An Examination of the Relationship Between Psychological Flexibility and Insomnia

by

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A thesis submitted in partial fulfillment
of the requirements for the degree of
Master of science
(Psychology)
in the University of Michigan – Dearborn
2020

Master's Thesis Committee:

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Acknowledgments

I want to thank Dr. David Chatkoff for all of his support throughout the past two years. His knowledge of Acceptance and Commitment therapy has been invaluable. Secondly, I would like to thank my secondary advisor, Dr. Pam McAuslan for her collaboration and knowledge of statistics and social psychology. I'm grateful for both of my advisors and their ability to examine constructs from various points of view. They have allowed me to think critically about my project while providing tons of support and guidance. Finally, I'd like to thank my friends and family for all of their care and support throughout my entire collegiate career. This project would not have been possible without all of the support I have received throughout the years.

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Abstract

Insomnia is a sleep-wake disorder characterized by difficulty initiating sleep, maintaining sleep, or falling back asleep. The main psychotherapeutic treatment for insomnia is Cognitive Behavioral Therapy for Insomnia (CBTI). Although the treatment is highly effective, its main limitations include poor adherence and high dropout rates, suggesting that many suffering from insomnia are unable to reap the benefits of CBTI. The present study proposes the use of psychological flexibility from Acceptance and Commitment Therapy (ACT) as a potential framework to examine insomnia. Psychological flexibility looks to promote healthy, flexible behaviors and thoughts to guide the individual towards their goals or values. There are six domains within psychological flexibility and all of which are interrelated and build upon one another. The present study utilized correlational analyses to examine the potential relationship between psychological flexibility and insomnia. A sleep-related psychological flexibility measure (SRPFM) was developed to examine psychological flexibility within a sleep-related context. The measure was designed to estimate a global sleep related psychological flexibility score as well as scores for each of the six individual domains. It was hypothesized that the global sleep related psychological flexibility score would be positively associated with how efficiently our participants slept and be negatively associated with levels of insomnia and daytime sleepiness. It was also hypothesized that the individual domains of psychological flexibility would be positively associated with how efficiently our participants slept and be negatively associated with levels of insomnia and daytime sleepiness. Sleep diaries were used to calculate sleep efficiency for 19 participants throughout the course of one week. Results found that higher

endorsement of global sleep related psychological flexibility yielded less endorsement of insomnia. Furthermore, Endorsement of various domains of psychological flexibility yielded less endorsement of insomnia. Essentially, those who are more psychologically flexible are less likely to endorse clinically significant insomnia. The results of this study suggest a relationship between sleep related psychological flexibility and insomnia. This information can be used to guide further examination of this connection as well as the future development of a new adjunctive or standalone treatment for insomnia.

Keywords: Psychological flexibility, insomnia, sleep disturbance, ACT

Chapter I

Introduction

Sleep has become an ever-increasing problem over the past few decades with about 60 million Americans suffering from sleep-related disorders that can cause a multitude of problems affecting individuals' long-term health and finances (Fullerton, 2006). The estimated total cost of sleep-related problems in the United States is upwards of $90 billion a year, which includes comorbidities related to sleep, motor vehicle crashes caused by a lack of sleep, and increased hospitalizations (Fullerton, 2006).

While there are many sleep disorders including obstructive sleep apnea, hypersomnolence, and restless leg syndrome, insomnia is the most prevalent sleep-related disorder where "one-third of adults report insomnia symptoms" (American Psychiatric Association, 2013, p.364). The specific behaviors associated with poor sleep are a decreased response to stimuli, decreased cognitive ability, a decrease in motor functioning, and slower eye movement (Chokroverty, 2010). Furthermore, adults with insomnia tend to have problems with attention, being alert, and overall performance in work or other areas of their lives (Rosekind & Gregory 2010). There is also evidence to suggest that individuals who suffer from insomnia are more likely to later be diagnosed with depression (Buyesse, et al., 2008). Older adults with insomnia have an increased chance of falling and potentially fracturing parts of their bodies (Ancoli-Israel, 2009; Stone, et al., 2008).

There are various pharmacological treatments which include a multitude of medication classes such as, benzodiazepines, melatonin agonists, orexin receptor agonists, and more (Sateia,

et al., (2017). Although pharmacological treatments are predominantly used (Edinger & Means, 2005; Sateia, et al, 2017), there are multiple limitations to their use such as increased levels of sedation, decreased driving ability, increased risk for falls, and an increased likelihood of abuse and dependence (Schweitzer & Feren, 2017). Furthermore, current psychotherapeutic treatments include Cognitive Behavioral Therapy for Insomnia (CBTI) and third-wave mindfulness psychotherapies (Baron, et al., 2017; Ong, et al., 2012). CBTI and mindfulness psychotherapies improve a person's sleep by altering their behavior, their thoughts, and their awareness of their sleep difficulty in an effort to promote healthier sleep habits (Baron, et al, 2017; Ong, et al, 2012). A meta-analysis examining 87 randomized controlled trials found the efficacy of CBTI to be relatively high ($g = 0.98$) when measured against the Insomnia Severity Index (ISI), which is a measure of clinical insomnia (van Straten, et al., 2018). Although the efficacy of CBTI is high, there are concerns about the lack of adherence to the treatment protocols as some of the treatments are counterintuitive, which can restrict the overall efficacy of the treatment (Matthews, et al., 2013; Riedel & Lichstein, 2001).

Taking into account all of these factors, it is clear that insomnia is a major problem that effects a wide range of people and their quality of life. Given the limitations surrounding CBTI's treatment adherence (Matthews, et al, 2013), there is a need for the development of additional treatment approaches. More specifically, the development of a treatment approach that does not appear to be counterintuitive to its participants and one that is easier to adhere to post-treatment. One such approach that may be beneficial is Acceptance and Commitment Therapy (ACT). Briefly, ACT looks to foster acceptance of one's thoughts, behaviors, and emotions that occur in the present moment, while striving towards that person's values (Hayes, et al., 2006). The present paper will address these concerns and attempt to explore the potential connection

between sleep difficulty and ACT's central domains through the use of a developed measure to capture ACT within a sleep-related context.

Sleep

Sleep is an essential part of our lives. The actual function of sleep is a mystery but is believed to be a restorative agent for the brain and our bodily processes (Eugene & Masiak 2015). Sleep has been found to help the body reduce stress, remove waste, improve alertness, and assist with memory consolidation (Eugene & Masiak, 2015). Being sleep deprived causes multiple problems related to poor attention, increased motor vehicle accidents, the development of a variety of cardiovascular and metabolic illnesses (Chokroverty, 2010) and much more that will be discussed in the following paper.

Overview of Sleep Disorders

There are multiple sleep-related disorders as defined in the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; DSM-5; APA, 2013) all with varying symptoms and classifications. There are three major groups of sleep-related disorders outlined in the DSM-5, the first of which is breathing-related sleep disorders, which includes obstructive sleep apnea hypopnea, central sleep apnea, and sleep-related hypoventilation (APA, 2013). The next category is Parasomnias, which are represented by non-rapid eye movement sleep arousal disorders and rapid eye movement sleep behavior disorder (APA, 2013). The last section is general sleep-wake disorders, which includes insomnia, hypersomnolence disorder, restless leg syndrome, and narcolepsy (APA, 2013). Some of these disorders can affect the two sleep states: rapid eye movement (REM) and Non-REM sleep which contribute to different physiological processes while the person is asleep, but these are outside of the scope of this paper (Chokroverty, 2010). For the purposes of this paper emphasis will be placed primarily on insomnia given the high

prevalence rates of insomnia in the United States (35%) (Mellinger, et al., 1985) as compared to other sleep disorders: narcolepsy (0.04%), obstructive sleep apnea (4%), and restless leg syndrome (1-19%) (Ohayon, 2011).

Insomnia

The major DSM-5 criteria for insomnia is as follows: difficulty initiating sleep, difficulty maintaining sleep, or difficulty falling back to sleep (APA, 2013). To be diagnosed with insomnia you need at least one of the three previously mentioned symptoms, with said symptom impairing the individual's ability to perform in meaningful areas of their life, the symptom occurs three nights a week, and is present for at least three months (APA, 2013). The DSM-5 diagnostic criteria coalesce into various biological, psychological, and social consequences.

Biological Consequences of Insomnia

Insufficient sleep and insomnia play a role in physiological problems (Bonnet & Arand, 2017). Problems include an increased risk of hypertension (Schwartz, et al., 1999), diabetes (Bonnet, et al., 2014), comorbid depression (Troxel, et al., 2012) and poorer overall immune function (Savard, et al., 2003). These biological consequences can affect a person psychologically as well.

Psychological Consequences of Insomnia

Individuals experiencing insomnia may become overconcerned with their poor sleep and place greater emphasis on trying to fall asleep (O'Malley & O'Malley, 2017; APA, 2013;). This results in the use of sleep safety behaviors, which are behaviors that an individual believes need to be done in order to fall asleep or to prevent themselves from having negative consequences due to their lack of sleep (Baron, et al, 2017; Ong, et al, 2012). Some examples of sleep safety behaviors include daytime napping, avoiding social events, using alcohol or other substances to

help initiate sleep, and spending increased amounts of time awake in bed (Baron, et al, 2017; Ong, et al, 2012).

