The Influence of Yoga on Individuals with Traumatic Brain Injury Related to Sleep and Mood

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THE INFLUENCE OF YOGA ON PEOPLE WITH TRAUMATIC BRAIN INJURY RELATED TO SLEEP AND MOOD

A Thesis
Presented to
the Graduate School of
Clemson University

In Partial Fulfillment
of the Requirements for the Degree
Master of Science
Parks, Recreation, and Tourism Management

by
Charity Hubbard
May 2018

Accepted by:
Dr. Marieke Van Puymbroeck, Committee
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Dr. Arlene Schmid
ABSTRACT

Sustaining a Traumatic Brain Injury (TBI) has a significant effect on an individual’s physical and mental abilities, resulting in decreased independence. Residual effects of TBI often include sleep and mood disorders. Sleep disorders include any disturbance in an individual’s quality of sleep and daytime functioning as a result; while mood disorders include depression, anxiety, and adjustment to injury. Rehabilitation after TBI involves a wide range of therapeutic services of which recreational therapy can serve as a holistic therapy, addressing both the mind and the body. Yoga as a recreational therapy intervention may be used to improve functioning for individuals with TBI. Thus, the purpose of this convergent mixed methods study was to examine the effects of yoga on individuals with TBI related to their sleep and mood.

This research study involved an eight-week yoga intervention, which occurred bi-weekly at the Shepherd Center. Six individuals with TBI completed the intervention. Pre-, mid-, and post-intervention assessments were given to measure sleep and mood. Upon completion of the intervention, participants and their caregivers took part in focus groups to share their perceptions of change in sleep and mood. Data were collected, analyzed, and reported to discuss the effects of yoga on sleep and mood in individuals with TBI. Quantitative data revealed no statistical significance, though percent change calculations of pre- and post-data showed a substantial decrease in anxiety and an improvement in adjustment to injury. Qualitative data was consistent with the calculated percent change in addition to an emerging theme of social support amongst individuals with TBI.
DEDICATION

I dedicate this thesis project to my fiancé Fabien, who read and re-read my writing, gave me feedback, and provided support throughout the entire process. Fabien’s intelligent and intentional thoughts contributed to the production of this thesis defense, and I couldn’t have done it without him. I would also like to dedicate this thesis project to my supportive parents, who encouraged me to pursue a Master’s in Recreational Therapy and provided an abundance of support throughout the process.
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Chapter 1

Introduction

Traumatic Brain Injury

A Traumatic Brain Injury (TBI) is defined as an acquired injury that is the result of direct damage to the brain (Brain Injury Association of America, 2011). Damage to the brain can be caused by a blunt force impact or penetration of an object (Long, Gregory, & Porter, 2015). A TBI can occur quickly and unexpectedly, but often has a long-term effect on an individual’s life and relationships (Zaloshnja, Miller, Langlois, & Selassie, 2008). Mild TBIs occur when an individual experiences blunt trauma to the head and experiences symptoms of headache, dizziness, concentration difficulties, and fatigue (Alves, Macciocchi, & Barth, 1993; Levin et al., 1987; Lundin, de Boussard, Edman, & Borg, 2006; Rutherford, Merrett, & McDonald, 1979). TBIs are considered moderate-to-severe when the individual has been unconscious for a short or prolonged amount of time, in combination with mental, physical, emotional, or psychological deficiencies that result from the injury (Brain Injury Association of America, 2011). The brain is the control center for voluntary and involuntary actions of the body, thus a TBI may result in physiological and neurological losses (Long et al., 2015; Ragnarsson et al., 1999).

In the United States, approximately 1.7 million people per year are admitted to the emergency room due to sustaining a TBI (Bigler, Weiner, & Lipton, 2009). Of these, 124,626 are classified as moderate-to-severe TBI and continue to live with the residual effects of the injury (Selassie et al., 2008). Based on the prevalence of TBI, this type of injury must be viewed as nationally important. The
effort to decrease the amount of TBIs sustained by individuals in the United States, the improvement of rehabilitation services to decrease long-term disability, and the long-term treatment for individuals who need post-acute care should remain a priority in health care (Langlois, Rutland-Brown, & Thomas, 2006). Post-injury, people with TBI may experience challenges related to their sleep and mood (Baumann, Werth, Stocker, Ludwig, & Bassetti, 2007; Hiott & Labbate, 2002; Masel & DeWitt, 2010).

**Residual effects of traumatic brain injury.** Sustaining a TBI impacts an individual’s physical and emotional state. The residual effects of a TBI include but are not limited to trouble sleeping, changes in mood, and difficulty adjusting to life after injury (Bellon et al., 2012; Verma, Anand, & Verma, 2007).

**Sleep disorders.** For individuals who have sustained a TBI, sleep is important due to the physiological recovery and emotional health it provides (Watson, Ceriana, & Fanfulla, 2012). Sleep disorders are any consistent internal disturbance in sleep (American Psychiatric Association, 2013), and can manifest in deviations from typical sleep patterns, ineffective sleep resulting in sleepiness throughout the day, and restless sleep (Baumann et al., 2007). Regarding people with TBI, poor sleep quality has the potential to decrease emotional and physical abilities, as well as slow the recovery process (Watson et al., 2012). In addition to the negative impacts from sustaining a TBI, individuals are also susceptible to mood disorders as a residual effect of TBI.

**Mood disorders.** Common behavioral impairments for people with TBI include mood disorders, which can manifest as depression, anxiety and adjustment
to injury (Bellon et al., 2012; Ragnarsson, et al., 1999). For the purpose of this study, mood disorders will be defined as symptoms of depression, anxiety, and/or adjustment.

Depression is a common secondary factor for clinical conditions related to TBI (Trahan, Ross, & Trahan, 2001). Depression is defined by the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (American Psychiatric Association, 2013), as a depressed mood or loss of pleasure in life activities for more than two weeks, a change from an individual’s baseline mood, and compromised functioning (such as impaired social, occupational, or learning ability). In a study on the long-term impact of TBI, major depressive disorder was detected in one-third of the 91 individuals observed (Jorge et al., 2004).

Generalized anxiety is defined in the DSM-5 as extreme or unrealistic worry for the majority of the days within six months (Grant et al., 2005). Anxiety after TBI can first be seen as a normal reaction to trauma, but individuals with TBI appear to have an increased risk of developing generalized anxiety in comparison to the general population (Hiott & Labbate, 2002).

Just as individuals with TBI experience depression and anxiety, they also go through an adjustment to life after injury (Moore, Stambrook, & Peters, 1989). Sustaining a TBI is a life-changing event, and adjustment after injury for individuals with TBI involves an emotional and behavioral change in functioning (Hanks, Temkin, Machamer, & Dikmen, 1999). Level of adjustment after sustaining a TBI can be observed through a presence of depression, anxiety, fatigue, and irritability (Kean, Malec, Altman, & Swick, 2011).
Treatment for Traumatic Brain Injury

Traditional rehabilitation. In the early stages of rehabilitation post-TBI, the acute care treatment team focuses on helping individuals recover as much function as possible (Khan, Baguley, & Cameron, 2003). Treatment for TBI can occur through an interdisciplinary rehabilitation team. The post-acute period of rehabilitation involves therapy aimed at improving physical, cognitive, and social abilities (Mazaux & Richer, 1998).

Due to the physical, cognitive, and emotional impacts of sustaining a TBI, treatment for TBI needs to be approached from multiple clinical practices, in which complementary integrative health (CIH) interventions can be utilized (Ernst, 2000; Cantor & Gumber, 2013). CIH interventions are non-mainstream practices used in combination with traditional medicine (National Center for Complementary and Integrative Health [NCCIH], 2017a). Individuals who experience CIH therapies during their rehabilitation process report a perceived benefit (Wainapel, Thomas, & Kahan, 1998). The increased use of CIH therapies is due to the benefits of a holistic approach to medicine designed to improve health and increase the sense of relief from the effects of sustaining an injury (Schmid et al., 2015).

Recreational therapy in rehabilitation. According to the American Therapeutic Recreation Association (2017), recreational therapy is a practice that uses recreation and activity-based interventions to meet needs of individuals with disabilities in order to improve their physical health, mental health, and quality of life. The core of recreational therapy lies in evaluating and addressing individual needs as a way to promote and enable holistic rehabilitation and wellbeing (Carter
Activity-based interventions are key to the practice of recreational therapy in a rehabilitation setting as they address one of the main aims in recreational therapy; allowing an individual to be personally impacted and intrinsically motivated within an activity (Caldwell, 2005). Recreational therapists may also integrate CIH into rehabilitation treatment for individuals who are receiving traditional medical care.

Defined by the Cochrane Collaboration, CIH includes a wide variety of healing interventions that counteract illness or assist in increasing health and wellbeing (Pal, 2002). CIH interventions, such as yoga, can be used in recreational therapy as a holistic and complementary treatment for the client being served (Bonadies, 2004; Paramore, 1994), to address physical and mental needs in rehabilitation.

**Recreational therapy and yoga.** Yoga is a physical, mental, and spiritual practice that brings peace to the mind and body (Mohan, 2001). As an activity-based intervention designed to meet the rehabilitation needs of individuals with TBI (Van Puymbroeck, Dickes, & Schmid, 2015), yoga can be utilized by the field of recreational therapy. When used as an 8-week intervention for individuals with chronic stroke, a cause of TBI, yoga appeared to improve activity levels, participation, and quality of life (Van Puymbroeck, Schmid, Miller, & Schalk, 2012). Yoga for individuals with TBI is a useful recreational therapy intervention due to the adaptability of yoga sequences, the potential physical and cognitive benefits, and the research pointing to the potential sleep benefits (Khalsa, 2004). Yoga was used as a recreational therapy intervention for individuals with anxiety and had a positive impact on physical and mental health (Bonadies, 2004). As a stress management
intervention for women, yoga assisted in alleviating symptoms associated with depression and anxiety disorders (Javnbakht, Kenari, & Ghasemi, 2009). Both yoga and recreational therapy are complementary forms of medicine, designed to increase an individual's wellbeing and quality of life through holistic treatment (Bonadies, 2004).

**Yoga and rehabilitation.** In the West, yoga focuses on three main practices: breathing, meditation, and physical poses (Pilkington, Kirkwood, Rampes, & Richardson, 2005). Yoga interventions have been utilized in varying rehabilitation settings (Khalsa, 2004; Schmid, Miller, Van Puymbroeck, & Schalk, 2016; Schmid et al., 2015) for the purpose of providing an alternative form of therapy, as well as offering physical and mental benefits through the breathe, the meditation, and the poses (Van Puymbroeck, Allsop, Miller, & Schmid, 2017). For example, in an examination of how yoga effects people who previously had cancer, Bower et al. (2005) found that yoga was connected to improved sleep, mood, and decreased anxiety. Yoga also appeared to have positive effects on physical abilities when used in stroke rehabilitation, which is a common cause of TBI (Lynton, Kligler, & Shiflett, 2007). When yoga was administered 16 times over the course of eight weeks, individuals with TBI expressed an improvement in physical, emotional, and mental domains (Schmid et al., 2016).
Purpose Statement

The purpose of this convergent mixed methods study was to determine the influence of participation in an eight-week yoga program on sleep and mood among individuals with TBI. Yoga, as a form of CIH, was used as a recreational therapy intervention. The effects of yoga on sleep and mood of individuals with TBI has not been widely studied. Therefore, foundational research is critical to understanding the potential influence of yoga on sleep and mood among individuals with TBI. This study observed changes in sleep and mood patterns before, during, and after participating in an eight-week yoga intervention.
Specific Aims

**Specific Aim 1.** To explore the influence of yoga on sleep for people with TBI. We hypothesize that yoga sessions two times per week for eight weeks will have a positive effect on participants’ sleep, resulting in longer amounts of sleep and less sleep interruptions after yoga sessions.

**Specific Aim 2.** To explore the influence of yoga on the mood of people with TBI. We hypothesize that there will be a positive relationship between yoga and mood (i.e., more yoga attended will be related to improvement in mood).
Definition of Terms

In order to clarify wording throughout the study, the following terms are defined:

1. *Yoga Intervention.* Defined by the utilization of yoga poses, meditation, and breathing, for illness prevention and improvement of health in healthcare settings (Stephens, 2017).

2. *Individual with Traumatic Brain Injury.* An individual who has sustained a sudden injury due to external impact to the head, resulting in a brief or extended period of loss of consciousness and a significant change in physical and cognitive functioning (White & Venkatesh, 2016).

3. *Mood.* Positive or negative emotions including but not limited to depression and anxiety (Watson & Clark, 1984).

4. *Adjustment.* A participant’s ability to adapt to activities of daily living, social initiation, and cognition after sustaining a TBI (Bohac, Malec, & Moessner, 1997).

