep Hygiene Practices

There were few problems with sleep hygiene practices found in this study sample as evident by the relatively low mean SHI global score of 23. Upon development of the SHI, Mastin, et al. (2006), indicated global scores range from 13 to 65 with higher scores more indicative of maladaptive sleep hygiene practices. There is currently no reported data available on the use of the SHI in CR or other populations.

In the current study, very few respondents used alcohol, tobacco, or caffeine frequently or always within four hours of going to bed or after going to bed. This may be due to the behavioral changes encouraged by the CR programs. Frequent day time naps were reported by only 2% of the sample. All of the CR participants in the current study reported never or rarely exercising prior to bed. Decreased daytime naps and not exercising prior to bed may be due in part to behavioral changes made in the CR program and the use of daytime exercise while in the program. Of specific interest was the large number of respondents (48%) who reported using their bed for other things besides sleep or sex. Of this group, 35% reported using the bed for things other than sleep or sex "frequently" or "always" and 13% reported the frequency as "sometimes". Several questionnaires were returned with the words "watching television" underlined. Watching

television in bed may be reflective of the persons reported bedtime on the PSQI. This time in bed is not spent trying to sleep, but is reflected in the sleep efficiency scores. Those scores may be actually lower, but still reflect the participant's perception of time awake and time asleep.

Limitations

The current research study had several limitations. A small convenience sample from only three facilities in Southern Montana was used in this study and data collection time was limited to 6 weeks. Self reported data from questionnaires was used, whereas use of interviews or other objective measures may have provided different results. Those persons who agreed to participate in this study may have been those who felt they currently had issues or problems with sleep. The limited sampling limits the ability to apply these finding to other CR participants in Montana. Although these factors may affect the ability to generalize these findings to other CR populations, the findings from this study provide a direction for future research.

Summary

This study has shown a majority of this sample population has poor sleep quality with some deficiencies found in sleep hygiene practices. Studies in other populations have shown good sleep hygiene practices are related to good sleep quality (Brown, et al., 2002; Lebourgeois, et al., 2005). Poor sleep quality, indicated by subjective sleep ratings, can lead to reduced physical health (Brown, et al.). The prevalence of self-reported, poor

sleep is as high as 60% 5 years after cardiac procedures such as CABG surgery or PTCA intervention (Edéll-Gustafsson, et al., 2003, 2001). In persons one year after coronary procedures, sleep disturbances were related to short sleep durations, longer sleep latency, frequent nocturnal awakenings, and difficulties returning to sleep (Edéll-Gustafsson & Hetta, 2001). All of these findings are similar to the current study.

In order to optimize patient health and independence, a primary goal in nursing is to promote self-efficacy by encouraging good self-care behaviors. An important self-care behavior in the CR population is high quality sleep, not only to promote optimal recovery and healing, but also to decrease risk of a recurrent cardiac event. Registered Nurses (RNs) and Advanced Practices Registered Nurses (APRNs) can evaluate sleep patterns and sleep hygiene practices in this population and help develop interventions to promote good quality sleep for every individual.

Future research is needed to study the cardiac rehabilitation population on a larger scale and determine if specific sleep hygiene practices correlate with poor sleep quality. The current study has shown poor sleep quality in this population with some maladaptive areas of sleep hygiene practices identified. In other populations, findings suggest that sleep hygiene practices improve sleep quality (Brown, et al., 2002; Lebourgeois, et al., 2005). By participating in CR programs, participants gain knowledge about behaviors that promote sleep hygiene such as tobacco cessation, limited use alcohol and caffeine, and regular exercise. Therefore, it may be beneficial to investigate sleep hygiene knowledge prior to CR participation.

Another area for study in the cardiac rehabilitation population is pain management. Pain has been identified as a factor that may be causing sleep disruptions in this population. Approximately 65% of persons with pain report some type of sleep problem (Deardorff, 2005) with the most common problems being frequent awakenings, decreased sleep duration, and delayed sleep onset (Miaskowski, 2009). Future research in sleep should consider these variables.

The focus of this study was to describe sleep patterns and sleep hygiene practices in the CR population by using a convenience sample from three CR facilities. A larger study should be done to validate these findings. These study findings can help guide future research and provide nursing with interventions to promote sleep and sleep hygiene practices in the persons with CHD in cardiac rehabilitation.