Another psychological concern associated with insomnia is daytime sleepiness and its effect on overall cognition (Goel, et al., 2009). The most immediate and costly effect is that insomnia increases the probability of car crashes or industrial accidents, which costs around $50 billion annually (Goel, et al, 2009; Ledger, 1994). The increase in accidents is due to increased lapses in attention, slower reactions times, and behavioral inhibition, all of which are attributed to sleep deprivation and increased daytime sleepiness (Goel, et al, 2009; Lowe, et al., 2017). Furthermore, problems associated with sleep deprivation include increased moodiness, daytime fatigue, as well as comorbid depression and anxiety (Goel, et al, 2009). In addition to biological and psychological consequences, insomnia also leads to social consequences for the individual.

Social Consequences of Insomnia

The social consequences of insomnia are centered around the economic aspects of life. Insomnia tends to lead to decreased job performance, decreased work attendance (Godet-Cayré, et al., 2006; Leger, et al., 2006), increased use of medical care, and increased medical costs (Daley, et al, 2009). Furthermore, older adults with insomnia were more likely to be hospitalized and utilize home health care services more than those without insomnia (Kaufmann, et al., 2013). In addition, those with insomnia tend to have increased feelings of loneliness (Chu, et al., 2016).

Risk Factors for Developing Insomnia

In general, women and European Americans have higher prevalence rates of insomnia than males and other ethnicities (Jean-Louis, et al., 2001; Ohayon, 1996;). Furthermore, the elderly and shift workers are also more likely to develop insomnia (Klink, et al., 1992). Other risk factors include being diagnosed with depression, anxiety, or schizophrenia (Weissman et al.,

1997). Moreover, low socioeconomic status, poor physical health, being unemployed, and being single, widowed, or divorced was indicative of higher rates of insomnia (Klink, et al, 1992; Ohayon, 1996). All in all, a variety of stressors can contribute to the development of insomnia, which is why it is important to maximize the availability of potential treatments for insomnia to address the wide variation in contributing factors.

Models of Insomnia

Spielman: Behavioral model of insomnia

One of the original behavioral models of insomnia was proposed by Spielman and colleagues focusing on the relationship between predisposing, precipitating, and perpetuating factors (Spielman, et al., 1987). An example of a predisposing factor would be an individual's genetic makeup that may make the individual be more or less predisposed to developing insomnia (Drake, et al., 2011). The precipitating factors can be multiple things that normally occur prior to the development of insomnia. Some examples would be minor pain or injury, loss of a loved one, and even certain stressful situations (Baron et al, 2017). The most concerning factor of the three are the perpetuating factors as these can prolong and even maintain symptoms over time even after undergoing treatment (Baron, et al, 2017). These perpetuating behaviors are similar to the aforementioned sleep safety behaviors (Ong, et al, 2012). The main issue with these sleep safety behaviors is that they actually have the opposite effect and may actually prevent sleep (Ong, et al, 2012). So instead of sleep safety behaviors promoting sleep, like the individual intends them to do, they will keep the individual awake because it shows inflexibility towards their sleeplessness and increases their general arousal (Ong, et al, 2012). A major addition to Spielman's model of insomnia is the role that classical conditioning plays in developing and maintaining insomnia. The symptoms of insomnia become paired to the bedroom, thus creating a

thus creating a conditioned insomnia response whenever an individual is getting ready for bed (Spielman et al., 1987).

Harvey: Cognitive model of insomnia

The way we think about our previous night's sleep and how it affects the rest of our day is important to consider when examining insomnia and its processes (Morin, et al., 2002). Harvey's cognitive model of insomnia (Harvey, 2002) conceptualizes insomnia and its processes through a cognitive lens that shifts the focus away from the behavioral conditioning aspect from Spielman's model (Spielman et al., 1987) to focus more on the sleep-related thoughts and beliefs of the individual. There are two areas of focus when it comes to the cognitive aspects of insomnia: the individual's beliefs or thoughts about their disorder and other arousal increasing actions like rumination (Baron, et al, 2017). Individuals with insomnia tend to have unrealistic or negative beliefs about their sleep and tend to catastrophize their potential consequences of getting poor sleep (Harvey, 2002; Harvey & Greenwall, 2003; Morin, et al., 2002). An example of an unrealistic belief is that if the individual does not get at least 4 hours of sleep a night, then they will get fired from work the next day. While the belief may not be accurate, the individual might function as if the belief were true (Harvey, 2002). Moreover, these negative beliefs tend to be about how the individual's loss of sleep is affecting their overall functioning and general health. Over time, the individual becomes anxious about their sleep loss and its effects. This in turn leads to the individual becoming hypervigilant to various sleep-related threats like sleep-related fatigue or daytime sleepiness during work. Furthermore, as the individual becomes aware of those threats, they become more and more anxious, thus creating a cycle of anxiety toward their sleep loss and its effects. Together, these beliefs promote the use of sleep safety behaviors

as the individual will attempt to cope with their concerns that stem from their sleep-related threats, but will be ineffective (Harvey, 2002).

The other side of the cognitive model is the idea of sleep-related rumination and arousal that perpetuates symptoms of insomnia (Baron, et al, 2017). The idea is that insomnia is caused by increased levels of physiological or mental arousal that keeps the body awake through rumination, which is the process of having intrusive thoughts repeated over and over again that often causes distress in that individual (Palagini, et al., 2017). The increased distress creates levels of hyperarousal in the body, thus making it harder for that individual to fall asleep (Bonnet & Arand, 1997). This process can feed into the anxiety-provoking cycle that was mentioned previously, further making it more difficult to fall asleep (Harvey, 2002).

Neurocognitive model

The neurocognitive model for insomnia builds upon Spielman's behavioral model of insomnia by providing a neurological source of arousal (Baron, et al, 2017). Arousal in the neurocognitive model is defined as being conditioned brain activity as opposed to general physiological arousal (Baron, et al, 2017). The neurocognitive model posits that increased cortical activity, like sensory or information processing, inhibits one's ability to fall asleep (Baron, et al, 2017). A study by Perlis, et al. (2001) used an electroencephalogram (EEG) to compare brain wave activity between patients with insomnia and a healthy control group. Perlis and colleague's (2001) examination found that those with insomnia had higher levels of Beta and Gamma brain wave activity. Beta and Gamma brain waves are associated with higher levels of cognitive functioning and processing (Başar-Eroglu, et al., 1996; Egner & Gruzelier 2004). It is hypothesized that these increased levels of cognitive functioning and processing make it difficult to fall asleep as the person experiences increased pre-sleep cognitive activity, which increases

their arousal and induces the anxiety-provoking cycle from Spielman's model (Baron, et al, 2017). Information in terms of what specifically occurs in the brain to allow for this increased cognitive activity is outside the scope of this paper.

Psychotherapeutic treatments

Cognitive behavioral therapy for insomnia (CBTI). This treatment modality utilizes the behavioral and cognitive models of insomnia. The most common psychotherapeutic treatment for insomnia is the aptly named cognitive behavioral therapy for insomnia (CBTI; Baron, et al, 2017). CBTI includes a combination of behavior change procedures that include sleep hygiene education, stimulus control, sleep restriction therapy and relaxation therapy, as well as cognitive restructuring to help modify maladaptive thoughts into helpful adaptive thoughts (Baron, et al, 2017; Kloss, et al., 2010).

Sleep hygiene education outlines various behavioral change techniques that are aimed to help that individual sleep better (Kloss, et al, 2010). The psychoeducation provided from this modality attempts to reduce the perpetuating factors of Spielman's behavioral model by introducing new behavioral techniques that promote healthier sleep by targeting the health and sleep-related environments of the person (Morin, et al., 1999). These techniques include the limiting of caffeine and other substances prior to bedtime, creating a bedtime routine, having a dark and quiet room, and having consistent sleep and wake times (Kloss, et al, 2010). The techniques are counter to the aforementioned sleep safety behaviors in that the behavioral changes outlined in sleep hygiene education actually promote sleep as opposed to restricting a person's sleep (Morin, et al, 1999; Ong, et al, 2012). Poor sleep hygiene alone is not enough to propel someone into developing insomnia, but as a person improves their sleep hygiene, they are better able to regulate those perpetuating factors that can prolong insomnia (Morin, et al, 1999).

A critical component of CBTI is stimulus control, which is a technique that has a goal of limiting the total amount of time spent in the bedroom outside of sex and sleeping (Baron, et al, 2017; Kloss, et al, 2010). Some examples of stimulus control include waking at the same time every morning, restricting sleeping only to the bedroom, and, most importantly, leaving the bedroom when unable to fall back asleep after fifteen minutes (Baron, et al, 2017; Kloss, et al, 2010). Stimulus control works on the classical conditioning aspect of insomnia in that it makes an effort to decrease the association between increased arousal and the bedroom (Kloss, et al, 2010).