5. *Caregiver.* A person who is committed to caring for person with TBI and assists the individual in accomplishing some (or all) activities of daily life.
Chapter 2

Literature Review

TBI is a prevalent injury that requires attention from multiple therapies throughout the rehabilitation process. Individuals with TBI may experience the repercussions of sustaining the injury throughout their life. In this section, research concerning TBI and yoga will be discussed. There is limited research on TBI and yoga, thus there is need for further studies related to the effects of yoga on individuals with TBI. This literature review will focus on the effects of TBI, traditional rehabilitation for TBI, how CIH is used in TBI rehabilitation, the use of yoga in recreational therapy, the use of yoga for individuals with TBI, and the theoretical framework for this study, the Health Protection/Health Promotion Model.

Traumatic Brain Injury

TBI is defined as an alteration in brain function, or other evidence of brain pathology, caused by an external force (Brain Injury Association of America, 2011). This damage to the brain can be due to a blunt force of impact or by an object penetrating the skull and brain (Long et al., 2015). The aftermath of TBI impacts an individual's function in multiple domains and occurs on a continuum, with certain functions changing as post-injury time passes (Ragnarsson et al., 1999).

TBI affects people throughout the world and across all socio-economic levels. In a report on the cause and occurrence of injuries, TBI appears to have increased, which may be connected to the rising number of motor vehicles around
the world (Maas, Stocchetti, & Bullock, 2008). The effects of TBI can be extensive and complicated (Zaloshnja et al., 2008).

**Residual effects of traumatic brain injury.** After sustaining a TBI, individuals experience residual effects related to their physical and cognitive functioning (Ragnarsson et al., 1999). Of these residual effects, individuals with TBI may experience a decrease in quality of sleep (Verma et al., 2007), and negative impacts on their mood (Luis & Mittenberg, 2002).

**Sleep disorders.** Sleep disorders are comprised of problems with the effectiveness, timing, or total hours of sleep per night, leading to daytime sleepiness and distress (American Psychiatric Association, 2013). Sleep difficulties are a common occurrence during the acute and chronic phase of TBI, resulting in daytime somnolence and an intense desire or need for sleep, which may lead to poor daytime performance, altered sleep-wake schedule, insomnia and depression (Verma et al., 2007). Individuals with TBI were reported to have a significant increase in sleep disturbances when compared to a control group, regardless of the severity of their injury (Parcell, Ponsford, Redman, & Rajaratnam, 2008). When observing 87 individuals with TBI at least three months post-injury, Castriotta, Wilde, Lai, Atanasov, Masel, and Kuna (2007) found that 46% experienced sleep disorders. Individuals with TBI experience post-traumatic sleep-wake disturbances like insomnia, hypersomnia, and excessive daytime sleepiness (Baumann et al., 2007). Individuals with TBI experience more restless sleep and daytime drowsiness than people who have not sustained a TBI (Parcell, Ponsford, Rajaratnam, & Redman, 2006), emphasizing the effect sustaining a TBI has on an individual’s health. In a
study on sleep-wake disturbances six months after sustaining a TBI with 65 patients, 22% of the participants experienced insomnia, and 18% reported taking naps daily (Baumann et al., 2007). Other research focused on sleep disorders among people with TBI found that 46% of the 639 individuals with TBI have sleep disturbances, ranging from sleep apnea, post-traumatic hypersomnia, narcolepsy, and Restless Leg Syndrome (Castriotta & Murthy, 2011). Difficulty with sleep is connected to changes in emotional state, potentially intensifying a mental health condition (American Psychiatric Association, 2013).

**Mood disorders.** Mood may also be affected following a TBI, and in this context, will be considered the appearance of symptoms of depression, anxiety, and/or adjustment (Gordon et al., 2006).

**Depression.** When observing depression in the year following TBI, depression was present in 53.1% of the individuals admitted to the hospital for sustaining a TBI (Bombardier et al., 2010). Not only is depression often present for individuals suffering from a recent TBI, but there is an increased risk of depression for these individuals two to five years post-injury due to the heightened awareness of the impact of their injury, higher dependence on others, and decreased social interaction (Olver, Ponsford, & Curran, 1996). In examining the result of sustaining a TBI, Hart et al. (2011) found that depression after TBI is common and should be addressed due to the correlation with low activity and low quality of life.

**Anxiety.** Anxiety is defined as excessive worry and concern about the future, and can cause significant distress or inhibit social and emotional areas of functioning (American Psychiatric Association, 2013). Anxiety is a common disorder
for individuals with TBI (Hiott & Labbate, 2002). When anxiety is attributed to a
TBI, it is termed “Anxiety Disorder Due to Traumatic Brain Injury” (American
Psychiatric Association, 2013). In a meta-analysis of multiple studies related to
individuals with TBI, anxiety disorder was found to have impacted approximately
29% of 759 participants (Moore, Terryberry-Spohr, & Hope, 1994). In a study on 30
individuals with TBI, there was 76.7% comorbidity for anxiety and depression
(Jorge et al., 2004). Regardless of the cause, anxiety has the potential to have a
negative impact on the rehabilitation recovery rates of individuals with TBI (Soo &
Tate, 2007). When Hiott and Labbate (2002) combined four studies on anxiety rates
for individuals with TBI, they found that the rate for generalized anxiety disorder
among individuals with TBI was 10.2%, which is twice the rate of the general
population found by Kessler et al. (1994).

Adjustment. Individuals with TBI experience difficulty in adjustment to life
after injury, no matter the severity of their injury (Sawchyn, Mateer, & Suffield,
2005). Adjustment relates to an individual’s level of anxiety, agitation, anger, and
emotional stability and is directly connected to an individual’s progress in
rehabilitation and community integration (Hanks et al., 1999). When observing
people two years post-injury, Weddel, Oddy, and Jenkins (1980) observed that
difficulty with adjustment to injury effects an individual’s emotional state, and leads
to social and vocational problems. In a follow-up study on individuals with TBI by
Oddy, Coughland, Tyerman, and Jenkins (1985), researchers found little
improvement in adjustment to injury seven years post-injury when compared to the
pre-intervention assessment two years after injury.
When depression effects an individual with TBI, anxiety is often present as well. In a study observing major depression following TBI, nearly 30% of the individuals observed experienced major depression and nearly 75% of these individuals also faced comorbid anxiety (Jorge et al., 2004). Depression and anxiety negatively impact individuals with TBI and can inhibit the rehabilitation process due to poorer social functioning and decreased motivation, negatively effecting the psychosocial outcomes of the individual with TBI (Jorge et al., 2004). Levels of depression and anxiety play an integral part in an individual’s adjustment to injury (Hanks et al., 1999), thus speaking to the need for an improvement in mood related to depression, anxiety, and adjustment. In order to address the immediate and residual effects of sustaining an injury, individuals with TBI are first admitted to an acute care facility followed by post-acute rehabilitation.

**Treatment for Traumatic Brain Injury**

Upon sustaining a TBI, individuals are immediately assessed by medical professionals using the Glasgow Coma Scale (GCS) to determine whether they have a mild, moderate, or severe TBI (Ghajar, 2000). When in intensive care, the primary focuses are to keep the individual medically stable, and to decrease the amount of secondary symptoms that result from sustaining the TBI (Hays & Varma, 2012). Based on severity of TBI, individuals stay in acute care for up to a year and receive therapy aimed at improving their physical and cognitive functioning while treating secondary symptoms that arise in the weeks following injury (Maas et al., 2008). People admitted to acute care for TBI are transitioned to post-acute rehabilitation,
which addresses their need for adjustment, self-care, self-management, emotion regulation, and community reintegration (Malec & Degiorgio, 2002).

**Traditional rehabilitation.** Post-acute TBI rehabilitation is best accomplished using an interdisciplinary approach, addressing activities of daily living, management of pain, physical and mental rehabilitation therapies, and pharmacological needs (Khan et al., 2003). Functional advances in rehabilitation are associated with an increased quality of life for individuals with TBI (Testa, Malec, Moessner, & Brown, 2005).

Due to the impacts of injury, individuals with TBI are in need of therapy to improve overall health post-injury, including their ability to rest and regulate emotions (Levack, Kayes, & Fadyl, 2010). Among other functional goals, holistic treatment for TBI involves the development of coping skills for managing emotions, adaptation to long-term challenges, and rehabilitation therapy to decrease negative behavior (Cicerone, Mott, Azulay, & Friel, 2004; Malec & Basford, 1996).

The overall goal of TBI rehabilitation is to help individuals return to their typical lifestyle, or as close to being independent as possible (Khan et al., 2003). Typical treatments for individuals with TBI are cognitive and physical therapy, community integration, and vocational rehabilitation (Malec & Degiorgio, 2002). The use of non-traditional therapies in rehabilitation is increasingly common due to a progressive holistic approach in healthcare (Hawks 2004; Switankowsky 2000).

**Complementary integrative health in traumatic brain injury rehabilitation.** CIH includes any non-mainstream practice that works together with conventional medicine to promote health and wellness in standard healthcare
settings (NCCIH, 2017a). CIH provides the opportunity for alternative forms of health care to work in combination with traditional medicine (Druss, & Rosenheck, 1999). Within CIH, mind and body approaches consist of a variety of interventions and are administered by a trained teacher (NCCIH, 2017a). These mind and body practices include yoga and meditation. There has been an increase in the use of CIH in rehabilitation settings since the early 90's, and now about 30% of adults and 12% of children use CIH methods for their health (NCCIH, 2017b).

**Recreational therapy in rehabilitation.** Recreational Therapy is “a systematic process that utilizes recreation and other activity-based interventions to address the assessed needs of individuals with illness and/or disabling conditions, as a means to psychological and physical health, recovery and wellbeing” (American Therapeutic Recreation Association, 2017, para. 1). As a practice that aims to increase holistic health and wellbeing, recreational therapy can utilize leisure-based CIH interventions (Bonadies, 2004; Paramore, 1994) in rehabilitation facilities. A leisure activity involves relative freedom, intrinsic motivation, competence, and a positive experience (Kleiber, Hutchinson, & Williams, 2002), all of which contribute to the rehabilitation of an individual with TBI (Koskinen, 1998).

**Recreational therapy and yoga.** As a recreational therapy intervention, yoga can contribute to rehabilitation for individuals with physical, mental, or social impairments (Telles & Naveen, 1997). Recreational therapy utilizes therapeutic aspects of leisure in order to increase quality of life through interventions that improve health and wellbeing (Caldwell, 2005). As an activity that is pleasant in experience, optional in nature, and engaging, yoga is a form of leisure (Carruthers &
Hood, 2007). Yoga is a historically eastern practice that utilizes breath, physical postures and exercises, and mindfulness to increase wellbeing (Jeter, Slutsky, Singh, & Khalsa, 2015). Recreational therapy can take the form of and utilize many different interventions or forms of therapy, one of which is yoga. Yoga was initially used in eastern cultures as a spiritual practice but has recently been utilized in western cultures for treating depression, anxiety, and other medical conditions due to the therapeutic benefits, such as reducing stress and increasing body awareness (Khalsa, 2007). Recreational therapy is an effective way to bring yoga into rehabilitation because of the common goal of the practice, which is to achieve overall wellbeing (Bonadies, 2004).

**Yoga and rehabilitation.** Yoga can easily be incorporated into holistic treatment for individuals with TBI due to the focus on physical and mental health. Research on the perceptions of yoga, when integrated into inpatient rehabilitation hospitals, shows the rehabilitation was enhanced by the use of yoga due to the added benefit yoga provided, including self-management skills and assisting long-term recovery (Schmid et al., 2015). Schaeffer (2002) found a positive correlation between the practice of yoga and overall health and wellbeing. According to Schmid et al., (2012) yoga can improve multiple impairments post-stroke including balance and self-efficacy. Following an adapted yoga group intervention for individuals with TBI, participants expressed favorable improvements in comfort with approaching balance and relaxation, as well as an increased self-awareness that helped with sleep (Roney, Sample, Stallones, Van Puymbroeck, & Schmid, in review).
Yoga and sleep. Yoga is a recommended form of CIH for individuals with sleep disorders, and has been shown to improve sleep for individuals with Restless Leg Syndrome, which is a common type of sleep disorder (Innes, Selfe, Agarwal, Williams, & Flack, 2013). Yoga has the potential to improve sleep patterns in people with TBI. In an analysis of the effects of yoga on sleep for people with TBI through sleep-wake diaries, a statistically significant improvement in sleep quality was found after eight weeks of yoga treatment (Khalsa, 2004). After six months of yoga, a group of older adults were shown to have significantly decreased symptoms of insomnia, improved daytime function, and enhanced sleep quality (Chen, Chen, Lin, Fan, Lin, & Li, 2010). Yoga improved quality of sleep and decreased the use of sleep medication for 410 individuals who were recovering from cancer (Mustian et al., 2013).