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APPENDICES

APPENDIX A

PITTSBURGH SLEEP QUALITY INDEX

Pittsburgh Sleep Quality Index (PSQI) ID #_____
DATE_____

Instructions:
The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month.

Please answer all questions.
1. During the past month, when have you usually gone to bed at night?
USUAL BED TIME_____
2. During the past month, how long (in minutes) has it usually take you to fall asleep each night?
NUMBER OF MINUTES_____
3. During the past month, when have you usually gotten up in the morning?
USUAL GETTING UP TIME_____
4. During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spend in bed.)
HOURS OF SLEEP PER NIGHT_____

5. During the past month, how often have you had trouble sleeping because you….	Not during the past month (0)	Less than once a week (1)	Once or twice a week (2)	Three or more times a week (3)
a. Cannot get to sleep within 30 minutes				
b. Wake up in the middle of the night or early morning				
c. Have to get up to use the bathroom				
d. Cannot breathe comfortably				
e. Cough or snore loudly				
f. Feel too cold				
g. Feel too hot				
h. Have bad dreams				
i. Have pain				
j. Other reason(s), please describe and how often does this occur:				
6. During the past month, how would you rate your sleep quality overall?(Check your answer)	Very good	Fairly good	Fairly bad	Very bad

	Not during the past month (0)	Less than once a week (1)	Once or twice a week (2)	Three or more times a week (3)
7. During the past month, how often have you taken medicine (prescribed or "over the counter") to help you sleep?				
8. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activities?				
9. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done? (Check your answer)	No problem at all	Only a very slight problem	Somewhat of a problem	A very big problem

APPENDIX B

SLEEP HYGIENE INDEX

Sleep Hygiene Index

Please rate all of the following statements using the scale below.

5 Always
4 Frequently
3 Sometimes
2 Rarely
1 Never

		5=Always	4=Frequently	3=Sometimes	2=Rarely	1=Never
Sleep Hygiene Index						
Please circle the letters or blacken the box by using the scale above.						
1.	I take daytime naps lasting two or more hours.	5	4	3	2	1
2.	I go to bed at different times from day to day.	5	4	3	2	1
3.	I get out of bed at different times from day to day.	5	4	3	2	1
4.	I exercise to the point of sweating within one hour of going to bed.	5	4	3	2	1
5.	I stay in bed longer than I should two or three times a week.	5	4	3	2	1
6.	I use alcohol, tobacco, or caffeine within four hours of going to bed or after going to bed.	5	4	3	2	1
7.	I do something that may wake me up before bedtime (for example: play video games, use the internet, or clean).	5	4	3	2	1
8.	I go to bed feeling stressed, angry, upset, or nervous.	5	4	3	2	1

9.	I use my bed for things other than sleeping or sex (for example: watch television, read, eat, or study).	5	4	3	2	1
10.	I sleep on an uncomfortable bed (for example: poor mattress or pillow, too much or not enough blankets).	5	4	3	2	1
11.	I sleep in an uncomfortable bedroom (for example: too bright, too stuffy, too hot, too cold, or too noisy).	5	4	3	2	1
12.	I do important work before bedtime (for example: pay bills, schedule, or study).	5	4	3	2	1
13.	I think, plan, or worry when I am in bed.	5	4	3	2	1

APPENDIX C

DEMOGRAPHIC QUESTIONNAIRE

DATE_____ ID#_____

DEMOGRAPHIC / SUPPLEMENTAL INFORMATION

Please answer these questions by circling your response or providing the information.

1. What is your gender?(Circle one) Male Female
2. What is your age?
3. What is your present marital status? (Circle one)

   Never married..... 1

   Married or living with partner..... 2

   Divorced/separated..... 3

   Widowed..... 4
4. Is this your first time participating in a cardiac rehabilitation program? Yes No
5. How long have you been a participant in the current cardiac rehabilitation program?(Circle one)

   Less than 8 weeks ……..... 1

   9 to 11 weeks ……..... 2

   Over 11 weeks..... 3
6. What cardiac event brought you into this cardiac rehabilitation program?

   _____
7. What date are you expected to finish the cardiac rehabilitation program?

   _____
8. How long have you been diagnosed with heart disease? (Circle one)

   Less than 6 months …….. 1

   7 to 12 months …… 2

   Over 1 year …… 3

   Unknown ……. 4
9. Have you ever had any of the following procedures?