Sleep restriction therapy also focuses on the classical conditioning aspect of insomnia but emphasizes a different approach by focusing a person's sleep around the average time they normally sleep (Kloss, et al 2010). Once the average is determined via a sleep diary, the clinician would instruct the patient when to fall asleep based on their average (Baron, et al, 2017). An example would be that if the patient only gets four hours of sleep a night and they are normally awake at eight o'clock in the morning, then the patient would be instructed to go to bed at four o'clock in the morning. This limits the patient's time awake in bed and helps increase the body's natural sleep drive by embracing the amount of time the body actually needs to rest (Kloss, et al, 2010). This promotes fuller sleep due to the patient only being in bed to sleep and reducing the amount of time they are awake in bed (Kloss, et al, 2010). The process of sleep restriction therapy is counterintuitive and often leads to patients discontinuing their treatment (Baron, et al, 2017).

Another component of CBTI is relaxation therapy which is about reducing physical and cognitive arousal through progressive muscle relaxation and diaphragmatic breathing (Baron, et al, 2017). The goal of progressive muscle relaxation is to release the build-up of tension that

someone may have when they are stressed (Lichstein, et al. 2001). The process of progressive muscle relaxation involves tensing different muscle groups for a few seconds and then releasing that tension only to move onto the next muscle group after thirty seconds of relaxation (Kloss, et al, 2010). With practice, the individual will be able to be more aware of when their body is tensed and actively release that tension, thus making it easier to fall asleep (Kloss, et al, 2010). Furthermore, diaphragmatic breathing looks to slow down the individual's breathing by focusing their breathing on the diaphragm and not the chest (Baron, et al, 2017). Breathing from your diaphragm activates the parasympathetic nervous system, which calms the body down by lowering your heart rate and blood pressure (Pal, et al., 2004), thus lowering the levels of physical arousal that may keep someone awake.

The goal of the cognitive therapy in CBTI is to de-emphasize the importance of that patient's maladaptive thoughts, an example of which being, "If I do not get enough sleep then I won't be able to perform well at school" (Baron, et al, 2017). These thoughts tend to present themselves over and over again while the patient is trying to initiate sleep, thus increasing arousal levels, which in turn prevents sleep (Palagini, et al, 2017). The main way these maladaptive thoughts are combated is through cognitive restructuring which is the process of allowing the patient to realize that their maladaptive thoughts are inaccurate (Baron, et al, 2017). The first step in restructuring occurs with the patient discussing with the clinician a list of the things they think will occur due to their poor sleep (Baron, et al, 2017). Following the creation of the list, the patient is asked to evaluate the likelihood of each of the previously mentioned events will occur given a night of poor sleep (Baron, et al, 2017). The clinician and patient then calculate the total number of times the patient has had poor sleep and then the patient is asked to determine how many times each of the events have occurred (Baron, et al, 2017). Finally, the

collection of data is then presented to the patient to show that there is a disproportionate relationship between their poor sleep and their perceived outcomes, thus helping the patient dissolve their attachment to their maladaptive thoughts (Baron, et al, 2017).

With regards to the overall effect size of CBTI, a meta-analysis examining 87 randomized controlled trials found it to be relatively high (g = 0.98) when measured against the insomnia severity index (van Straten, et al, 2018). Although the effect sizes are large, there is concern about treatment adherence (Matthews, et al, 2013; Riedel & Lichstein, 2001). A meta-analysis by Robin DiMatteo, et al. (2002) found the adherence rate for sleep disorders (65.5%) to be less than the average adherence rate of the other physical health disorders that they analyzed like diabetes and various heart diseases (75%). A study by Ong, et al. (2008) found that 14% to 40% of participants withdraw from CBTI treatment before any meaningful change occurs in their sleep. These rates of withdrawal could be due to how counterintuitive the CBTI techniques are (Baron, et al, 2017). Oftentimes, an individual may experience increased daytime sleepiness, fatigue, and frustration during the sleep restriction process (Kyle, et al., 2011). As patients become frustrated, they may withdraw from CBTI treatment as they may feel that it is not benefitting them (Baron, et al., 2017).

Pharmacological treatments

There are some pharmacological treatments for insomnia that include prescriptions like benzodiazepine receptor agonsists (BzRA), melatonin receptor agonists, antidepressants, antipsychotics, anticonvulsants orexin antagonists, and histamine antagonists (Schweitzer, & Feren, 2017). Other non-prescription treatments include, alpha-adrenergic antagonists and melatonin (Schweitzer, & Feren, 2017). The various classes of pharmacological treatments are recommended by the American Academy of Sleep Medicine (AASM) as being effective in

improving sleep onset and maintenance (Sateia, et al, 2017). However, side effects of these medications include an increase in motor vehicle accidents (Vermeeren, 2004), an increase in the risk of falling especially in older adults (Ham, et al., 2014), an increase in mortality in terms of a 3 to 5 hazard ratio (Kripke, et al., 2012), increased sedation, an increased likelihood of abuse and dependence (Schweitzer & Feren, 2017), and an increase in bouts of amnesia (Roth, et al., 1990). A full examination of the pharmacological processes of each medication class is outside the scope of this paper.

New third-wave treatments

There has been increased research into third-wave psychotherapies, namely meta-cognitive therapies for insomnia (Ong, et al, 2012). The main theory behind these types of psychotherapies is that mindfulness helps decrease arousal levels, thus improving sleep quality (Ong, et al, 2012). Furthermore, it examines the maladaptive thoughts but does not act on them; rather they push for a disconnection between the thoughts and the individual, thus freeing them their maladaptiveness (Ong, et al, 2012). As discussed earlier, maladaptive thoughts increase our pre-sleep arousal thus causing us to stay awake (Palagini, et al, 2017). Being able to disconnect the maladaptive component from our thoughts, while allowing the thought to still be a thought, is the goal of meta-cognitive therapies of insomnia (Ong, et al, 2012).

Mindfulness based treatment

Some examples of mindfulness-based treatment approaches would be mindfulness-based stress reduction (MBSR) or applying mindfulness concepts to CBT (Ong, et al, 2012). Multiple studies have examined the mindfulness as a way of either supporting CBTI or to be used on its own to either treat or alleviate insomnia symptoms. A study done by Ong, et al. (2009) combined mindfulness meditation and CBTI to examine their effects over a 12-month period. The results

suggested a decrease in pre-sleep arousal and insomnia symptoms (Ong, et al., 2009). Furthermore, more than 60% of the individuals did not have recurrent insomnia during the follow-up. A randomized clinical trial examined the differences between sleep hygiene education and mindfulness practices and found that mindfulness training greatly increased sleep quality and yielded larger effect sizes when compared to the sleep hygiene education (Black, et al., 2015). The mindfulness training also lead to improvements in depression and daytime impairments (Black, et al, 2015). However, the mindfulness effect size (0.89) (Black, et al, 2015) was not greater than the CBT effect size (0.96) which was based on a meta-analysis from Smith, et al., (2002).

Acceptance and Commitment Therapy: A new proposed model

One area of mindfulness-based treatment that has not been fully explored with sleep and insomnia is acceptance and commitment therapy (ACT). Similar to other third-wave, meta-cognitive therapies, ACT does not focus on changing the individual's thoughts directly, but rather focuses on altering the functional aspects of those thoughts (Hayes, et al., 2006).

Philosophical underpinning - Functional Contextualism

ACT pulls its philosophy from functional contextualism which focuses on how the entire individual interacts with the world around them while accounting for the differing contexts in which their behaviors may appear (Hayes, et al, 2006). Furthermore, it outlines thoughts as being continual behaviors that are based on the situational contexts in which they occur (Hayes, et al, 2006). Meaning, that our thoughts occur within the context of the situation in which they present themselves (Hayes, et al, 2006). Essentially, the way we think, and our corresponding feelings do not influence each other or other behaviors, but rather the differing contexts in which they occur is what links them together (Hayes, et al, 2006).

Theoretical underpinning – Relational Frame Theory

The theoretical underpinning of ACT is Relational Frame Theory (RFT). RFT is a human linguistic theory that implies that the development of our cognitions and overall language depends largely on our ability to create connections between different situations and to modify their functions according to their different connections (Hayes, et al, 2006). In essence, how we relate different events to one another is how we develop language and cognitions (Hayes, et al, 2006). There are three main aspects that encompass the application of RFT, the first being that our cognitions derive from learned associations (Hayes, et al, 2006). The second is that our thoughts can impact how we behave, meaning that how we think about a given situation can alter our response to a specific stimulus (Dymond & Barnes, 1995). The third aspect is that the relationships or connections between our thoughts are managed by the differing contexts in which they appear (Wulfert & Hayes, 1988). Therefore, RFT posits that language and cognition is developed through paired associations across varying contexts and are moderated through different functions (Hayes, et al, 2006). Based on RFT, psychopathology can develop through having functionally incompatible behaviors or thoughts based on the given context of the situation (Hayes, et al, 2006). Furthermore, having an unwillingness to modify the functional aspects of those behaviors or thoughts is known as psychological inflexibility, which can initiate and maintain psychopathology (Hayes, et al, 2006). There are six domains that encompass psychological inflexibility and ACT (Hayes, et al, 2006). As one becomes more flexible in those domains, they may be less likely to develop or maintain psychopathology (Hayes, et al, 2006).