Yoga and mood. Yoga has also been utilized in treatment for mood, showing decreased reports of depression and anxiety after a five-week yoga intervention (Woolery, Myers, Sternlieb, & Zeltzer, 2004). In a systematic review of 25 studies on the effects of yoga on mood for individuals with medical diagnoses of stress, anxiety, and depression, Pascoe and Bauer (2015) found that Hatha and Iyengar yoga (both of which involve breathing, meditation, and physical postures) improved positive affect and decreases symptoms of depression and anxiety. When observing the effects of yoga on anxiety, Bonadies (2004) found that individuals with AIDS-related pain and anxiety experienced a decrease in anxiety after an 8-week yoga intervention. With a sequence of yoga poses and rest in a supine position with cyclic meditation, research has shown overall lower anxiety that continues beyond the
final resting pose (Verma et al., 2007). Yoga was also shown to be beneficial in reducing anxiety among older adults who experience general anxiety and depression symptoms (Allen & Steinkohl, 1987). As a complementary therapy that improves physical and mental ability, yoga can contribute to overall adjustment to injury for individuals with TBI (Telles & Naveen, 1997). Yoga as an intervention has the ability to help individuals develop their emotional awareness, assisting the adjustment to life after sustaining TBI (Khalsa, 2007).

Yoga offers potentially beneficial effects on sleep and mood, though these effects have not been thoroughly studied in patients with TBI. Due to insufficient research, further investigation of yoga as a therapeutic intervention for sleep and mood disorders for individuals with a TBI is warranted (Pilkington et al., 2005). Yoga is likely to be a useful intervention for issues of sleep and mood due to the relaxing and calming nature of the sessions. These sessions incorporate breathing, meditation, and intentional body movement to help the patient become relaxed and learn coping strategies they can apply to real-life situations, including managing their sleep and mood. Yoga was shown to improve sleep and mood for older adults, and the benefits were sustained for at least six-months (Chen, Chen, Chao, Hung, Lin, & Li, 2009). As the guiding model for the use of yoga as a recreational therapy intervention, the Health Protection/Health Promotion Model (Austin, 1998) supports the effort to prevent potential negative health impacts for individuals with TBI while simultaneously improving their current health through holistic treatment.
Health Protection/Health Promotion Model

As a theoretical foundation, the Health Protection/Health Promotion (HP/HP) Model (see Figure 1) provides a therapeutic context for studying yoga as an intervention for individuals with TBI. The HP/HP Model contains concepts of behavior, self-actualization, improved health, and the overall wellness of an individual (Austin, 1998). The HP/HP Model has been used in a variety of settings, including an integrated HP/HP intervention to decrease unhealthy habits and reduce the likelihood of cancer on manufacturing sites (Sorensen et al., 1998). Yoga as an intervention fits into this model by accomplishing health and wellness goals through a leisure activity, as well as decreasing the likelihood of secondary conditions including sleep and mood (Khalsa, 2004; Satyapriya et al., 2013). The HP/HP Model is designed to fit into a clinical setting, addressing physical and cognitive goals of rehabilitation facilities. In short, this model views recreational therapy as a mode to achieving rehabilitation post-injury, and to reaching optimal health for any individual (Austin, 1998). Yoga is a two-fold intervention that first promotes the progress of post-acute rehabilitation and secondly enables individuals to continue their yoga practice in their local community. The HP/HP model is the conceptual foundation of this study, as it supports the use of yoga as a prescriptive activity for individuals with TBI to aide with sleep and mood (health protection) as well as allowing for further progress and health through yoga participation (health promotion).
In conclusion, a significant amount of evidence suggests that individuals with TBI are in need of interventions that address their sleep and mood. While traditional therapies focus on functional skills related to an individual’s ability to accomplish activities of daily life, yoga as a form of CIH provided by recreational therapists has the potential to improve the sleep and mood for people who are experiencing the effects of TBI. Although the impact of yoga on certain populations has been studied, it appears there are no studies specific to the sleep and mood for individuals with TBI. This convergent mixed methods study may reveal the benefits of yoga as a
recreational therapy intervention for people with TBI, with resultant improvements in sleep and mood.
Chapter 3

Methods

Design of the Study

This convergent mixed methods study examined the influence of yoga participation on sleep and mood among individuals with TBI (Creswell & Creswell, 2018). Quantitative data was collected using a repeated measures design, with pre-, mid-, and post-intervention assessments. Qualitative data consisted of two post-intervention focus groups, one with the participants, and one with the participants’ caregivers. Prior to the start of this study, approval through the Shepherd Center Institutional Review Board (IRB) and the Clemson IRB were obtained.

Selection of Subjects

Selection of subjects was through a purposeful, criterion-based sampling design to decrease the range of variation amongst subjects (Palinkas, 2015). Seven individuals who have sustained a TBI were recruited for the study from the Shepherd Center (a hospital that offers a continuum of care for individuals with TBI) and Shepherd Pathways (an outpatient TBI rehabilitation hospital) databases. The project coordinator, a Recreational Therapist at the Shepherd Center, screened all individuals interested in the study, based on the following inclusion and exclusion criteria. Inclusion criteria for persons with TBI required that they: (a) had a diagnosis of moderate-to-severe TBI, verified by the individual’s Glasgow Coma Scale (See Appendix A) score upon admission to the Shepherd Center (Balestreri, et al., 2004), (b) were a fluent speaker of English, by self-report, (c) were 18 years of age or older, (d) were able to move into different seated, standing, and supine
postures without assistance (based on self- and caregiver-report), (e) had a caregiver that is willing to assist with participant needs throughout the study, and (f) had sufficient cognitive status to participate, as determined by a score of 4/6 or higher on the Six-Item Screener (See Appendix B). The presence of any one of the following criteria resulted in exclusion from the study: (a) were unable to attend 12 or more yoga classes during the eight-week intervention, (b) had current drug or alcohol abuse, per self-report, and (c) enrollment in another intervention study that could effect sleep or mood.

Inclusion and exclusion criteria were also established for caregivers of people with TBI to ensure they were able to fulfill the role of caregiver throughout the study. The number of caregivers depended on each participant, as caregivers were only needed if the individual with TBI needed assistance with daily tasks. Inclusion criteria for the caregivers of people with TBI required that individuals: (a) were age 18 or older, (b) had no prior history of TBI, (c) were the self-identified caregiver of a participant with TBI, (d) were a fluent speaker of English, per self-report, and (3) were willing to transport the participant to all yoga sessions related to the study (as needed). Exclusion criteria for caregivers of people with TBI were as follows: (a) were unable to report on participant for whom they provide care, and (b) had current drug or alcohol abuse based on self-report.

**Procedures**

The project coordinator contacted potential participants via telephone and mailed a yoga research flyer (see Appendix C) to potential participants. Participant contact information was obtained through the Shepherd Center and Shepherd
Pathways database. Only those who formerly acknowledged on their Shepherd medical records that they were willing to be contacted for research were called by the project coordinator and mailed a flyer.

When the project coordinator recruited participants over the telephone, she informed the potential subjects about the inclusion and exclusion criteria, provided basic information about the study length and duration, and informed the participant that if he or she has the need for a caregiver on a regular basis, the caregiver was required to participate in the data collection process. The individuals with TBI received free yoga throughout the program as well as a $25 check (funded by the Shepherd Center Research Department for clinician research projects) upon completion of the program. If the individual expressed interest in the study and met the initial criterion, the project coordinator proceeded completing the Six-Item Screener to understand the presence or level of cognitive impairment. Individuals who scored at least four out of six were accepted into the study (Chen, Guo, Cao, Hong, & Liu, 2010). Immediately after performing the Six-Item Screener, the project coordinator informed the individual whether he or she was eligible to participate and gave them the dates and location of the yoga sessions.

The first yoga session had an allotted forty-five minutes prior to the yoga session for participants and caregivers to complete the assessments. The mid-point assessments were given to the participants to complete at home before returning for the ninth session. The post-intervention assessments were completed after the sixteenth yoga session. Before the first yoga session, individuals were also be required to complete the informed consent form approved by the IRB (see Appendix
F). Caregivers were asked to complete the Mayo Portland Adaptability Inventory-Part B (MPAI-Part B) (See Appendix G) and the Pittsburgh Sleep Quality Index (PSQI) (See Appendix D) based on their observation of the individual they care for. Upon completion of the intervention, participants were asked to take part in a focus group regarding the influence of yoga on their sleep and mood. Caregivers were asked to participate in a separate focus group regarding their observations of the individual they care for the duration of the yoga intervention.

**Yoga intervention.** Yoga sessions were conducted in group sessions with all participants, twice a week for eight weeks. The setting of the yoga room, which was housed in the rehabilitation center, was intentionally designed to look more like a yoga studio and less like a hospital space. The design of the room included low lighting, wall hangings, soft music, and yoga equipment (bolsters, blankets, blocks, and mats) that was set up for each individual prior to their arrival.

A recreational therapist who specializes in yoga for individuals with TBI taught all yoga sessions. The sequences of yoga poses were designed based on the Love Your Brain (LYB) Foundation yoga program, developed by Kevin Pearce (“Yoga,” 2012). The LYB Foundation designed a sequence of yoga classes specifically for people who have sustained TBI and are in need of physical, cognitive, and emotional recovery. The project coordinator of this study further adapted the LYB yoga sequences to fit this specific study group (Jourdan et al., 2016), being aware of the unique impact that a TBI has on each individual, and to focus on changes in sleep and mood (See Appendix K). Each yoga class was one hour long and included a 15-minute centering and focusing of the mind, 30 minutes of gentle physical activity
consisting of yoga postures in supine, prone, seated, and standing, and 15 minutes of meditation and relaxation.

Data Collection

**Six-Item Screener.** The Six-Item Screener (SIS) (See Appendix C) is derived from the Mini Mental State Exam (Callahan, Unverzagt, Hui, Perkins, & Hendrie, 2002) and can be completed by phone, making this screener efficient and easy to accomplish in the beginning of a study (Callahan et al., 2002). The SIS is designed to assess cognitive status in order to determine eligibility for a program or intervention. This screener includes six questions that can be scored “correct,” or “incorrect” based on the interviewee’s answer. If an individual has a score of less than four correct answers, he or she is at high-risk of cognitive impairment (Carpenter, DesPain, Keeling, Shah, & Rothenberger, 2011). The screener is designed “with acceptable sensitivity and specificity for identifying subjects with cognitive impairment” (Callahan et al., 2002, p. 771). The six questions assessed their orientation to reality and recall ability, which were needed to participate in the yoga sessions. The SIS has been used as a screener into yoga studies for individuals with TBI (Schmid, Miller, Van Puymbroeck, & Schalk, 2015).

**Pittsburgh Sleep Quality Index.** Sleep was measured using the Pittsburgh Sleep Quality Index (PSQI) (See Appendix D). The PSQI is a self-report questionnaire used to assess the quality of sleep over a one-month period (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). The index includes 24-items, the last five of which are to be completed by a partner or caregiver (Cole, Motivala, Buysse, Oxman, Levin, & Irwin, 2006). The first four questions on the PSQI are fill-in-the-blank while the
rest have a four-point likert scale ranging from 0=*not during the past month* to 4=*three or more times a week*, 0=*very good* to 4=*very bad*, and 0=*not a problem at all* to 4=*a very big problem*. The 24-items inquire about sleep duration, sleep medication, sleep latency, sleep quality, and how sleep effects an individual’s daytime activity (Grandner, Kripke, Yoon, & Youngstedt, 2006). An individual may be diagnosed with poor sleep if he or she has a global PSQI score of greater than five (Buysse et al., 1989). The PSQI has been used to screen for insomnia in individuals with TBI in post-acute care (Fichtenberg, Putnam, Mann, Zafonte, & Millard, 2001). The PSQI has a diagnostic sensitivity of 89.6%, and a specificity of 86.5% when differentiating between individuals who experience ‘poor’ or ‘good’ sleep (Buysse et al., 1989).

**Mood assessments.**

**Patient Health Questionnaire-9.** Depression was measured using the Patient Health Questionnaire-9 (PHQ-9) (see Appendix E). An individual is diagnosed with depression when a minimum of two depressive symptoms have been present for the majority of the days within a two week period, one of which must be depressed mood or decreased ability to feel pleasure (Kroenke, Spitzer, & Williams, 2001). The PHQ-9 was developed based on the DSM-5 criteria of depression (American Psychiatric Association, 2013), and can be self-administered (Martin, Rief, Klaiberg, & Braehler, 2006). The PHQ-9 is a nine-item depression scale that measures level of depression over the past two weeks using four-point likert responses, where 0=*not at all*, to 3=*nearly every day* (Kroenke, Spitzer, & Williams, 2010). Once completed, the total score was summed to assess level of overall depressive symptoms. Level of
depressive symptoms can be estimated based on the sum score; 1-4 indicating minimal depression, 5-9 indicating mild depression, 10-14 indicating moderate depression, 15-19 indicating moderately severe depression, and 20-27 indicating severe depression (Kroenke, Spitzer, & Williams, 2001). The PHQ-9 was successfully used to assess individuals who sustained a stroke (Williams et al., 2005) and appeared to discriminate well between each level of depression. The PHQ-9 was also effectively used in a study on combat-related TBI (Costanzo et al., 2014). This form of measurement was chosen for its reliability, validity, and straightforward questionnaire style (Martin et al., 2006).