   Cardiac stent placement…….. yes no

   Coronary artery bypass surgery……..... yes no

   Angioplasty……. yes no

   Other _____

10. Have you ever been diagnosed with….?

Congestive heart failure……. yes no

Sleep apnea…… yes no

Asthma…….. yes no

Insomnia…… yes no

APPENDIX D

IRB APPROVAL LETTERS

MONTANA
STATE UNIVERSITY

INSTITUTIONAL REVIEW BOARD

For the Protection of Human Subjects
FWA 00000165

960 Technology Blvd. Room 127
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Chair: Mark Quinn
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Administrator:
Cheryl Johnson
406-994-6783
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MEMORANDUM

TO: Tina Barker and Rita Cheek

FROM: Mark Quinn, Ph.D. Chair Mark Quinn CHJ
Institutional Review Board for the Protection of Human Subjects

DATE: December 17, 2008

SUBJECT: *"A Description of Sleep Patterns and Sleep Practices for Adults in Cardiac Rehabilitation Programs in Southwestern Montana" [TB121708-EX]*

The above research, described in your submission of December 16, 2008, is exempt from the requirement of review by the Institutional Review Board in accordance with the Code of Federal Regulations, Part 46, section 101. The specific paragraph which applies to your research is:

___ (b)(1) Research conducted in established or commonly accepted educational settings, involving normal educational practices such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.

_X_ (b)(2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.

___ (b)(3) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior that is not exempt under paragraph (b)(2) of this section, if: (i) the human subjects are elected or appointed public officials or candidates for public office; or (ii) federal statute(s) without exception that the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter.

___ (b)(4) Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available, or if the information is recorded by the investigator in such a manner that the subjects cannot be identified, directly or through identifiers linked to the subjects.

___ (b)(5) Research and demonstration projects, which are conducted by or subject to the approval of department or agency heads, and which are designed to study, evaluate, or otherwise examine: (i) public benefit or service programs; (ii) procedures for obtaining benefits or services under those programs; (iii) possible changes in or alternatives to those programs or procedures; or (iv) possible changes in methods or levels of payment for benefits or services under those programs.

___ (b)(6) Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives are consumed, or (ii) if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the FDA, or approved by the EPA, or the Food Safety and Inspection Service of the USDA.

Although review by the Institutional Review Board is not required for the above research, the Committee will be glad to review it. If you wish a review and committee approval, please submit 3 copies of the usual application form and it will be processed by expedited review.

INSTITUTIONAL REVIEW BOARD OF BILLINGS

SERVING
Billings Clinic Montana Cancer Consortium St. Vincent Healthcare Other Independent Investigators & Institutions

January 12, 2009

Tina Barker RN BSN
Principal Investigator
P.O. Box 1955
Livingston MT 59047

Dear Ms. Barker:

The IRB of Billings on January 12, 2009, determined that the following minimal risk protocol for anonymous self-report patient survey does not meet IRB review criteria for human subjects research and is therefore an exempt activity:

Montana State University-Bozeman – College of Nursing, Billings Campus
Local conduct site: Billings Clinic

09.05 A Description of Sleep Patterns and Sleep Practices for Adults in Cardiac Rehabilitation Programs in Southwestern Montana
Materials received by the IRB included but were not limited to: Curriculum vitae for Ms. Barker. Notice of exemption from Montana State University-Bozeman dated 12/17/08, with complete university research application, including Letter to Subjects; Subject Questionnaires; Sleep Hygiene Index and Pittsburgh Sleep Quality Index.

The above-named materials describe a patient survey project that does not collect patient-identifying information; therefore, no IRB review is required for this project. The Principal Investigator is to provide any required IRB of Billings review determination to oversight authorities, study sponsors, or others. Research exempted by the IRB may be subject to further institutional review, for approval or disapproval.

Sincerely,

Stephanie A Fofonoff BS MHA, Administrator
Certified IRB Professional

Copies (2):

1. Nancy Stockman MSN CNM FNP, IRB of Billings Representative to Billings Clinic Nursing Research Council
2. Billings Clinic Research Center *(Required notification for new research at Billings Clinic)*

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