Six core domains of ACT

Acceptance. The first of the six core domains is acceptance (Hayes, et al, 2006). Acceptance is viewed as the ability to monitor one's own thoughts and behaviors without

holding any level of judgment towards them and accepting them for what they are (Hayes, et al, 2006). Individuals can become accepting of different aspects of their life by not trying to forcefully change those aspects (Hayes, et al, 2006). In terms of RFT, acceptance can be developed by allowing the individual to be aware of the context of their thoughts or feelings and allowing them to 'be there.'

The opposite of acceptance is experiential avoidance, which encompasses an individual's ability to control their thoughts and feelings as a way to avoid uncomfortable situations (Hayes, et al., 1996). In terms of RFT, experiential avoidance is developed by forcefully trying to modify the context in which something is occurring and not allowing that 'something' to just be present.

Cognitive defusion. The second core domain is cognitive defusion, which is the ability to not let one's maladaptive thoughts have a functional impact, but rather let them stay as thoughts (Hayes, et al, 2006). This is achieved through changing the context in which those maladaptive thoughts present themselves and allowing them to be more benign (Hayes, et al, 2006). In terms of RFT, cognitive defusion is seen as being able to modify the function of thoughts to only being thoughts and to not let it have an impact on the individual.

The opposite of cognitive defusion is cognitive fusion, which occurs when an individual is focused solely on one thought that it blocks out other aspects of their surroundings (Luoma, et al., 2017). In terms of RFT, individuals who are cognitively fused may act in a way that is inappropriate given the context of the situation (Hayes, et al, 2006).

Contact with the present moment. The third domain is having contact with the present moment (Hayes, et al, 2006). The idea here is to allow the oneself to focus more on the present situation as opposed to the past or future events. This way the individual can better adapt their behavior to be more representative of their core values (Hayes, et al, 2006). In terms of RFT,

contact with the present moment could be developed through thinking about the present situation to better modify behavior in a more adaptive way.

The opposite of contact with the present moment is the over-importance of the individual's conceptualized past and their feared future (Hayes, et al, 2006). Individual's with a poor awareness of the present moment tend to withdraw into reactionary behaviors over time, thus creating a cycle of performing the same behaviors over and over again (Luoma, et al., 2017). Relating back to RFT, individuals become preoccupied with different contexts outside of their current situation which can lead to more rigid and reactionary behaviors since their mind is elsewhere (Luoma, et al., 2017).

Self as context. The fourth domain is self as context and focuses on having the individual see themselves in the present moment and not as they perceive themselves to be (Hayes, et al, 2006). In terms of RFT, self as context is seen through the ability to focus on the present 'you' and use that to guide your thoughts and behaviors based on who 'you' truly are.

The opposite includes having an attachment to one's conceptualized self or how they believe themselves to be (Hayes, et al, 2006). This process comes about through the use of stories an individual may tell themselves (Luoma, et al., 2017). Over time these stories become ingrained into who that person believes themselves to be. For example, an individual who is depressed may say, "I am depressed. I always have been, always will be." This individual may have told themselves this many times over until it becomes a part of who they are, and they become attached to that idea. A more flexible individual would be aware of the context of their situation and would not let the idea of "I will always be depressed" manifest into who they believe themselves to be.

Values. The fifth domain is the individual's values. These values are long-term goals that may never be reached. However, they can be satiated by moment to moment interactions (Hayes, et al, 2006). In terms of RFT, the individual's behavior could be seen as being consistent with their short-term and long-term goals.

A psychologically inflexible person would have a lack of contact or clarity in terms of their overall values (Hayes, et al, 2006). Individuals struggling with their values may have difficulty deciding what gives their life meaning (Luoma, et al, 2017), which in turn creates problems as their behaviors, which are linked to their values, become inconsistent with their own lives (Luoma, et al, 2017). In terms of RFT, the lack of values could be seen as a learned behavior or thought that it would be easier to not have values (Luoma, et al, 2017).

Committed **action.** The sixth and final domain is committed action, which is essentially having behaviors that strive towards one's values (Hayes, et al, 2006). In terms of RFT, committed action is seen through one's ability to know their values and consciously perform behaviors that move them towards their goals.

The opposite of committed action includes being inactive, being impulsive and being avoidant (Hayes, et al, 2006). An individual with psychological inflexibility within this domain tends to be focused solely on the goals that are the most readily available and less so on their long-term goals, if they have any (Hayes, et al, 2006; Luoma, et al, 2017). In terms of RFT, the inaction, avoidance, and impulsivity occur because the individual is unaware of their values and thus not able to guide their behaviors towards those values or goals.

The extent to which one embraces and functions within the adaptive side of each domain leads to psychological flexibility, which theoretically leads to healthy outcomes, while

functioning within the maladaptive side of the previously mentioned domains can lead to psychopathology (Hayes, et al, 2006).

Psychopathological context of ACT

The aforementioned domains of ACT are meant to exist on a continuum (Hayes, et al, 2006). On one end you have psychological inflexibility, which promotes psychopathology through the use of inflexible behaviors or thoughts that inhibit the individual from reaching their long-term goals or values (Hayes, et al, 2006). On the opposite spectrum, you have psychological flexibility, which seeks to promote flexible behaviors or thoughts to help the individual move towards their long-term goals or values. For example, cognitive fusion is one of the domains featured in psychological inflexibility, while cognitive defusion is featured in psychological flexibility (Hayes, et al, 2006). There are varying levels of each domain and their opposites, which means that one person is never fully psychologically flexible or inflexible within a specific domain (Hayes, et al, 2006). Furthermore, in terms of treatment with respect to the philosophical and theoretical underpinnings, clinicians would focus on the functional aspects of an individual's thoughts or behaviors as opposed to the actual content of their thoughts or their behaviors (Hayes, et al, 2006).

ACT's success with depression and anxiety. ACT has been used to treat individuals with anxiety and depression (Bluett, et al., 2014; Churchill, et al., 2013). A meta-analysis conducted by Bluett and colleagues (2014) found that ACT yielded similar results when compared to standard treatments for anxiety and other obsessive-compulsive disorders like CBT. In addition, it was found that psychological flexibility was a mediating factor for various anxiety disorders (Bluett, et al. 2014). Furthermore, Churchill and colleagues' (2013) meta-analysis found that ACT was effective at treating short-term depression.

ACT and Chronic Pain. ACT has been used extensively and effectively to treat chronic pain and other health conditions (Ruiz, 2010). The essence of using ACT to treat chronic pain is to teach the client not to resist or try to modify their pain, but to live with it and accept it for what it is while increasing their overall level of functioning (Hahn & McCracken, 2014). Interestingly, both chronic pain and insomnia share similar features. Both feature dysfunctional thoughts surrounding either their sleep or their pain (Bryson, et al., 2014). For example, chronic pain patients may believe they are broken or flawed because of their pain (Bryson, et al, 2014). Similarly, patient's with insomnia may believe that they need a specific number of hours sleep to be able to function the following morning (Carney, et al, 2010). Taken together, both chronic pain patients and insomnia patients appear to be cognitively fused to their dysfunctional beliefs. Furthermore, catastrophizing of their symptoms or problems is present in both insomnia and chronic pain (Harvey & Greenall, 2003; Sullivan, et al., 2001). Pain catastrophizing has been conceptualized as cognitive fusion towards the patient's beliefs towards their nociceptive experience of pain (McCracken & Morley, 2014). Similarly, patient's with insomnia catastrophize about the consequences of their poor sleep (Harvey & Greenall, 2003), which may suggest that they are cognitively fused with their beliefs towards their experience of their sleep difficulty. In addition, patients suffering from chronic pain or insomnia tend to be hypervigilant towards their pain or sleep problems (Semler & Harvey, 2004; Vlaeyen & Linton, 2000). Chronic pain patients who become hypervigilant will actively avoid experiencing their pain (Vlaeyen & Linton, 2000). This avoidance is akin to experiential avoidance, where the patient will actively avoid the thoughts and feelings that are experienced when they are in pain. In terms of insomnia, as patients become hypervigilant, they may engage in more compensatory behaviors like sleep safety behaviors (Harvey, 2002) to avoid the thoughts and feelings surrounding their

poor sleep. Given the overall efficacy of using ACT with chronic pain (Hahn & McCracken 2014; Ruiz, 2010) and the previously mentioned theoretical similarities between chronic pain and insomnia, it is astonishing that no research has been done to examine the use of ACT to treat insomnia.

Potential application of ACT for insomnia

The only information, that this author is familiar with, regarding the use of ACT with only insomnia is a case study that used ACT principles when CBTI was not sufficient to help a patient with his insomnia (Dalrymple, et al., 2010). Following 3-weeks of CBTI the patient had trouble adhering to the behavioral treatments and was, "afraid to let go" when it came to sleeping (Darlymple, et al, 2010). The clinicians decided to use ACT and divided the treatment into multiple phases with each phase focusing on a different core domain. At the end of the phases, the patient was better able to realize when he was having symptoms and to accept them for what they were. Although that was a case study, it still shows the potential effectiveness of ACT as a therapeutic tool when other treatments fail to work.