**Generalized Anxiety Disorder-7.** Anxiety was measured using the Generalized Anxiety Disorder-7 (GAD-7) survey (see Appendix F). The GAD-7 assessed levels of anxiety related to worry, trouble relaxing, and restlessness. The GAD-7 is a seven-item anxiety scale that measures level of anxiety of the past two weeks using four-point likert responses, where 0=not at all, to 3=nearly every day (Spitzer et al., 2006). The GAD-7 classifies level of anxiety based on the sum of responses, with 0-4=minimal anxiety, 5-9=mild anxiety, 10-14=moderate anxiety, 15-21=severe anxiety, and a score greater than 10 is the cutoff for being diagnosed with generalized anxiety disorder (Spitzer et al., 2006). This self-report questionnaire has shown reliability and validity (Löwe et al., 2008; Spitzer et al., 2006), and can be used to analyze anxiety in the general population (Löwe et al., 2008). The GAD-7 was validated in primary care facilities (Kroenke et al., 2010) but has also been used to measure anxiety in a study on sleep and psychological conditions after sustaining
TBI (Fogelberg, Hoffman, Dikmen, Temkin, & Bell, 2012) and used to measure anxiety related to mild TBI related to combat (Costanzo et al., 2014).

**Mayo-Portland Adaptability Inventory-4.** Mood was also analyzed using the adjustment section of the Mayo-Portland Adaptability Inventory (MPAI-4), Part B (see Appendix G). The MPAI-4 has four parts, A-D, each of which address a different aspect of adjusting to injury. Each index within the MPAI-4 can be used separately based on the design of the assessment (Malec, 2005). Part B was selected due to the specific focus on adjustment to injury related to an individual’s mood (irritation, aggression, pain, depression, anxiety, fatigue, social interaction, self-awareness, and sensitivity to symptoms). The rating scale ranges from 0-4, from 0 = *no problem* to 4 = *severe problem* that interferes with activities more than 75% of the time (Malec & Lezak, 2008). A sum score of 0-7 = mild limitations, 8-15 = mild to moderate limitations, 16-24 = moderate to severe difficulties, and greater than 25 = severe limitations with a score of less than seven indicating a good outcome (Malec & Lezak, 2003). This scale was designed to assist in the clinical evaluation of participant adjustment during the post-acute (post hospital) period following an acquired brain injury (ABI) (Kean et al., 2011). This scale has been used in multiple rehabilitation settings, including post-acute rehabilitation, comprehensive day treatment, and community based rehabilitation (Altman, Swick, Parrot, & Malec, 2010; Malec, 2001; and Testa et al., 2005). This assessment includes questions that can be answered by the caregiver’s observation, further speaking to the adjustment status of the individual with TBI. Both persons with TBI and caregivers completed assessment.
**Qualitative data collection.** To broaden the understanding of the quantitative measures, the participants and caregivers each participated in focus groups aimed at better understanding participant perspectives on how yoga influenced sleep, and mood (See Appendix H-I). The qualitative data collection process was designed using the Interpretative Phenomenological Analysis (IPA) to observe deeper meaning amongst participant experiences and to give a general account of the population (Pietkiewicz & Smith, 2014). The participant focus group (see Appendix H) focused on the participant’s experience in the yoga intervention over the past eight-weeks, giving an account of their experience, any change they noticed in sleep, depression, anxiety, or adjustment to injury, and any additional comments they had about the influence of yoga over the past eight-weeks.

**Examples of Participant Focus Group Questions:**

1. Tell me about your experience participating in yoga over the past eight-weeks.

2. Having completed the eight-week yoga program, how would you describe your experience?

3. Tell me about how your sleep has been before, during, and after eight-weeks of yoga.

4. Describe your level of depression or feeling of hopelessness since completing the eight weeks of yoga.

5. Describe your level of nervous, anxious or restless feelings since completing the eight-weeks of yoga.

6. How do you feel yoga has changed your adjustment to your injury?

7. Do you have any additional comments on the yoga program?

The caregiver focus group (See Appendix I) asked similar questions, focused on the caregiver’s observation of participant behavior.
Examples of Caregiver Focus Group Questions:

1. Tell me about your participant’s experience participating in yoga over the past eight-weeks.
2. Having completed the eight-week yoga program, how would you describe your participant’s experience?
3. Tell me about how your participant’s sleep has been over the past eight-weeks.
4. Describe your thoughts on your participant’s level of depression or feeling of hopelessness since completing the eight weeks of yoga.
5. Have you observed a change in amount of nervous, anxious or restless feelings since completing the eight weeks of yoga?
6. How do you feel yoga has changed the participant’s adjustment to sustaining a traumatic brain injury?
7. Do you have any additional comments on the yoga program?

These focus groups were held in the private yoga room at the Shepherd Center and recorded using two audio recorders.

Data Analysis

Quantitative analysis. Descriptive statistics were used to describe demographics, which included age, gender, marital status, race, work status, education, time (in years) since injury, and cause of injury. The Friedman Two-way Analysis of Variance by Ranks was used to compare mean ratings of each assessment, using the Statistical Package for the Social Sciences (SPSS) software version 24. Comparisons were made between the group mean Pittsburgh Sleep Quality Index scores (PSQI), depression scores (PHQ-9), anxiety scores (GAD-7), and adjustment scores (MPAI-4, Part B) from pre-, mid-, and post-intervention assessments. To further examine the quantitative results using the means from each
assessment, percent change was calculated using the following formula: Percent change from pre-intervention = [(post-intervention value–pre-intervention value)/pre-intervention value] x 100%.

**Qualitative analysis.** The qualitative focus groups were transcribed verbatim to increase descriptive validity (Johnson & Turner, 2003). To ensure participant confidentiality, transcriptions were de-identified, with each individual being referenced based on their assigned participant number. The caregiver focus group lasted 35 minutes, and the participant focus group lasted 25 minutes. The caregiver focus group yielded more in depth responses, potentially due to the third-person perspective that caregivers were able to provide about participant experiences. The project coordinator observed the focus groups to ensure interpretive validity (Johnson & Turner, 2003), reporting that the project coordinator and primary researcher shared the same perceptions of focus group discussions.

In accordance with Creswell and Creswell’s (2018) sequential process of qualitative analysis, focus group transcriptions were organized and read thoroughly by the primary researcher. Coding was utilized to identify patterns within the data relevant to predetermined codes (i.e., sleep and mood), and to determine the existence of any emergent codes. Similar codes were categorized and described as themes, and a table-representation of descriptive information was created. The IPA enabled the primary researcher to consider the connection between verbal response and emotional change by identifying themes as people described their experience throughout the yoga intervention (Smith, Flowers, & Osborn, 1997).
After initial transcription, the primary researcher reviewed the qualitative data for themes, and categorized the responses based on their connection to sleep, depression, anxiety, and adjustment to injury. The project coordinator and an additional researcher peer reviewed the transcribed focus groups before and after analysis to check for consistency and establish inter-rater reliability (Creswell & Creswell, 2018).

**Mixing quantitative and qualitative data.** The influence of yoga participation on sleep and mood among individuals with a TBI was best examined through multiple forms of data, addressing research questions in a general and broad quantitative fashion, as well as providing a narrative and explanatory qualitative aspect (Fetters, Curry, & Creswell, 2013). Based on the convergent mixed methods research design, qualitative and quantitative data were collected and analyzed separately (Creswell & Creswell, 2018). Following analysis, quantitative and qualitative results were compared to discover converging or differing results (Fetters et al., 2013).
Chapter 4

Manuscript
The Influence of Yoga on Traumatic Brain Injury Related to Sleep and Mood

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Abstract

Sustaining a Traumatic Brain Injury (TBI) has a significant effect on an individual's physical and mental abilities. Residual effects of TBI include sleep and mood disorders. Sleep disorders include any disturbance in an individual’s quality of sleep and daytime functioning. Mood disorders include depression, anxiety, and adjustment to injury. Rehabilitation after TBI involves a range of therapeutic services in which a holistic approach to therapy addresses both the mind and the body. Yoga may be used to improve functioning for individuals with TBI. The purpose of this convergent mixed methods study was to examine the influence of yoga on the sleep and mood in individuals with TBI. This research study involved an eight-week yoga intervention at a large rehabilitation hospital in the southern United States. Seven individuals who sustained a TBI were recruited for the intervention. Sleep and mood were assessed pre-, mid-, and post-intervention. Upon completion of the intervention, participants and their caregivers took part in focus groups to share their perceptions of change in sleep and mood. Data were collected, analyzed, and reported to discuss the influence of yoga in individuals with TBI. Quantitative data revealed no statistical significance, though percent change calculations of pre- and post-data showed a substantial decrease in anxiety and an improvement in adjustment to injury. Qualitative data were consistent with the calculated percent change in addition to an emerging theme of social support amongst individuals with TBI.

Keywords: Yoga, therapy, Traumatic Brain Injury, sleep, mood, depression, anxiety, adjustment
Introduction

A Traumatic Brain Injury (TBI) is defined as an acquired injury that is the result of direct damage to the brain (Brain Injury Association of America, 2011). A TBI can occur quickly and unexpectedly, but often has a long-term effect on an individual’s physiological and neurological abilities (Long et al., 2015; Ragnarsson et al., 1999). In the United States, approximately 1.7 million people per year are admitted to the emergency room due to sustaining a TBI (Bigler, Weiner, & Lipton, 2009), many of whom continue to live with residual effects (Selassie et al., 2008). The residual effects of a TBI include, but are not limited to, trouble sleeping, changes in mood, and difficulty adjusting to life after injury (Bellon et al., 2012; Verma, Anand, & Verma, 2007).

Sleep disorders are defined as any consistent internal disturbance in sleep (American Psychiatric Association, 2013). Regarding people with TBI, poor sleep quality is common (Verma et al., 2007) and has the potential to decrease emotional and physical abilities, as well as slow the recovery process (Watson et al., 2012). In addition to the negative impacts from sustaining a TBI, individuals are also susceptible to mood disorders as a residual effect of TBI. Common behavioral impairments for people with TBI include mood disorders, which can manifest as depression, anxiety, and adjustment to injury (Bellon et al., 2012; Ragnarsson et al., 1999). Depression is a common secondary factor for clinical conditions related to TBI (Trahan, Ross, & Trahan, 2001). Depression is defined by the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (American Psychiatric Association, 2013), as depressed mood or loss of pleasure in life activities for more than two
weeks, change from an individual’s baseline mood, and compromised functioning. Generalized anxiety is defined in the DSM-5 as extreme or unrealistic worry for the majority of the days within six months (American Psychiatric Association, 2013). Anxiety after TBI may first be seen as a normal reaction to trauma, but individuals with TBI appear to have an increased risk of developing generalized anxiety in comparison to the general population (Hiott & Labbate, 2002). Individuals with TBI also experience an adjustment to life after injury (Moore, Stambrook, & Peters, 1989). Level of adjustment after sustaining a TBI can be observed through the presence of depression, anxiety, fatigue, and irritability (Kean, Malec, Altman, & Swick, 2011).

Due to the physical, cognitive, and emotional impacts of sustaining a TBI, treatment for TBI needs to be approached from a multidisciplinary perspective. As an emerging element of physical rehabilitation, complementary integrative health (CIH) interventions are health practices used in combination with traditional medicine (National Institutes of Health, 2016). CIH includes a wide variety of healing interventions that counteract illness or assist in increasing health and wellbeing (Pal, 2002). CIH interventions, such as yoga, can be used as a holistic and complementary treatment to address the physical and mental needs of individuals with TBI (Bonadies, 2004; Paramore, 1994).

In the West, yoga focuses on three main practices: breathing (pranayama), meditation (dhyana), and physical poses (asanas) (Salmon, Lush, Jablonski, & Sephton, 2009). Yoga interventions have been utilized in several rehabilitation settings (Khalsa, 2004; Schmid, Miller, Van Puymbroeck, & Schalk, 2016; Schmid et
al., 2015, Van Puymbroeck, Miller, Dickes, & Schmid, 2015) for the purpose of providing a complementary form of therapy. Research on the perceptions of yoga, when integrated into inpatient rehabilitation hospitals, shows patients’ rehabilitation was enhanced by the use of yoga due to the added benefit yoga provided, including self-management skills and assisting long-term recovery (Schmid et al., 2015, Van Puymbroeck, 2015).

Yoga for individuals with TBI is likely a useful intervention due to the adaptability of yoga sequences, the potential physical and cognitive benefits, and the research pointing to the potential sleep and mood benefits (Van Puymbroeck et al., 2017; Khalsa, 2004). While there is limited research on yoga for TBI, one small, exploratory study found that when yoga was administered 16 times over the course of eight weeks, individuals with TBI expressed improvement in physical, emotional, and mental domains (Schmid et al., 2016). In an analysis of the influence of yoga on sleep for people with TBI through sleep-wake diaries, a substantial improvement in sleep quality was found after eight weeks of yoga treatment (Khalsa, 2004). Following an adapted yoga group intervention for individuals with TBI, participants expressed favorable improvements in comfort with approaching balance and relaxation, as well as an increased self-awareness that helped with sleep (Roney, Sample, Stallones, Van Puymbroeck, & Schmid, in review).

There is limited research on yoga for individuals with a TBI and yoga, thus there is need for further studies related to the influence of yoga on sleep and mood in this population. Therefore, the purpose of this study was to observe, analyze, and discuss the influence of yoga on TBI related to their sleep and mood.
Methods

Design

This convergent mixed methods pilot study examined the influence of yoga participation on sleep and mood among individuals with TBI. Quantitative data was collected using a repeated measures design, with pre-, mid-, and post-intervention assessments given. Qualitative data was collected through two post-intervention focus groups, consisting of one focus group with participants and one with the participants’ caregivers. Prior to the start of this study, approval through the Rehabilitation Hospital’s Institutional Review Board (IRB) and the Clemson IRB were obtained.

Recruitment and Participants

Purposeful, criterion-based sampling was employed in this study to decrease the variation of diagnosis amongst subjects (Palinkas, 2015). Fifteen individuals who sustained a TBI and were prior patients at a large rehabilitation hospital in the Southeastern United States, that provides a continuum of care for individuals with TBI, were contacted by the project coordinator. The project coordinator, a Recreational Therapist at the rehabilitation hospital, screened all individuals interested in the study using the Six-Item Screener (SIS) to assess cognitive status in order to determine eligibility for a program or intervention (Callahan, Unverzagt, Hui, Perkins, & Hendrie, 2002). The SIS has been used as a screener into yoga studies for individuals with TBI (Schmid, Miller, Van Puymbroeck, & Schalk, 2015).
After screening the individuals, the project coordinator reviewed the inclusion and exclusion criteria with the individuals with TBI as well as their caregivers, to determine if they met the inclusion and exclusion criteria for the study. Inclusion criteria for persons with TBI required that they: (a) had diagnosis of moderate-to-severe TBI, verified by the individual’s Glasgow Coma Scale score upon admission to the rehabilitation hospital (Balestreri, et al., 2004), (b) were a fluent speaker of English, by self-report, (c) were 18 years of age or older, (d) were able to move into different seated, standing, and supine postures without assistance (based on self- and caregiver-report), (e) had a caregiver that was willing to assist with participant transportation needs throughout the study, and (f) had sufficient cognitive status to participate, as determined by a score of at least 4/6 on the Six-Item Screener. The presence of any one of the following criteria resulted in exclusion from the study: (a) were unable to attend 12 or more yoga classes during the eight-week intervention, (b) had current drug or alcohol abuse, per self-report, and (c) enrollment in another intervention study that could affect sleep or mood. Inclusion and exclusion criteria were also established for caregivers of participants with TBI to ensure they were able to fulfill the role of caregiver throughout the study, although a caregiver was only required if the individual with TBI needed assistance with daily tasks. Inclusion criteria for the caregivers required that individuals: (a) were age 18 or older, (b) had no prior history of TBI, (c) were the self-identified caregiver of person with TBI, (d) were a fluent speaker of English, per self-report, as being willing to transport participant to all yoga sessions related to the study (as needed). Exclusion criteria for caregivers of people with TBI were as
follows: (a) were unable to report on participant for whom they provide care, and
(b) had current drug or alcohol abuse based on self-report. All participants provided
written informed consent prior to the start of the study. Participants admitted to the
study were given a $25 incentive, funded by the rehabilitation hospital research
department for clinician research projects, upon completion of the study.

**Intervention**

Yoga sessions were conducted in groups in a yoga room within a large
rehabilitation hospital in the Southeastern United States. Sessions occurred twice a
week for eight weeks, for a total of 16 yoga sessions. A recreational therapist who is
a yoga teacher and specializes in yoga for individuals with TBI taught all yoga
sessions. The sequences of yoga poses were designed based on the Love Your Brain
(LYB) Foundation yoga program, which is designed for individuals with TBI (“Yoga,”
2012). The project coordinator of this study adapted the LYB yoga sequences to fit
this specific study group (Jourdan et al., 2016), to focus on influencing sleep and
mood. Changes to the LYB protocol included increased time for meditation and a
decrease in poses accomplished on hands and knees. The yoga sequence is available
in Appendix K. Each yoga class was one hour long and included a 15-minute
centering and focusing of the mind, 30 minutes of gentle physical yoga postures in
supine, prone, seated, and standing positions, and 15 minutes of meditation and
relaxation. The yoga sessions remained at the same level of difficulty from start to
finish, in order to facilitate the transition from the rehabilitation setting to the
community setting by encouraging growth towards mastery of the postures as
opposed to growth in the number of postures.
Data Collection

Quantitative measures were chosen to focus on sleep and mood for individuals with TBI. Qualitative data were collected through post-intervention focus groups. The primary researcher conducted all data collection.

Quantitative Measures.

Sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI), a self-report questionnaire used to assess the quality of sleep over a one-month period (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). The 24-items inquire about sleep duration, sleep medication, sleep latency, sleep quality, and how sleep effects an individual’s daytime activity (Grandner, Kripke, Yoon, & Youngstedt, 2006). An individual may be diagnosed with poor sleep if he or she has a global PSQI score of greater than five. The PSQI has been used to screen for insomnia in individuals with TBI in post-acute care (Fichtenberg, Putnam, Mann, Zafonte, & Millard, 2001). The PSQI has a diagnostic sensitivity of 89.6%, and a specificity of 86.5% when differentiating between individuals who experience ‘poor’ or ‘good’ sleep (Buysse et al., 1989).

Depression was measured using the Patient Health Questionnaire-9 (PHQ-9). The PHQ-9 was developed based on the DSM-V criteria of depression (American Psychiatric Association, 2013), and can be self-administered (Martin, Rief, Klaiberg, & Braehler, 2006). The PHQ-9 is a nine-item depression scale that measures level of depression over the past two weeks using four-point likert responses, where 0=not at all, to 3=nearly every day (Kroenke, Spitzer, & Williams, 2010). Once completed,
the total score was summed to assess level of overall depressive symptoms. The
PHQ9 classifies level of depression based on the sum of responses, with 0-
4=minimal depression, 5-9=mild depression, 10-14=moderate depression, 15-
19=moderately severe depression, greater than 20=severe depression (Fann et al.,
2005), and a score greater than 12 is the cutoff for being diagnosed with major
depressive disorder (Cook et al., 2011). The PHQ-9 was also effectively used in a
study on combat-related TBI (Costanzo et al., 2014).

Anxiety was measured using the Generalized Anxiety Disorder-7 (GAD-7)
survey. The GAD-7 is a seven-item anxiety scale that measures level of anxiety of the
past two weeks using four-point likert responses, where 0=not at all, to 3=nearly
every day (Spitzer et al., 2006). This self-report questionnaire has shown reliability
and validity (Löwe et al., 2008; Spitzer et al., 2006), and can be used to analyze
anxiety in the general population (Löwe et al., 2008). The GAD-7 classifies level of
anxiety based on the sum of responses, with 0-4=minimal anxiety, 5-9=mild anxiety,
10-14=moderate anxiety, 15-21=severe anxiety, and a score greater than 10 is the
cutoff for being diagnosed with generalized anxiety disorder (Spitzer et al., 2006).
The GAD-7 was validated in primary care facilities (Kroenke et al., 2010) but has
also been used to measure anxiety in a study on sleep and psychological conditions
after sustaining TBI (Fogelberg, Hoffman, Dikmen, Temkin, & Bell, 2012) and used
to measure anxiety related to mild TBI related to combat (Costanzo et al., 2014).

Adjustment was analyzed using Part B of the Mayo-Portland Adaptability
Inventory (MPAI-4). The MPAI-4 has four parts, each of which address a different
aspect of adjusting to injury. Part B was selected due to the specific focus on
adjustment to injury related to an individual's mood (irritation, aggression, pain, depression, anxiety, fatigue, social interaction, self-awareness, and sensitivity to symptoms). The rating scale ranges from 0-4, from 0 = no problem to 4 = severe problem that interferes with activities more than 75% of the time (Malec & Lezak, 2008). A sum score of 0-7 = mild limitations, 8-15 = mild to moderate limitations, 16-24 = moderate to severe difficulties, and >25 = severe limitations with a score of less than seven indicating a good outcome (Malec & Lezak, 2003). This scale was designed to assist in the clinical evaluation of participant adjustment during the post-acute (post hospital) period following an acquired brain injury (Kean et al., 2011). This scale has been used in multiple rehabilitation settings, including post-acute rehabilitation, comprehensive day treatment, and community based rehabilitation (Altman, Swick, Parrot, & Malec, 2010; Malec, 2001; Testa et al., 2005).

**Qualitative Data Collection.** As a convergent mixed methods study, this intervention was best examined through multiple forms of data, addressing research questions in a general and broad quantitative fashion, as well as providing a narrative and explanatory qualitative aspect (Fetters, Curry, & Creswell, 2013). The participant focus group focused on the participant’s experience in the yoga intervention, giving an account of their experience, any change they noticed in sleep, depression, anxiety, or adjustment to injury, and any additional comments they had about the influence of yoga over the past eight-weeks. The caregiver focus group facilitator asked similar questions, and focused on the caregiver’s observation of participant behavior over the past eight-weeks. These focus groups were held in the
private yoga room at the rehabilitation hospital and recorded using two audio
recorders.

Data Analysis

Quantitative analysis. Descriptive statistics were used to describe
demographics, which included age, gender, marital status, race, work status,
education, time (in years) since injury, and cause of injury. Nonparametric analysis
was indicated because of the low sample size, thus the Friedman Test was used to
compare mean ratings of each assessment, using the Statistical Package for the
Social Sciences (SPSS) software version 24. Comparisons were made between the
group mean Pittsburgh Sleep Quality Index (PSQI) scores, depression scores (PHQ-9),
anxiety scores (GAD-7), and adjustment scores (MPAI-4, Part B) from pre, mid,
and post-intervention assessments. To further examine the quantitative results
using the means from each assessment, percent change was calculated using the
following formula: Pre-intervention = [(post-intervention value–pre-intervention
value)/pre-intervention value] x 100%.

Qualitative analysis. The qualitative focus groups were transcribed
verbatim to increase descriptive validity (Johnson & Turner, 2003), and participants
and caregivers were assigned a subject number to ensure confidentiality. The
project coordinator observed the focus groups to ensure interpretive validity
(Johnson & Turner, 2003), reporting that the project coordinator and primary
researcher shared the same perceptions of the focus group discussion. After initial
transcription, the primary researcher reviewed the qualitative data for themes, and
categorized the responses based on their connection to sleep, depression, anxiety,
and adjustment to injury. The project coordinator and an additional researcher reviewed the transcripts from the focus groups before and after analysis to check for consistency and establish inter-rater reliability (Creswell & Creswell, 2018). In accordance with Creswell and Creswell’s (2018) sequential process of qualitative analysis, focus group transcriptions were organized and read thoroughly by the primary researcher. Coding was deductive, to identify patterns within the data relevant to predetermined outcomes (i.e., sleep and mood), and to determine the existence of any emergent codes.

**Mixing quantitative and qualitative data.** Qualitative and quantitative data were collected and analyzed separately (Creswell & Creswell, 2018). After individual data analysis, quantitative and qualitative data were compared to discover converging or differing results (Fetters et al., 2013).

**Results**

Overall, 15 people were contacted and invited to participate in eight weeks of yoga. Ultimately, seven people passed the SIS, met the inclusion criteria, and committed to the study, while eight declined despite having passed the SIS, citing scheduling conflicts, distance from home, lack of interest, and inability to commit to eight sequential weeks. Six people completed the study, five of whom had caregivers, while one person dropped out of the study 1.5 weeks prior to completion due to travel conflicts. Of the six participants who completed the study, four (67%) were female, and the average age was 31, with the ages ranging from 21-43 years old. The majority of participants were White (66%), and most were single (83%). Half of participants had a graduate degree, although 50% were unable to work. The
average time since injury was 4.67 years. On average, participants attended 14 of
the 16 sessions, with an attendance rate of 89% based on total number of sessions
offered. See Table 1 for additional participant demographics.