In examining the six core domains of ACT and how they theoretically relate to insomnia, one can see how it may have the potential to be a successful adjunctive or standalone treatment. The majority of the six domains will tack onto insomnia by ways of increased arousal seen in the previously mentioned cognitive and behavioral models for insomnia. Patient's with insomnia who attempt to avoid or alter their feelings such as arousal may engage in cognitive fusion with catastrophizing their thoughts or symptoms and the use of sleep safety behaviors. As the patient engages in cognitive fusion, they may experience increased levels of pre-sleep arousal which may further perpetuate their insomnia. As an insomnia patient engages in experiential avoidance, they may actively avoid experiencing their symptoms or their thoughts surrounding the

consequences of their poor sleep. The active avoidance may increase pre-sleep arousal as the patient may attempt to continue to solely engage in avoidance as opposed falling asleep, thus delaying their sleep onset. Similar to previous domains, contact with the present moment could be seen has having a focus on their worry and rumination as they are not allowing themselves to monitor the present moment and are instead thinking about the potential problems associated with their poor sleep, which further increases arousal levels. Self as context could be linked to insomnia by means of having the individual feel like they are only their symptoms, which would suggest an increased attachment to their conceptualized self, which can potentially lead to psychopathology and greater arousal. Sleep-related values is hard to quantify in terms of insomnia, but an example of having inflexible values may be having something that is impossible or maladaptive to what they really value, thus making it impossible to satiate or strive towards their true values. Furthermore, the impossibility of their values might lead to increased worry or rumination, thus increasing their arousal and delaying sleep. The final domain, committed action, can easily be seen as the aforementioned sleep safety behaviors. A psychologically inflexible person may view these safety behaviors as being necessary for them to go to fall asleep and satiate their values, but in actuality they inhibit their sleep, which further increases their arousal.

The Present Study

To this author's knowledge, no studies have examined the relationship of ACT and insomnia. In other words, no studies have examined how the construct of psychological flexibility or the individual domains relate to insomnia and factors that contribute to and maintain it. Based on the previously discussed information, it appears that the ACT domains may be associated with sleep quality and levels of insomnia.

The present study examined the relationship between four of the six domains of ACT (Acceptance, cognitive defusion, committed action, and experiential acceptance), insomnia, and two factors that contribute to and maintain insomnia (daytime sleepiness and sleep efficiency). These four ACT domains were chosen because of their similar presentation with those who struggle with chronic pain. The other two domains, values and self as context, were excluded from this study given their complexity and lack of theoretical support potentially linking them to insomnia.

To examine the relationships between the ACT domains, insomnia and the other factors, healthy college students who report some concern about their sleep were recruited to fill out various measures and complete a sleep diary over a period of 1 week while wearing a FitBit Charge 3 to track their sleep patterns. The end goal was to determine whether or not there is a connection between how an individual scores on the four specific domains of ACT and their level of insomnia, daytime sleepiness, and sleep efficiency.

The purpose of the present study was to examine the potential connection between levels of insomnia, sleep difficulties and ACT's central domains through the use of a developed measure to capture ACT within a sleep-related context. If there is a connection between the two, then it could allow for the development of a new, either adjunctive or standalone, treatment for insomnia surrounding the ACT domains. This is desirable as it would provide a wider range of treatment options for those struggling with insomnia.

Hypothesis of the Present Study

Hypothesis 1: *The global measure of psychological flexibility will be positively associated with sleep efficiency, and inversely related to levels of insomnia and daytime sleepiness.*

Hypothesis 2: *Specific domains of psychological flexibility will be relevant to sleep quality and sequela. More specifically, measures of sleep-related committed action (operationally defined as sleep safety behaviors), cognitive defusion, experiential acceptance and the ability to stay in the present moment will be positively associated with sleep efficiency, and inversely associated with levels of insomnia and daytime sleepiness.*

Chapter II

Methods

The outbreak of COVID-19 in March 2020 has forced us to change our procedure. Restrictions were put in place that prohibited in-person research and forced us to discontinue data collection prematurely. Due to these changes, our data analyses will focus on the effect sizes via levels of variance[1], of our correlations rather than their significance levels alone due to the low sample size. Furthermore, data were excluded from the FitBits due to inconsistent use on the part of the participants, which led to variable data output. For example, oftentimes we would receive no sleep data from the FitBits or the data would suggest that the participant slept from 2:00pm to 8:00pm when their sleep diary showed that they slept from 11:30pm to 6:30am. Given that the amount of data we received from the FitBits were minimal, we opted to solely use the sleep diary data to calculate sleep efficiency since all of the participants completed the diary.

Participants

The final data of this study consisted of 19 participants, undergraduate students attending University of Michigan – Dearborn. Inclusion criteria consisted of individuals who were 18 years old or older and who subjectively endorsed feelings of not getting enough sleep. Exclusion criteria included individuals with a previously diagnosed sleep disorder (e.g. insomnia, narcolepsy, restless leg syndrome, etc.), treated or untreated mood, anxiety, or psychotic disorder, significant medical condition (e.g. different cancers), and those that frequently use

[1] Cohen's D is not available due to the data being on a computer that is restricted due to COVID-19

stimulants. Descriptive statistics for job, responsibility, part-time, full-time, shift, use of over the counter sleep aides or prescription sleep aides (OTCorPX), and gender are displayed in Table 1 below. The study consisted of male participants (n = 7) and female participants (n = 12). The average participant age was 18.89 years old. Some participants held a part-time job (n = 7). Of those who worked, most of them were shift workers (n = 6). None of the participants utilized prescription or over the counter sleep aides (n = 0).

Measures

Demographics and screening questionnaire

The participants were asked to complete a demographics (Appendix A) and a screening questionnaire (Appendix B). The demographics questionnaire consisted of six questions that asked about age, how many credits the individual takes in a semester, on average how many hours of sleep they get each night, whether or not they have children or have a full or part-time job, and whether or not the individual takes any over the counter sleep aides.

The screening questionnaire (Appendix B) consisted of four questions that were used to determine whether or not the individual was eligible to participate in the study. The measure examined whether or not they had a previously diagnosed sleep disorder, an untreated or treated anxiety or psychotic disorder, any significant medical conditions, and if they use any stimulants from a provided list.

Epworth Sleepiness Scale

Every participant was required to complete the Epworth Sleepiness Scale (ESS; Johns, 1992; see Appendix C). This questionnaire was used to measure levels of daytime sleepiness based on the sum of the ratings answered (Johns, 1992). Participants were asked to rate on a 0 – 3 Likert-scale (0 = *would never doze*, 1 = *slight chance of dozing*, 2 = *moderate chance of dozing*, 3 = *high*

chance of dozing) how likely they would doze off in eight stated situations. Some sample situations include, "sitting and reading," "watching TV," and "sitting and talking to someone." A sum from 0-5 is lower normal daytime sleepiness, 6-10 is higher normal daytime sleepiness, 11-12 is mild excessive daytime sleepiness, 13-15 is moderate excessive daytime sleepiness, 16-24 is severe excessive daytime sleepiness. The reliability of the ESS in past research was α = 0.88 (Johns, 1992). The Cronbach alpha level for the current sample is not available due to the COVID-19 pandemic restricting access to the data points necessary to calculate the level.

Insomnia Severity Index

Each participant was required to complete the Insomnia Severity Index (ISI) (Morin, et al., 2011; see Appendix D). Participants were asked to answer 7 questions on a 0 – 4 Likert-scale (items 1-3 are scored as 0 = *none*, 1 = *mild*, 2 = *moderate*, 3 = *severe*, 4 = *very severe*. Item 4 is scored as 0 = *very satisfied*, 1 = *satisfied*, 2 = *moderately satisfied*, 3 = *dissatisfied*, and 4 = *very dissatisfied*. Items 5-7 are scored as 0 = *not at all*, 1 = *a little*, 2 = *somewhat*, 3 = *much*, and 4 = *very much*) about their sleep and potential insomnia symptoms. The ISI was scored similarly to the ESS in that the sum of each of the 7 questions determines their severity of the participant's insomnia problems. A score of 0 – 7 indicates no clinically significant insomnia, 8 – 14 indicates subthreshold insomnia, 15 – 21 indicates clinical insomnia (moderate severity), and finally 22 – 28 indicates clinical insomnia (severe). The reliability of the ISI in past research was α = 0.91 (Morin, et al, 2011). The Cronbach alpha level for the current sample is not available due to the COVID-19 pandemic restricting access to the data points necessary to calculate the level.

Sleep Diary

Participants were asked to fill out a sleep diary every day for one week (see Appendix E). The sleep diary allowed the participant to complete subjective information regarding their sleep

and was a way of tracking and calculating an individual's level of sleep efficiency. The areas the sleep diary examined are the time they wake up, the time they go to bed, their estimated sleep latency or the amount of time it takes to fall asleep, their number of awakenings throughout the night, the time they are awake during the awakenings, the number of early morning awakenings, the time out of bed during the awakenings, the number of naps they take, on average how long their naps were, their overall sleep quality on a 0 – 4 likert scale (0 = *very poor*, 4 = *very good*), and their levels of fatigue throughout the day on a 0 – 4 likert scale (0 = *no fatigue*, 4 = *very fatigued)*. The Sleep diary came with a set of directions and definitions to ensure that each participant understood what each section of the sleep diary was asking for. Participants were given a hard copy of the sleep diary and directions to fill it out throughout the week. Furthermore, participants were sent daily email reminders to complete the diary.