Table 1. Participant demographics

<table>
<thead>
<tr>
<th>Participant Number</th>
<th>Gender</th>
<th>Age</th>
<th>Race</th>
<th>Marital Status</th>
<th>Education</th>
<th>Employment</th>
<th>Years since TBI</th>
<th>Cause of TBI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>F</td>
<td>35</td>
<td>Hispanic/Latino</td>
<td>Single</td>
<td>Bachelor’s Degree</td>
<td>Unemployed</td>
<td>13</td>
<td>Car hit pedestrian</td>
</tr>
<tr>
<td>2</td>
<td>M</td>
<td>40</td>
<td>White</td>
<td>Married</td>
<td>Graduation Degree</td>
<td>Unemployed</td>
<td>1</td>
<td>Tree branch fell on head</td>
</tr>
<tr>
<td>3</td>
<td>F</td>
<td>27</td>
<td>White</td>
<td>Single</td>
<td>Graduation Degree</td>
<td>Unable to work</td>
<td>3</td>
<td>Fell off horse</td>
</tr>
<tr>
<td>4</td>
<td>M</td>
<td>43</td>
<td>White</td>
<td>Single</td>
<td>Graduation Degree</td>
<td>Unable to work</td>
<td>5</td>
<td>Assault</td>
</tr>
<tr>
<td>5</td>
<td>F</td>
<td>22</td>
<td>Black/African</td>
<td>Single</td>
<td>Some college</td>
<td>Unable to work</td>
<td>2</td>
<td>Gun Shot Wound</td>
</tr>
<tr>
<td>6</td>
<td>F</td>
<td>21</td>
<td>White</td>
<td>Single</td>
<td>High School Graduate</td>
<td>Student</td>
<td>4</td>
<td>Gun Shot Wound</td>
</tr>
</tbody>
</table>

In the following sections, both quantitative data and qualitative data are
provided by outcome, as the intent of this convergent mixed methods design was to
compare converging or differing results (Fetters et al., 2013). See Table 2 for the
mean pre and posttest, p-value, and percent change.

Table 2. Quantitative Data

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Mean ± SD Pre Test</th>
<th>Mean ± SD Post Test</th>
<th>p-value</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSQI</td>
<td>5.33±3.01</td>
<td>5.00±2.83</td>
<td>p=0.48</td>
<td>-5.66%</td>
</tr>
<tr>
<td>PHQ9</td>
<td>4.57±5.03</td>
<td>3.89±3.41</td>
<td>p=1.00</td>
<td>-14.88%</td>
</tr>
<tr>
<td>GAD7</td>
<td>4.71±3.25</td>
<td>2.83±2.40</td>
<td>p=0.31</td>
<td>-39.90%</td>
</tr>
<tr>
<td>MPAI-4, Part B</td>
<td>6.29±4.35</td>
<td>2.67±3.67</td>
<td>p=0.25</td>
<td>-57.61%</td>
</tr>
</tbody>
</table>

**Sleep.** The Friedman Test revealed that quality of sleep did not differ
significantly when comparing pre-, mid-, and post-intervention PSQI scores.
(X²=1.46; p=0.48). The percent change from the pre- and post-intervention scores yielded a result of -5.7% change, indicating a minor decrease in reported issues related to sleep. The qualitative data on sleep was convergent with the quantitative data, supporting that there was no significant change in sleep quality for most participants. Most caregivers and participants commented on an improvement in sleep since the individual sustained the injury, but most did not identify further improvement as a result of the yoga intervention. However, one caregiver believes yoga has enabled her loved one to have deeper rest while sleeping. The caregiver stated that her loved one has "deeper sleep, she sleeps longer in the morning, has trouble to wake up, and she dreams. And she remembers her dreams!" In addition, one participant commented on her ability to sleep, saying sleeping in the past year "I would hear any little noise, it’d just bother me and wake me. So sleep with earplugs, I slept with earplugs and an eye mask for light. Now I’m much better and I don’t need earplugs or a mask."

**Depression.** The quantitative and qualitative data showed converging results regarding depression, as neither form of data collection identified substantial changes following the yoga intervention. The Friedman Test showed insignificant results regarding pre-, mid-, and post-PHQ-9 data (X²=0, p=1.00), while the percent change from the pre- to post-intervention assessment was -14.9%, indicating a slight decrease in depression. Depression was briefly highlighted in the participant focus group, as one individual stated “I’ve never seen myself as depressed,” and later said “I don’t think I’m depressed but again, the doctors have
attributed my past tiredness and sluggishness to depression, and they say that now that I am active, it helps that aspect.”

**Anxiety.** No significant difference in anxiety was found using the Friedman Test ($X^2=2.33$, $p=0.31$). However, the percent change from pre- to post-test was -39.9%, representing a substantial decrease in anxiety after the yoga intervention. Complementing the percent change calculation, both caregivers and participants provided meaningful comments related to a decrease in anxiety during focus groups. Caregivers stated that yoga was “calming,” “relaxing,” and “increased the awareness” of their loved ones. Participants shared similar thoughts, using the words “calming” and “relaxing” throughout their discussion of their yoga experience. One caregiver stated:

What my daughter seems to get out of it more than anything is the mindfulness and the meditation and just calming her down. Because we go at a high pace, and so this is a good way for her to just relax and help her brain get better.

In addition, another caregiver said “she’s maybe more relaxed I would say. Less anxious.” Later on this same caregiver explained, that yoga “sets her back and somehow it’s relaxing in order to let other things than the panic in her mind.”

Participant responses aligned with the caregiver perspectives, as participants commented, “yoga has always relaxed me,” and “it helps me loosen up.” Another participant expressed her appreciation of yoga, saying:
It’s perfect how the practice slows down, repeats, and just focuses on just a healthy mind. So whereas out in the world, we’re supposed to go, go, go. Here we can just slow down, be in our minds, be present, and just be.

**Adjustment.** Though quantitative data regarding adjustment to injury produced non-significant findings based on the Friedman Test ($X^2=2.80$, $p=0.25$), the calculated percent change from the pre- to post-intervention MPAI-4 Part B assessment was -57.6%, indicating a considerable decrease in issues related to adjustment to injury. In addition, the qualitative data showed an improvement in adjustment. Qualitative data showed an increased interest in activity and self-esteem, as well as a decrease in irritability from the perspective of both the caregivers and the participants. When asked about a change in amount of activity for individuals with TBI, one caregiver said “he’s interested in doing more than just this.” When asked the same question, a participant stated, “I do want to do more activities outside of the house.” Moreover, one participant explained, “I do have more endurance of being able to take on more activities throughout the course of the day.” Caregivers emphasized an increase in self-esteem following the yoga intervention. One caregiver commented on the relationship between improvement in self-esteem, and the eight weeks of yoga, saying:

> Self-esteem I think is a big problem. I mean, a huge problem. But um, maybe for the past two months she, I think she’s more aware and more in acceptance. So it seems like the self-esteem is less of a problem,

While another caregiver explained that her husband is considering taking initiative on a project that she relates to an increase in self-esteem. Concerning irritability, a
caregiver stated her son is “definitely getting more pleasant to be with,” and a participant said “yoga, being mindful, the whole practice of presence and really being intentional and present with what you’re doing has positively affected the way I approach anything.”

**Social Support in the TBI Community.** Though not included in the purpose of this study, appreciation of the community that formed as a result of the yoga intervention was evident as a theme throughout the caregiver and participant focus groups. In the profound words of a caregiver, yoga has provided “a place [for the participants] to be injured.” Caregivers expressed “it’s just nice to be with people who are maybe dealing with the same things,” “they need groups to socialize, to exchange because they’re very lonely,” and yoga has “been wonderful for him because the rest of the time he is in the home alone.” In line with caregiver responses, a participant stated that yoga helps in “having community support others who know your situation, experience, having gone through the same things.” One participant expressed an appreciation of the ability to share experiences, saying “it’s better to have friends that you can meet actually, all of you, and to know that they’re doing the same thing that you have to.” The community developed through yoga is unique due to the emphasis on rest and relaxation, which one caregiver highlighted by saying “yoga allows them to have time to think...we’re not the ones that are gonna settle down with them like ‘ah, let’s rest’...we don’t have the time and probably not the patience either.”
Discussion

The primary purpose of this pilot study was to examine the influence of yoga on individuals TBI related sleep quality and mood after eight weeks of bi-weekly yoga.

There was not a substantial change in sleep based on the PSQI. The data in this study differ from previous research that found yoga to improve sleep (Khalsa, 2004; Mustian et al., 2013). Though sleep disorders are common for individuals with TBI (Verma et al., 2007), the majority of this study population did not express complaints with sleep prior to or after the yoga intervention, resulting in little to no change in quantitative and qualitative results related to sleep.

Considered to be a residual effect of sustaining TBI (Olver, Ponsford, & Curran, 1996), depression was expected to be present in this study population. The pre-intervention average depression score from the PHQ9 was 4.57, (just beneath the mild depression score of 5-10), showing that participants did not initially experience significant depression symptoms. Depression was not significantly impacted by the yoga intervention, though the percent change showed a slight reduction in depressive symptoms, consistent with previous research claiming yoga yielded decreased reports of depression (Woolery, Myers, Sternlieb, & Zeltzer, 2004).

The findings of this study support previous work that yoga has the potential to decrease symptoms of anxiety (Bonadies, 2004; Pascoe & Bauer, 2015; Verma et al 2007). Though quantitative measures yielded insignificant results, the percent change showed a substantial decrease in symptoms of anxiety. The qualitative data
also demonstrated a reduction in anxiety, which participants identified was due to the emphasis on the calming and relaxing effect of yoga. Furthermore, a study by Verma et al., (2007) that identified a decrease in anxiety continued beyond the yoga session was supported by caregiver and participant perspective shared during the focus groups.

Although not statistically significant, adjustment to injury did substantially improve, as indicated in the percent change calculation and the qualitative data. In congruence with the claim that yoga contributes to overall adjustment for individuals with TBI (Telles & Naveen, 1997), this yoga intervention contributed to a decrease in irritability, and an increase of interest in activities. In addition, focus group discussions showed considerable improvement of self-esteem and self-awareness, supporting previous work that demonstrated the ability to improve emotional awareness through yoga after sustaining TBI (Khalsa, 2007). The yoga intervention focused on awareness of the body and the mind by encouraging participants to bring awareness to specific body parts at time, and acknowledge certain emotions that may come up. The focus on awareness throughout each yoga session likely contributed to the comments on increased self-esteem and awareness, consistent with the study results on the impact of an 8-week yoga program for individuals with TBI that indicated an improvement in self-perception (Donelly, Linnea, Grant, & Lichtenstein, 2017).
A theme of social support through the yoga intervention became apparent through the focus group discussions. In a study on social support for individuals with TBI, Stålnacke (2007) found reports of low quality social support due to lack of social interaction. Consistent with results from other yoga studies (Van Puymbroeck, Schmid, Shinew, & Hsieh, 2011; Moadel, 2007; Greenglass, Fiksenbaum, & Eaton, 2006; Van Puymbroeck, Payne, & Hsieh, 2007), caregivers and participants described the yoga sessions as beneficial due to the sense of camaraderie with people who have similar life changes due to sustaining TBI. Caregivers expressed the need for their loved ones to be with other people due to their loss of friends since sustaining TBI. Discussions during both caregiver and participant focus groups indicated an appreciation of the shared experience yoga provides. Participants in an inpatient rehabilitation setting benefited from the social interaction provided by yoga (Schmid et al., 2015), supporting the theme of social support that emerged from this pilot study.

**Implications for Further Research and Practice**

The diverging results from quantitative measures and qualitative interpretations specific to the influence of yoga on sleep and mood indicate a need for further investigation. In order to expand this study, future research should consider including only those with current complaints related to sleep and mood, and involve a larger sample size. Future studies may also consider the use of a yoga sequence that becomes progressively more challenging, as the content of the yoga intervention used in this study maintained the same level of difficulty from start to
finish. A progression of poses may produce more substantial results, as challenging activities are more likely to produce change (Paluska & Schwenk, 2000).

Yoga is a valuable therapy that can be implemented in a rehabilitation setting (Cantor & Gumber, 2013; Schmid et al., 2015; Van Puymbroeck et al., 2015). Attendance was high due to the location of the yoga intervention, since the rehabilitation hospital was a familiar place to all participants. Participants and caregivers also stated that they would like to see yoga included in TBI rehabilitation and they also identified the desire for the yoga intervention to continue and be offered individuals in outpatient programs. The qualitative data supported the value of yoga within a TBI rehabilitation setting as it can decrease anxiety, improve adjustment to injury, and promote social support within the TBI community.

**Limitations**

Due to the nature of research, this pilot study has limitations. This study took place in one rehabilitation hospital in the southeast, and cannot be generalized to all yoga programs within a rehabilitation hospital. Second, while we aimed to observe the influence of yoga on ten people, only six people remained committed to the study from start to finish, resulting in a small sample size, where it is difficult to determine statistically significant changes in outcomes. More clearly stating attendance requirements when recruiting participants may increase commitment to the study. This study was not blind to the primary researcher or the participants, as the primary researcher was in direct contact with the participants, and the participants were informed of the purpose of the study when recruited for the study. Due to the pilot nature of this study, no control group was observed in
comparison with the individuals receiving the yoga intervention. By adding a control group, researchers may be able to further understand the influence of yoga versus other environmental and social influences. Finally, the yoga sessions were not designed to build on themselves, but rather involved the same primary moves with variations according to the yoga instructor’s preference. A yoga sequence that becomes progressively more challenging may yield stronger results.
Chapter 5

Conclusion

This was an eight-week study designed to observe the influence of yoga on individuals with TBI related to their sleep and mood, known residual effects of individuals who have sustained a TBI (Bellon et al., 2012; Verma et al., 2007). As an intervention that can be utilized in a rehabilitation setting (Schmid 2015; Van Puymbroeck et al., 2015), yoga was selected for its potential to address residual effects of TBI. The primary researcher hypothesized that eight weeks of bi-weekly yoga would result in an improvement in quality of sleep, and a resulting positive relationship between yoga and mood (e.g. mood will improve with increased participation in yoga). After recruitment, seven participants committed to the study and six remained with the study through completion. Participants were given pre-, mid-, and post-intervention assessment that assessed sleep and mood (specifically depression, anxiety, and adjustment to injury). Upon completion of the study, caregivers and participants took part in separate focus groups to further understand caregiver and participant perspectives on the influence of yoga on individuals with TBI. Data collection and analysis was based on a convergent mixed methods design (Creswell & Creswell, 2018), which involved separate analysis of quantitative and qualitative data, followed by a comparison of quantitative and qualitative results to determine whether finders were convergent or divergent of one another.

This convergent mixed methods pilot study found that individuals with TBI who participate in an eight-week yoga intervention do not experience significant change in quality of sleep. The lack of change in sleep can likely be explained by the
participants’ initial report on sleep, which displayed a high quality of sleep before the study began. Percent change analyses and the focus group data demonstrated an improvement in anxiety symptoms and an improvement in adjustment to injury. The mood-related improvements are likely the result of the intentional design of the yoga intervention, having a focus on breath and relaxation throughout each session. In addition to the improvements related to mood, individuals with TBI experienced a strong sense of social support within the TBI community through participating in an eight-week yoga intervention. Positive social support through yoga can be attributed to the environment provided by the yoga room in the rehabilitation hospital. This is a welcoming space where yoga is provided by a recreational therapist who specializes in yoga for individuals with TBI. The yoga room is unique due to the contrast from the standard hospital environment. The recreational therapist intentionally designed the room to have low lighting, calming scents, and little distraction. The room is a quiet place within the hospital that does not have medical equipment or fluorescent lighting. Ultimately, the yoga room within the hospital, and the use of a recreational therapist who is a yoga instructor allowed participants to have a positive shared experience.

**Practical Implications**

The findings of this study reinforce the results of former studies on the benefits of yoga (Schaeffer, 2002; Roney, Sample, Stallones, Van Puymbroeck, & Schmid, in review), speaking to the value of incorporating yoga into recreational therapy practice and TBI rehabilitation.
The results of this study are also consistent with the aim of CIH interventions (NCCIH, 2017a). Specifically, the qualitative results of decreased anxiety, improvement in adjustment to injury, and increased social support are useful for the field of recreational therapy. As a field that utilizes activities to promote health and wellbeing (American Therapeutic Recreation Association, 2017, para. 1), recreational therapists can employ this yoga intervention in TBI rehabilitation settings. Recreational therapists who are yoga teachers have the ability to assess, plan, implement, and evaluate yoga interventions for their clients in order to improve their mood and promote social support. As a practice that emphasizes independence and community integration, recreational therapy can benefit from the use of yoga. This convergent mixed methods pilot study shows the social and emotional benefits of yoga, specifically in a rehabilitation setting.
Appendices
Appendix A
Glasgow Coma Scale
Glasgow Coma Scale

**Eye Opening Response**
- Spontaneous—open with blinking at baseline **4 points**
- To verbal stimuli, command, speech **3 points**
- To pain only (not applied to face) **2 points**
- No response **1 point**

**Verbal Response**
- Oriented **5 points**
- Confused conversation, but able to answer questions **4 points**
- Inappropriate words **3 points**
- Incomprehensible speech **2 points**
- No response **1 point**

**Motor Response**
- Obeys commands for movement **6 points**
- Purposeful movement to painful stimulus **5 points**
- Withdraws in response to pain **4 points**
- Flexion in response to pain (decorticate posturing) **3 points**
- Extensive response in response to pain (decerebrate posturing) **2 points**
- No response **1 point**

**References**
Teasdale G, Jennett B. Assessment of coma and impaired consciousness. Lancet 1974; 81-84.

**Categorization:**
Coma: No eye opening, no ability to follow commands, no word verbalizations (3-8)

**Head Injury Classification:**
Severe Head Injury—GCS score of 8 or less
Moderate Head Injury—GCS score of 9 to 12
Mild Head Injury—GCS score of 13 to 15
(Adapted from: Advanced Trauma Life Support: Course for Physicians, American College of Surgeons, 1993)

**Disclaimer:**
Based on motor responsiveness, verbal performance, and eye opening to appropriate stimuli, the Glasgow Coma Scale was designed and should be used to
assess the depth and duration coma and impaired consciousness. This scale helps to
gauge the impact of a wide variety of conditions such as acute brain damage due to
traumatic and/or vascular injuries or infections, metabolic disorders (e.g., hepatic or
renal failure, hypoglycemia, diabetic ketosis), etc. Education is necessary to the
proper application of this scale. Teasdale G, Kril-Jones R, van der Sande J. Observer
variability in assessing impaired consciousness and coma. J Neurol Neurosurg
Psychiatry 1978; 41:603-610; Rowley G, Fielding K. Reliability and accuracy of the
Glasgow Coma Scale with experienced and inexperienced users. Lancet 1991;
337:535-538). The predictive value of the GCS, even when applied early, is limited
(Waxman K, Sundine MJ, Young RF. Is early prediction of outcome in severe head
injury possible? Arch Surg 1991; 126:1237-1242). Despite these and other
limitations (Eisenberg HM. Outcome after head injury: Part I: general
Considerations, in Becker DP, Povlishock JR (eds): Central Nervous System Trauma
280), health care practitioners continue to use this practical scale widely. Source:
Adapted from Glasgow Coma Scale, Womack Army Medical Center, Fort Bragg, NC.
Appendix B

Six Item Screener
Six-Item Screener

1. I would like to ask you some questions that ask you to use your memory. I am going to name three objects. Please wait until I say all three words, then repeat them. Remember what they are because I am going to ask you to name them again in a few minutes. Please repeat these words for me: APPLE---TABLE---PENNY.

(Interviewer may repeat names 3 times if necessary but repetition not scored)

<table>
<thead>
<tr>
<th>Did patient correctly repeat all three words?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorrect</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. What year is this?</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>2. What month is this?</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>3. What is the day of the week?</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

What were the three objects I asked you to remember?

<table>
<thead>
<tr>
<th>What were the three objects I asked you to remember?</th>
<th>0</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Apple</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>5. Table</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>6. Penny</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>
Appendix C

Yoga Recruitment Flyer
Do you have sleeping and/or mood changes after traumatic brain injury?

Shepherd Center is looking at how yoga effects sleep and mood after a traumatic brain injury after discharge

- Are you age 18 years or older?
- Have you sustained a TBI in the last 3 years?
- Can you follow 2-3 step instructions?
- Can you move independently and safely into different postures on the floor, seated, and standing per self and caregiver report?

If you answered yes to these questions, you are invited to take part in a yoga program designed for people with traumatic brain injury

- The study involves 2 yoga sessions per week for 8 weeks
- You will receive free yoga in addition to a $25 stipend upon completion of the program
- Your confidentiality and privacy will be protected

If interested, please contact Lauren Tudor at 1-954-254-8577 or email lauren_tudor@shepherd.org
Appendix D

Pittsburgh Sleep Quality Index
The Pittsburgh Sleep Quality Index

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 the 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 taken you to fall asleep each night?

   number of minutes ______________________________

3. During the past month, when have you usually got 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________________________

For each of the remaining questions, check the one best response. Please answer all questions.

5. During the past month, how often have you had trouble sleeping because you……

   (a) Cannot get to sleep within 30 minutes

      Not during the past month _____ once a week _____ twice a week _____ three or more times a week _____

   (b) Wake up in the middle of the night or early morning

      Not during the past month _____ once a week _____ twice a week _____ three or more times a week _____

   (c) Have to get up to use the bathroom

      Not during the past month _____ once a week _____ twice a week _____ three or more times a week _____
(d) Cannot breathe comfortably

Not during the past month ___ Less than once a week ___ Once or twice a week ___ three or more times a week ___

(e) Cough or snore loudly

Not during the past month ___ Less than once a week ___ Once or twice a week ___ three or more times a week ___

(f) Feel too cold

Not during the past month ___ Less than once a week ___ Once or twice a week ___ three or more times a week ___

(g) Feel too hot

Not during the past month ___ Less than once a week ___ Once or twice a week ___ three or more times a week ___

(h) Had bad dreams

Not during the past month ___ Less than once a week ___ Once or twice a week ___ three or more times a week ___

(i) Have pain

Not during the past month ___ Less than once a week ___ Once or twice a week ___ three or more times a week ___

(j) Other reason(s), please describe________________________________________________________

How often during the past month have you had trouble sleeping because of this?

Not during the past month ___ Less than once a week ___ Once or twice a week ___ three or more times a week ___
6. During the past month, how would you rate your sleep quality overall?
   
   Very good________
   Fairly good_______
   Fairly bad________
   Very bad__________

7. During the past month, how often have you taken medicine (prescribed or “over the counter”) to help you sleep?
   
   Not during the past month____  Less than once a week____ Once or twice a week____ three or more times a week____

8. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?
   
   Not during the past month____  Less than once a week____ Once or twice a week____ three or more times a week____

9. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?
   
   No problem at all________
   Only a very slight problem__
   Somewhat of a problem______
   A very big problem________

10. How often do you feel tired during the following times during the day?

    Morning:
    
    | Morning | 0 | 1 | 2 | 3 |
    |---------|---|---|---|---|
    | most days | often | occasionally | never |

    Afternoon:
    
    | Afternoon | 0 | 1 | 2 | 3 |
    |-----------|---|---|---|---|
    | most days | often | occasionally | never |

    Evening:
    
    | Evening | 0 | 1 | 2 | 3 |
    |---------|---|---|---|---|
    | most days | often | occasionally | never |
Appendix E

Patient Health Questionnaire-9
1. Over the last 2 weeks, how often have you been bothered by any of the following problems? Read each item carefully, and circle your response.

<table>
<thead>
<tr>
<th>Problem Description</th>
<th>Not at all</th>
<th>Several days</th>
<th>More than half the days</th>
<th>Nearly every day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Little interest or pleasure in doing things</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Feeling down, depressed, or hopeless</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trouble falling asleep, staying asleep, or sleeping too much</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feeling tired or having little energy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor appetite or overeating</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feeling bad about yourself, feeling that you are a failure, or feeling that you have let yourself or your family down</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trouble concentrating on things such as reading the newspaper or watching television</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moving or speaking so slowly that other people could have noticed. Or being so fidgety or restless that you have been moving around a lot more than usual</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thinking that you would be better off dead or that you want to hurt yourself in some way</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Totals</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. If you checked off any problem on this questionnaire so far, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?

<table>
<thead>
<tr>
<th>Difficulty Level</th>
<th>Not Difficult At All</th>
<th>Somewhat Difficult</th>
<th>Very Difficult</th>
<th>Extremely Difficult</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix F

Generalized Anxiety Disorder-7 Survey
## Generalized Anxiety Disorder 7-item (GAD-7) scale

Date: ___________  Name: ________________________________  DOB: _______________

Over the last 2 weeks, how often have you been bothered by the following problems?

<table>
<thead>
<tr>
<th>Over the last 2 weeks, how often have you been bothered by the following problems?</th>
<th>Not at all</th>
<th>Several days</th>
<th>Over half the days</th>
<th>Nearly every day</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Feeling nervous, anxious, or on edge</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2. Not being able to stop or control worrying</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3. Worrying too much about different things</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4. Trouble relaxing</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>5. Being so restless that it's hard to sit still</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>6. Becoming easily annoyed or irritable</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>7. Feeling afraid as if something awful might happen</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

*Add the score for each column*  

| Add the score for each column | + | + | + | + |

Total Score (*add your column scores*) =

If you checked off any problems, how difficult have these made it for you to do your work, take care of things at home, or get along with other people?

Not difficult at all __________
Somewhat difficult _________
Very difficult _____________
Extremely difficult ___________

Appendix G

Mayo-Portland Adaptability Scale, Part B
Mayo-Portland Adaptability Inventory-4

Muriel D. Lezak, PhD, ABPP & James F. Malec, PhD, ABPP

Below each item, circle the number that best describes the level at which the person being evaluated experiences problems. Mark the greatest level of problem that is appropriate. Problems that interfere rarely with daily or valued activities, that is, less than 5% of the time, should be considered not to interfere. Write comments about specific items at the end of the rating scale.

For Items 13-20 please use the rating scale below.