Sleep Tracker

A FitBit Charge 3 was used to collect sleep data as the participants sleep throughout the night. More specifically the FitBit Charge 3 was used to calculate sleep efficiency via dividing the total time the participant is asleep by their total amount of time in bed. Furthermore, the data from the FitBit Charge 3 was compared to the self-report data from the sleep diary.

Sleep-Related Psychological Flexibility Measure

The sleep-related psychological flexibility measure (SRPFM) was a measure that examined the six domains of psychological flexibility: experiential acceptance, contact with the present moment, values, committed action, self as context and cognitive defusion, and experiential avoidance of psychological inflexibility from Acceptance and Commitment Therapy (ACT) in relation to an individual's sleep (See Appendix H). This measure was developed because there were no known measures that examined psychological flexibility and sleep. The

measure itself was broken down into three sections with each section having its own directions and response options.

Section 1. The first section represented the majority of the domains. The **self as context** measure, which examined levels of self in relation to an individual's sleep, had its eight questions pulled from the Self Experiences Questionnaire (SEQ; Yu, et al., 2016). The SEQ was originally developed for measuring levels of self in chronic pain patients. The questions that were used for the SRPFM were modified to ensure that we are measuring sleep-related self as context. An example of a modification that was made was to change, "above all my experiences, there is a sense of myself who is noticing them" (Yu, et al., 2016) to "above all my poor sleep experiences, there is a sense of myself who is noticing them." These questions were answered on a 5-point Likert-scale (1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neutral*, 4 = *somewhat agree*, and 5 = *strongly agree*).

The **values** measure consisted of seven items and examined general health-related values since developing a way of measuring sleep-related values was quite difficult. The values section had its items taken from two different measures. Items 1 – 4 come from the Health Values scale, which was developed as a way to determine levels of health being a value (Lau, et al., 1986). Items 5 – 7 come from the health section of the Health Value, Attitudes, Expectations, Perceptions, and Intentions Scales (Tudoran, et al., 2009). An example item from each measure is, "If you don't have your health, you don't have anything" and "Good health is important to me." These questions were answered on a 5-point Likert-scale (1 = strongly disagree, 2 = *somewhat disagree*, 3 = *neutral*, 4 = *somewhat agree*, and 5 = *strongly agree*).

The eight **cognitive fusion** items of the SRPFM came from the Catastrophic Thoughts about Insomnia Scale (CTIS; Tan, et al., 2017). The CTIS was originally developed to determine

how catastrophic thoughts about sleep play a role in overall sleep quality (Tan et al, 2017). The items taken from the CTIS mirror what it means to be cognitively fused with a thought. These items assessed levels of cognitively fused thoughts towards sleep. An example item from this scale is "A single night of bad sleep ruins my entire week." The cognitive fusion items also examined different thought patterns that individual's with sleep problems may experience. These questions were answered on a 5-point Likert-scale (1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neutral*, 4 = *somewhat agree*, and 5 = *strongly agree*).

The **acceptance** section of the SRPFM consisted of eight items; the latter four were created for the present study. This measure of acceptance assessed levels of awareness and overall acceptance over any potential sleep issues an individual may face. Items 1 – 4, come from the Sleep Problem Acceptance Questionnaire (SPAQ) (Bothelius, et al., 2015). The SPAQ was originally developed to measure levels of acceptance in individuals with sleep issues and has two factors: "activity engagement" and "willingness." For the purposes of this study, we chose to only use the four items from the activity engagement factor as these questions better fit our definition of acceptance. However, the four questions taken from the SPAQ were slightly modified for better consistency with the measure as a whole. An example modification includes changing, "My life is going well, even though I have sleeping problems." (Bothelius et al., 2015) to "My life is going well despite my sleep issues". An example question that was created includes, "My sleep difficulties get in the way of my life". These questions were answered on a 5-point Likert-scale (1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neutral*, 4 = *somewhat agree*, and 5 = *strongly agree*).

The eight **experiential avoidance** items were developed for the present study as a way to measure physiological responses to the anxiety of various sleep problems. No other sleep-related

experiential avoidance measures were available that this author is aware of. The items in this section assessed levels of active avoidance of an individual's physiological reactions to sleep. An example item from this section includes, "I avoid situations if there is a chance that I'll start to feel nervous about my sleep." These questions were answered on a 5-point Likert-scale (1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neutral*, 4 = *somewhat agree*, and 5 = *strongly agree*).

Section 2. of the SRPFM involved measuring the participant's **attention to the present moment** through seven items, which assessed how focused the individual was on the present moment with regards to their sleep. Item 1 comes from the sleep-related behaviors questionnaire (SRBQ) and was originally developed to examine the use of sleep safety behaviors and how they may be used to as a tool to improve sleep (Ree & Harvey, 2004). The item from the SRBQ is, "I spend time considering ways to improve my sleep." Items 2, 3, and 5 came from the CTIS (Tan, et al, 2017). An example item from the CTIS was, "I'm scared of the problems that may happen if I don't get enough sleep." Items 4, 6, & 7 were developed by the primary investigator to focus on the experience of staying within the present moment. An example item that was developed is, "When I lay in bed I pay attention to the comfortable sensation of laying down." These items are all answered on a 5-point Likert-scale (1 = *almost never*, 2 = *rarely*, 3 = *sometimes*, 4 = *often*, and 5 = *almost always*).

Section 3. The final section of the SRPFM were the nine items about **committed action**. Items 1 & 7 were developed by the primary investigator and the other items in this section come from the SRBQ (Ree & Harvey, 2004). The items that were taken from the SRBQ exemplify our definition of committed action, mainly the idea of sleep safety behaviors. This measure assessed the level in which someone uses sleep safety behaviors to try and modify their sleep. An example

item pulled from the SRBQ was, "I do something active close to bedtime to tire myself out." An example item that was developed by the primary investigator is, "I change the time I go to bed in order to try to get adequate sleep." All nine items were answered on a 5-point Likert-scale (1 = *almost never*, 2 = *rarely*, 3 = *sometimes*, 4 = *often*, and 5 = *almost always*). The Cronbach alpha for each of the individual subscales was $\alpha = 0.593$. The Cronbach alpha for the SRPFM as a whole was $\alpha = 0.452$.

Procedure

Participants were recruited from undergraduate psychology classes. Participants were informed during the recruitment process that, to be eligible to participate in this study they need to be 18 years old or older and have endorsed subjective feelings of not getting enough sleep. Furthermore, they were informed that they would be excluded from the study if they endorsed a previously diagnosed sleep disorder (e.g. insomnia, narcolepsy, restless leg syndrome, etc.), treated or untreated mood, anxiety, or psychotic disorder, significant medical condition (e.g. different cancers), and those that frequently use stimulants.

Up to 15 participants had undergone the study at the same time over the course of one week. There were two phases to this study: the education phase and the data collection phase. For the education phase, upon arrival to the subject pool room, each participant was provided with an informed consent form (See Appendix G). Following the completion of the informed consent form, participants were assigned a participant number and asked to complete the screening questionnaire. Any participants who answered 'yes' to any of the questions on the questionnaire was excluded from the study and given partial course credit. Those who answered 'no' to the questionnaire continued on with the study and was given the demographics questionnaire afterwards.

Following the completion of the demographics questionnaire, the participants were handed a sleep diary and taught how to use it. The 11 items on the sleep diary were explained by referencing the definitions found on the diary itself and the participants were told that the diary needed to be completed each day over the course of 1 week.

Once the researcher explained how to use the sleep diary, the researcher then explained how to use the FitBit Charge 3. The researcher explained to the participants that the FitBit needs to be worn at all times especially when they go to sleep. After the FitBit Charge 3 had been explained, the education phase ended and each participant received their course credit for completing this phase.

Participants received notifications to their email to remind them to fill out the sleep diary once a day at 12:00pm. The day before phase 2, participants were reminded to return to the lab with either a cell phone or laptop to complete the Sleep-Related Psychological Flexibility measure (SRPFM) and the Insomnia Severity Index (ISI) through Qualtrics as well as the Epworth Sleepiness Scale in a paper and pencil format. Furthermore, they were reminded to return the sleep diary and FitBit at the specified time. Paper and pencil versions of the SRPFM and ISI were available if they were unable to complete the measures through Qualtrics.

Following one week, all of the participants returned back to the subject pool room and handed in their sleep diaries. Once they were handed in, the participants completed the Epworth Sleepiness Scale (ESS). Following the completion of the ESS, participants were asked to complete the Insomnia Severity Index and the Sleep-Related Psychological Flexibility Measure through Qualtrics on either the participant's laptop or cell phone or they were given a paper-pencil version if necessary. After all of the measures were completed, all of the participants were debriefed and any questions they had were answered. Participants were compensated for their

time by receiving course credit. Participants were given a debriefing form (See Appendix H) that provided information regarding journal articles so they could learn more about the study and contact information of counseling and support services available at the University of Michigan – Dearborn, if the participants required additional services.