<table>
<thead>
<tr>
<th></th>
<th>0. None</th>
<th>1. Mild problem but does not interfere with activities; may use assistive device or medication</th>
<th>2. Mild problem; interferes with activities 5-24% of the time</th>
<th>3. Moderate problem; interferes with activities 25-75% of the time</th>
<th>4. Severe problem; interferes with activities more than 75% of the time</th>
</tr>
</thead>
</table>

Part B. Adjustment

1. **Anxiety**: Tense, nervous, fearful, phobias, nightmares, flashbacks of stressful events
   0 1 2 3 4

2. **Depression**: Sad, blue, hopeless, poor appetite, poor sleep, worry, self-criticism
   0 1 2 3 4

3. **Irritability, anger, aggression**: Verbal or physical expressions of anger
   0 1 2 3 4

4. **Pain and headache**: Verbal and nonverbal expressions of pain; activities limited by pain
   0 1 2 3 4

5. **Fatigue**: Feeling tired; lack of energy; tiring easily
   0 1 2 3 4

6. **Sensitivity to mild symptoms**: focusing on thinking, physical or emotional problems attributed to brain injury; rate only how concern or worry about these symptoms affects current functioning over and above the effects of the symptoms themselves
   0 1 2 3 4

7. **Inappropriate social interaction**: acting childish, silly, rude, behavior not fitting for time and place
   0 1 2 3 4

8. **Impaired self-awareness**: lack of recognition of personal limitations and disabilities and how they interfere with everyday activities and work or school
   0 1 2 3 4
Appendix H

Participant Focus Group Questions
Participant Focus Group Questions

1. Tell me about your experience participating in yoga over the past eight-weeks.

2. Having completed the eight-week yoga program, how would you describe your experience?
   a. What did you like or dislike about the program?
      i. Program characteristics
      ii. Yoga instructor
      iii. Group aspect
      iv. Location

3. Tell me about how your sleep has been before, during, and after eight-weeks of yoga.
   a. Have you noticed a change in you length of sleep?
   b. Have noticed a change in the amount of restless sleep?
   c. Have you noticed a change in your energy levels?

4. Describe your level of depression or feeling of hopelessness since completing the eight weeks of yoga.
   a. Have you been more interested in doing things outside of the house?
   b. Have you felt more or less energized during the day?
   c. How do you feel about your self-image? In other words, do you feel more confident in who you are?

5. Describe your level of nervous, anxious or restless feelings since completing the eight-weeks of yoga.
   a. Have you felt more or less relaxed?
   b. Have you noticed a change in the amount of worrying you experience?
   c. Have you become less easily annoyed or irritable?

6. How do you feel yoga has changed your adjustment to your injury?
   a. Have you experienced less...
      i. Verbal or physical expressions of anger
      ii. Pain or headaches
   b. Have you experienced more...
      i. Energy
      ii. Appropriate social interaction
      iii. Improved self-awareness (recognition of personal limitations and abilities)

7. Do you have any additional comments on the yoga program?
Appendix I

Caregiver Focus Group Questions
Caregiver Focus Group Questions

1. Tell me about your participant's experience participating in yoga over the past eight-weeks.

2. Having completed the eight-week yoga program, how would you describe your participant's experience?
   a. What did he/she like or dislike about the program?
      i. Program characteristics
      ii. Yoga instructor
      iii. Group aspect
      iv. Location

3. Tell me about how your participant’s sleep has been over the past eight-weeks.
   a. Have you noticed a change in your participant's length of sleep?
   b. Have you noticed a change in amount of restless sleep for your participant?
   c. Have you noticed a change in your participant’s energy levels?

4. Describe your thoughts on your participant’s level of depression or feeling of hopelessness since completing the eight weeks of yoga
   a. Has he or she been more interested in doing things outside of the house?
   b. Has he or she felt more or less energized during the day?
   c. How does he or she feel about their self-image? In other words, does he or she feel more confident in who they are?

5. Have you observed a change in amount of nervous, anxious or restless feelings since completing the eight weeks of yoga?
   a. Has he or she felt more or less relaxed?
   b. Has he or she experienced an increase or decrease in worrying?
   c. Has he or she become less easily annoyed or irritable?

6. How do you feel yoga has changed the participant’s adjustment to sustaining a traumatic brain injury?
   a. Has he or she experienced less...
      i. Verbal or physical expressions of anger
      ii. Pain or headaches
   b. Has he or she experienced more...
      i. Energy
      ii. Appropriate social interaction
      iii. Improved self-awareness (recognition of personal limitations and abilities)

7. Do you have any additional comments on the yoga program?
Appendix J

Informed Consent Forms
Title: The Effects of Yoga on People with Traumatic Brain Injury Related to Sleep and Mood

Sponsor: Shepherd Center, Inc.

Principal Investigator: Lauren Tudor, CTRS, YT

RRC Project: #727

Subject name: ___________________________ I.D.: __________

Caregiver name: ___________________________

What is the purpose of the study?

The purpose of this study is to learn how yoga may change or influence sleep and mood including anxiety and depression. Information obtained in this study may be valuable in providing information to direct development and testing of the yoga program.

The subject must meet all the following criteria to be eligible for the study:

- Diagnosis of moderate-to-severe TBI, defined by admission Glasgow Coma Scale score \(^5^9\) information obtained from Shepherd Center records by Lauren Tudor

- Fluent speaker of English, by self-report

- Maximum of 3 years’ post-injury

- Age 18 years or older

- Able to move into different seated, standing, and supine postures without assistance, by self and caregiver report (Appendix D)

- Sufficient cognitive status to participate, as determined by Lauren Tudor. You may choose to answer these questions by phone or in person at The Shepherd Center.
Lauren Tudor will use the “Six-Item Screener to Identify Cognitive Impairment Among Potential Research Subjects for Clinical Research” (Appendix C) as a screening tool to assess cognitive status (score of ≥ 4 eligible for participation).

If you join this study, the primary researcher will ask you to come to Shepherd Center for up to 2 hours at least 2 weeks before study begins to:

- Review and sign consent forms (caregiver and participant)
- take 3 surveys (these measures will be given to both the person with TBI and their caregiver two weeks before the yoga sessions begin, at the end of the 4th week of yoga class, and two weeks after the last yoga session)
  1) The Patient Health Questionnaire-9 (PHQ-9)
  2) Generalized Anxiety Disorder (GAD-7)
  3) The Mayo Portland Adaptability Inventory (MPA-4)
- Your caregiver will be trained to install the Tracker. You will allow your caregiver to install Beddit Sleep Tracker on your bed. This will record information about your sleep patterns.
- Return Beddit Sleep Tracker 2 weeks after final yoga session and complete final surveys at that time.
- Provide contact information for follow-up interviews or to share information about the study (address, email address, and telephone number). All information that you share will be confidential. By signing this form, you are giving us permission to collect and use information described above.

What will happen in this study?

- Participate in an 8-week yoga program at Shepherd Center. You will attend 2 classes per week for 8 weeks for a total of 16 classes. Each yoga class will be one hour long and will include:
  - 15-minute centering and focusing of the mind
  - 30 minutes of gentle physical activity consisting of yoga postures in supine, prone, seated, and standing
  - 15 minutes of meditation and relaxation

Will I be paid for taking part in this study? Yes, you will receive a $25.00 check at the last Yoga session. You must complete at least 12 of the 16 classes during this research study to be eligible for the stipend.

Is my participation voluntary? Yes, you do not have to be in this study if you don’t want to. You do not have to sign this form. If you do not want to sign this form, you cannot be in this study.
May I quit the study? Yes, you may quit the study at any time. You may also skip any questions that you do not feel comfortable answering. **If you do not want to be in this study or if you quit while the study is going, the healthcare you receive from Shepherd Center and its affiliates will not be changed in anyway.**

Is there any benefit to me if I take part in this study? There is no guarantee that you will receive any benefits from participation. The information provided may help others with your conditions in the future. In addition, the all Yoga sessions will be provided at no charge to you.

Will it cost me anything to be in this study? All study visits and parking are free of charge. You are responsible for any costs related to your time and travel to the sessions.

Are there any risks to me? We think the risk to being in this study is minimal.

- Participating in the yoga sessions make you tired. If you get tired, you can stop at any time. Falling is a risk in this study. You will be asked to participate in standing and balancing postures. You can skip any posture that you are not comfortable with or use a wall or chair to assist with balance.

How will my privacy be protected? We will protect your privacy (personal and health information) by:

- Keeping all your information in a locked file cabinet in a locked office
- Using a password-protected computer
- Using a code number for your information instead of your name

May the researchers contact you for more information after you leave the study for future studies?

☐ Yes, you can contact me.
☐ No, you cannot contact me.

Contact Information:

Phone Number: Cell Phone:
(________)__________________________________________

Home Phone:
(________)__________________________________________

Email Address: _________________________________________
Mailing Address:

City, State, Zip Code:

It is important to know that email is not a secure mode of communication. There is a chance that information sent to you or from you via email could become known to someone else.

**How long will you keep my information?**
We will keep important study information for 3 years.

**Who will use my health information?**
The information collected from you during this study will be used by researchers and research staff of Shepherd Center for this study. Whenever possible, your information will be kept confidential. Others at Shepherd Center who may need to use your health information during this research:
- Shepherd Center regulatory and research oversight boards and offices
- Research support services staff at the Shepherd Center and its affiliates

No one else outside of Shepherd Center will need to receive your health information during this research.

**Who should I contact if I have questions?** Please take as much time as you need to think about if you want to be in the study. If you have any questions about this study at any time, contact the research team:

**Project Coordinator:** Lauren Tudor, CTRS, YT  
**Phone:** (404) 350-7572  
**Email:** Lauren_tudor@shepherd.org  
**Mailing Address:** Shepherd Center  
2020 Peachtree Rd, NW  
Atlanta, GA 30309

If you are not satisfied with response of research team, have more questions, or want to talk with someone about your rights as a research participant, please contact Michael Jones, PhD, Chair of the Shepherd Center IRB at 404-350-7595.
Agreement to Participate in This Study and Permission to Use and Disclose My Health Information

I have read the information presented in this informed consent form. I have had an opportunity to ask questions and all my questions have been answered to my satisfaction. This form is being signed voluntarily by me, indicating my agreement to participate in this study, until I might decide to withdraw my consent. I will receive a copy of this signed consent form. I understand that by signing this consent form I do not give up any of my legal rights by agreeing to participate.

______________________________________________
Signature of Subject                               Date

Printed Name of Subject

______________________________________________
Signature of Witness (if applicable)               Date

Printed Name of Witness (if applicable)

______________________________________________
Signature of Person Conducting Consent Discussion  Date

Printed Name of Person Conducting Consent Discussion
Appendix K

Yoga Intervention
<table>
<thead>
<tr>
<th><strong>Yoga Pose</strong></th>
<th><strong>English</strong></th>
<th><strong>Sanskrit</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Introduction</strong></td>
<td>Easy Seated Position</td>
<td>Sukhasana</td>
</tr>
<tr>
<td></td>
<td>Bridge</td>
<td>SetuBandha Sarvangasana</td>
</tr>
<tr>
<td><strong>Warm Up</strong></td>
<td>Victorious Breath</td>
<td>Ujayi Pranayama</td>
</tr>
<tr>
<td></td>
<td>Seated Twist</td>
<td>Bharadvajasana</td>
</tr>
<tr>
<td></td>
<td>Forward Fold</td>
<td>Uttanasana</td>
</tr>
<tr>
<td></td>
<td>Tabletop</td>
<td>Bahrmanasana</td>
</tr>
<tr>
<td></td>
<td>Cat/Cow</td>
<td>Marjaiasana/Bitilasana</td>
</tr>
<tr>
<td></td>
<td>Childs pose</td>
<td>Balasana</td>
</tr>
<tr>
<td></td>
<td>Locus variations (legs, arms, one leg at a time)</td>
<td>Salabhasana</td>
</tr>
<tr>
<td></td>
<td>Sphinx</td>
<td>Niravalasana</td>
</tr>
<tr>
<td></td>
<td>Standing Mountain</td>
<td>Tadasana</td>
</tr>
<tr>
<td></td>
<td>Mountain Arm Flow</td>
<td>Tadasana Pravaaha</td>
</tr>
<tr>
<td><strong>Peak Poses</strong></td>
<td>Warrior 1</td>
<td>Virabhadrasana I</td>
</tr>
<tr>
<td></td>
<td>Warrior 2</td>
<td>Virabhadrasana II</td>
</tr>
<tr>
<td></td>
<td>Triangle</td>
<td>Trikonasana</td>
</tr>
<tr>
<td></td>
<td>Tree</td>
<td>Vrksasana</td>
</tr>
<tr>
<td></td>
<td>Staff Pose</td>
<td>Seated Dandasana</td>
</tr>
<tr>
<td><strong>Cool Down</strong></td>
<td>Supine wind relieving R/L</td>
<td>Pawanmuktasana</td>
</tr>
<tr>
<td></td>
<td>Supine Twist</td>
<td>Supta Matsyendrasana</td>
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<tr>
<td></td>
<td>Final Resting Pose</td>
<td>Savasana</td>
</tr>
</tbody>
</table>
REFERENCES


National Center for Complementary and Integrative Health (2017, September 24-a). *Complementary, Alternative or Integrative Health: What's In a Name?*. Retrieved from https://nccih.nih.gov/health/integrative-health#types