Statistical Analysis Related to the Hypothesis

All analyses were performed using SPSS Statistics, Version 25.

Hypothesis 1: To test this hypothesis three correlations were conducted to examine the relationship between the global Sleep-Related Psychological Flexibility Measure (SRPFM) and three dependent variables: Levels of insomnia via the Insomnia Severity Index, Sleep efficiency via the sleep diary and daytime sleepiness via the Epworth Sleepiness Scale.

Hypothesis 2: To test this hypothesis seven correlations were conducted to examine the relationships between the four specific domains measured of the Sleep-Related Psychological Flexibility Measure (cognitive fusion, committed action, experiential acceptance, attention to present moment,) and the three dependent variables: Levels of insomnia via the Insomnia Severity Index, Sleep efficiency via the sleep diary, and daytime sleepiness via the Epworth Sleepiness Scale.

Chapter III

Results

Descriptives

Descriptive statistics for age, average credits, average hours of sleep, insomnia severity (ISI), daytime sleepiness (ESS), scores on sleep-related psychological flexibility measure (SRPFM) (SaC, Val, CDFuS, CA, Acc, APM, EA), the combined SRPFM score, and sleep efficiency are displayed in table 2. Certain data points from table two are of note. On average, participants slept 6.24 hours each night. They scored, on average, 19.68 on the ISI and 9.42 on the ESS. They had an average sleep efficiency percentage of 0.91.

Primary Analysis

Prior to data analysis, data were checked for skewness and kurtosis and results are displayed in table 2. In addition, data were checked for univariate and multivariate outliers and no outliers were detected. The full sample of 19 people were used for these analyses. Furthermore, variance was used as a measure of effect size to determine whether or not a correlation warranted further examination when it was statistically insignificant. A minimum variance of $r^2 = .10$ is needed to warrant further examination.

Prior to examining the primary analyses, the data from the outcome variables (ISI, ESS, sleep efficiency) were assessed to examine if there was a relationship among them. The correlations, effect sizes, and levels of variance are outlined in table 3. There were marginal associations between the ISI and ESS. Furthermore, the SRPFM total score, CDFuS, CA, APM, and EA scores were analyzed to examine if there was a relationship among them and to

determine if they share variance within the construct of psychological flexibility. The correlations, effects sizes, and levels of variance are outlined in the first column of table 4. There were significant associations between the SRPFM total score and CDFus, APM, and EA. Furthermore, significant associations were found between CDFuS and APM and EA, as well as between APM and EA. CA was the only domain that was not associated with the global measure or the individual domains.

In addition, independent samples *t*-tests were conducted to determine whether or not there was a difference in scores on the outcome variables based on the participant's gender or whether or not they have a job. For males, $m = 0.93$, SD = 0.045; $m = 20.42$, SD = 2.87; $m =$ 9.42, SD = 3.55 for sleep efficiency, ISI, and ESS respectively. For females, $m = 0.89$, SD = 092; $m = 19.25$, SD = 6.60; $m = 9.41$, SD = 2.90 for sleep efficiency, ISI, and ESS respectively. For gender, these tests were found to be statistically insignificant, $t(17) = 1.06$, $p = 0.304$; $d =$ 0.4627, $t(16) = 0.537$, $p = 0.599$; $d = 0.2312$, $t(11) = 0.008$, $p =$0.994; $d = 0.0036$, for sleep efficiency, ISI, and ESS respectively. The effect sizes of these analyses were statistically insignificant, thus equal variances were not assumed. These results suggest that there was no difference in outcome variables based on the participant's gender. However, given the moderately sized *d*, it may be that sleep efficiency is affected by gender.

For those who worked $m = 0.91$, SD = 0.069; $m = 18.28$, SD = 5.61; $m = 9.85$, SD = 3.07 for sleep efficiency, ISI, and ESS respectively. For those who did not work $m = 0.91$, SD = 0.087; $m = 20.50$, SD = 5.43; $m = 9.16$, SD = 3.15 for sleep efficiency, ISI, and ESS respectively. For work, these tests were also found to be statistically insignificant, $t(15) = 0.6$, p = .953; $d = 0.0267$, $t(12) = -0.839$, $p = 0.418$; $d = 0.4005$, $t(13) = 0.467$, $p = 0.648$; $d = 0.2214$, for sleep efficiency, ISI, and ESS respectively. The effects sizes of these analyses were also

statistically insignificant. These results suggest that there was no difference in outcome variables based on whether or not the participant had a job. However, given the moderately sized *d*, it may be that levels of insomnia are affected by whether or not someone has a job.

Hypothesis 1: *The global measure of psychological flexibility will be positively associated with sleep efficiency, and inversely with levels of insomnia and daytime sleepiness.*

The correlations, effect sizes, and levels of variance between the global measure of psychological flexibility (SRPFM), sleep efficiency, levels of insomnia (ISI), and daytime sleepiness (ESS) are located in Table 5. Contrary to expectations, the global SRPFM was not associated with sleep efficiency or daytime sleepiness and the effect sizes were small. However, as expected, there was a significant negative correlation between the global SRPFM and levels of insomnia. These correlations suggest that higher levels of psychological flexibility as measured by the SRPFM was related to lower levels of insomnia as measured by the ISI. The effect size of the correlation fell within the large range.

Hypothesis 2: *Specific domains of psychological flexibility will be relevant to sleep quality and sequela. More specifically, measures of sleep-related committed action (operationally defined as sleep safety behaviors), cognitive defusion, experiential acceptance and the ability to stay in the present moment will be positively associated with sleep efficiency, and inversely associated with levels of insomnia and daytime sleepiness.*

The correlations between the SRPFM domains, sleep efficiency, levels of insomnia, and daytime sleepiness are located in Table 5. As predicted, levels of insomnia were significantly negatively associated with cognitive defusion, attention to the present moment, and experiential avoidance. Levels of daytime sleepiness were marginally negatively associated with cognitive defusion and experiential acceptance which produced effect sizes of 0.1672 and 0.1953

respectively. However, contrary to expectations, sleep efficiency was not associated with any of the SRPFM domains and had low effect sizes ranging from 0.005 to 0.0388. Moreover, levels of insomnia were not associated with committed action with a small effect size of 0.064. Lastly, daytime sleepiness was not associated with committed action or attention to the present moment and produced effect sizes of 0.1036 and 0.002 respectively.

Chapter IV

Discussion

The purpose of this study was to develop a better understanding of the potential connection between specific ACT domains; attention to the present moment, committed action, cognitive defusion, and experiential acceptance, and daytime sleepiness, sleep efficiency, and overall levels of insomnia.

The results from the descriptive analyses are of note. The average daytime sleepiness score via the ESS was 9.42 which is suggestive of normal levels of daytime sleepiness given that a score of 11 or higher is indicative of daytime sleepiness or daytime impairment. Those who participated in the present study averaged a sleep efficiency score of 0.91 which is suggestive of sleeping efficiently. Furthermore, participant's averaged 6.24 hours of sleep per night, which was less than the 7.02 hours of sleep per night found by Lund, et al. (2010) who examined the sleep patterns of college students. This suggests that those who participated in this study slept less than the average college student. Moreover, participant's averaged 19.68 points on the ISI while 17 (89%) of them had a minimum score of 15 which is indicative of clinically significant insomnia. Overall, those who participated in the present study, on average, had normal levels of daytime sleepiness, slept at a below average rate, slept efficiently, but had clinically significant insomnia.

The results from the correlational analyses of the outcome variables suggest a marginal relationship between levels of insomnia and daytime sleepiness with a small effect size. The current data is supported by the literature. A review by Riedel & Lichstein (2000) found that patients with insomnia did not have increased levels of daytime sleepiness or daytime

impairment relative to patients without insomnia. Furthermore, Lichstein, et al. (1994) found that those with insomnia experience daytime sleepiness similarly to those without insomnia. The lack of daytime sleepiness in patients with insomnia has been attributed, in part, due to them not being sleep deprived (Chambers & Kelly, 1993). However, contrary to Chambers and Kelly, (1993), the current findings suggest that the participants, on average, had clinically significant insomnia (89%) and were more likely to be sleep deprived given the average number of hours a week they slept (6.24), but had normal levels of daytime sleepiness on average. The potential connection between levels of insomnia and daytime sleepiness may be about how sleep deprived the current sample was. Although they were sleeping efficiently, they were sleeping less than the average college student.

Examining the results from the descriptive analyses and the correlational analyses of the outcome variables, this may suggest that those who participated in the present study had endorsed initial insomnia or difficulty initiating their sleep. This is seen through how efficiently each participant slept and their lack of daytime sleepiness or daytime impairment. Given the high levels of sleep efficiency, this may suggest that they might have had difficulty initiating their sleep but once they were asleep, they were not interrupted throughout the night. If the participants had fragmented sleep, then the results may have shown decreased levels of sleep efficiency.

No other associations between sleep efficiency, daytime sleepiness and insomnia were statistically significant or meaningful based on effect size.

The discrepancy between the current findings and the literature may be due to the way participants were screened. During the screening process, participants were accepted into the study if they reported subjective feelings of "poor sleep." This process may have allowed more

participants with clinically significant insomnia to participate in the study than those who denied having "poor sleep". Furthermore, college students who work tend to have an increased likelihood of endorsing sleep difficulty (Yang, Wu, Hsieh, et al, 2003) so it is reasonable to expect those with sleep difficulty to be in the present study given that 37% of our participants work. In addition, those who commute to their university are more likely to endorse sleep difficulty (Peltzer & Pengpid 2015). Given that the University of Michigan – Dearborn is a commuter campus, it is further reasonable to expect the current study's participants to endorse sleep difficulty. Furthermore, the ESS is not a diagnostic tool for insomnia, but rather aims to capture sleep propensity or how likely someone will be able to move from being awake to being asleep (Sanford, et al., 2006). Although our data showed a relationship between levels of insomnia and daytime sleepiness, it should be noted that daytime sleepiness is not a predictor of insomnia, but is a component of insomnia (Sanford, et al, 2006). Given that the majority of our participants scored at a level that indicated clinically significant insomnia, this may explain why they had elevated levels of daytime sleepiness.

The results from the correlational analyses of the predictor variables are of interest. The goal of the SRPFM was to develop a measure that would accurately capture the domains of psychological flexibility in a sleep-related context. The global SRPFM was found to be significantly associated with cognitive defusion, attention to the present moment, and experiential acceptance, which was expected given that the individual domains contribute to the global measure. Given the effect sizes and statistical significance, the results may suggest that the scales are sharing the variance within a larger construct that may be sleep-related psychological flexibility. Furthermore, the strong intercorrelations between the three domains further suggests that they are contributing to a larger construct that may be sleep-related

psychological flexibility, which was expected given how the domains are meant to be related to one another (Hayes, et al, 2006).

Committed action was found to have insignificant correlations to the global SRPFM and a small effect size. In ACT, committed action aims to use psychologically flexible behaviors to promote the values of the individual (Hayes, et al, 2006). These results may be due to the questions that were developed for this domain. The questions were developed around being the opposite of sleep safety behaviors or healthy sleep behaviors. However, perhaps sleep safety behaviors do not reflect psychologically flexible behavior and may be unrelated to one's values. This may explain why committed action was found to not be associated with any of the predictor variables, since theoretically all of the ACT domains are meant to build and support one another (Hayes, et al, 2006). Thus, results regarding this variable should be considered with caution.

The intercorrelations between the ACT domains are of interest as well. Strong significant correlations were found between experiential acceptance and cognitive defusion, which is supported by the theory of psychological flexibility. Psychological flexibility is comprised of three pillars: openness, awareness, and engagement (Luoma, et al, 2017). These pillars encompass the six domains. The pillar related to openness includes both cognitive defusion and experiential acceptance as both domains look to improve and foster openness to experiences and thoughts within the individual (Luoma, et al, 2017). The high intercorrelations between these two domains may suggest that they are sharing a significant amount of the variance (54%), thus suggesting that they may be related to one another as ACT suggests they would (Luoma, et al, 2017).

Attention to the present moment was found to be significantly related to both cognitive defusion and experiential acceptance. Because attention to the present moment is one of the two

domains under the awareness pillar (Luoma, et al, 2017), this relationship is to be expected. Each of the domains are meant to be interrelated as each of the domains support one another (Hayes, et al, 2006). Furthermore, along with the three pillars of psychological flexibility, the domains themselves can be placed in two groups (Hayes, et al, 2006). The first group involves mindfulness and acceptance and the second group involves commitment and behavior change (Hayes, et al, 2006). The domains found in the mindfulness and acceptance group are cognitive defusion, experiential acceptance, attention to the present moment, and self as context (Hayes, et al, 2006). Overall, this data suggests that the questions developed for the cognitive defusion, attention to the present moment, and experiential acceptance domains have sound associations.

Committed action was the only variable that was not associated with the global measure or the individual domains. These results were unexpected and may suggest that the questions developed for this domain were not related to psychological flexibility as seen by the lack of shared variance and intercorrelations between this domain, the global measure and the other three domains. Furthermore, the lack of an association between the committed action variable and the global measure may be due to how the variable was defined. For this study, committed action was defined as being the opposite of sleep safety behaviors. In other words, committed action was defined as being health sleep behaviors. Given the results, it may be that sleep safety behaviors are unrelated to psychological flexibility, psychological inflexibility, and the other measured domains.

The results of each hypothesis will be discussed in the next sections, followed by discussions of the strengths and limitations of the study, future research, and implications. It should be noted that the effect sizes of non-significant correlations may be due to random error. Given the COVID-19 pandemic outbreak in March 2020 halting data collection and limiting the

sample size of this study, the following interpretations should be taken with caution. However, in the spirit of this project being a thesis, examining the effect sizes of those non-significant correlations may direct future research once researchers are reestablished in universities.

Hypothesis 1 Discussion

It was anticipated that global psychological flexibility (measured by SRPFM) would be positively associated with sleep efficiency (measured via sleep diary) and inversely associated with levels of insomnia (measured by ISI) and daytime sleepiness (measured by ESS). Contrary to expectations, there were no significant associations between daytime sleepiness and sleep efficiency with global psychological flexibility only accounting for 7.8% and 2.5% of the variance respectively. The produced results may suggest that psychological flexibility does not predict daytime sleepiness or how efficiently someone sleeps.

Given the lack of findings to support the hypothesis, this may suggest that daytime sleepiness taps into different constructs not measured by the SRPFM. It may be that psychological flexibility has an impact on how people initiate sleep, but once they are asleep their sleep is not impacted. This may point to ACT being useful for those who suffer from initial insomnia as opposed to those who have difficulty maintaining their sleep. This may further explain the lack of association between sleep efficiency, daytime sleepiness, and the global SRPFM especially since the sample, on average, produced normal levels of daytime sleepiness.

Furthermore, how efficiently one sleeps may not be impacted by how open, accepting, and aware someone is of the present moment. Sleep efficiency can be altered by a variety of different factors (Desjardins, et al., 2019), many of which may not be related to psychological flexibility. For example, nocturia and physical health issues can prevent someone from falling asleep (Desjardins, et al., 2019), thus lowering their sleep efficiency. Given the wide variety of

factors that can affect sleep efficiency, it is reasonable that the SRPFM may not have been able to capture all of the variables. Furthermore, sleep efficiency was calculated using sleep diaries and the lack of FitBit data makes it difficult to calculate a completely accurate sleep efficiency. This may potentially explain why there was no association between the SRPFM and sleep efficiency.

However, there was a significant negative association between the SRPFM and levels of insomnia severity. This negative relationship was expected and suggests that participants who had higher levels of global psychological flexibility tended to have less severe insomnia. Theoretically, the more accepting, open, aware, and engaged the person is in the present moment, the less that person is likely to endorse insomnia. This is supported by the literature when chronic pain patients who are struggling with insomnia endorse psychological flexibility, they were less likely to have sleep disturbance (McCraken, et al., 2011).

Hypothesis 2 Discussion

It was anticipated that the individual psychological flexibility domains related to committed action, cognitive defusion, attention to the present moment, and experiential avoidance (all measured by SRPFM) would be positively associated with levels of sleep efficiency and negatively associated with levels of insomnia and daytime sleepiness.

It was found that the committed action domain yielded insignificant correlations and small effects sizes when compared to sleep efficiency, daytime sleepiness, and levels of insomnia. This suggests that committed action may not be affected by levels of insomnia, feelings of daytime sleepiness, or how efficiently a person sleeps throughout the night. However, the association between committed action and daytime sleepiness shared 10% of the variance, which may suggest a relationship. The effect size may be due to random error given the sample

size. It may also be that flexible behaviors, or sleep safety behaviors, may impact how we experience daytime sleepiness. In essence, as one uses sleep safety behaviors, there may be an increased likelihood of experiencing daytime sleepiness. Thus, moving towards the use of more flexible behaviors may reduce the impact of daytime sleepiness and further push someone towards their values as they will not be burdened by daytime sleepiness. It may also be that the questions developed for the committed action scale were unrelated to psychological flexibility and the other domains, which may explain the lack of correlations to the other domains and the global measure.

However, as expected, it was found that the psychological flexibility domain related to cognitive defusion was significantly and negatively associated with levels of insomnia. Endorsing cognitive defusion indicates an ability to not allow thoughts to burden a person or to serve a negative function (Hayes, et al, 2006). This finding suggests that endorsing higher levels of cognitive defusion may reduce the likelihood of developing clinically significant insomnia. This decrease may be seen in the ability to fall asleep more readily since the person may be able to allow their thoughts to hold a benign function, thus decreasing their pre-sleep arousal.

The marginally significant association between cognitive defusion and levels of daytime sleepiness are important to consider given its effect size ($r^2 = 0.1672$). The marginal association between cognitive defusion and daytime sleepiness was found to capture 16% of the variance. Given the effect size, it is reasonable to examine the potential relationship between cognitive defusion and daytime sleepiness even though it did not yield statistically significant results. If these results were significant, it would suggest that how well a person is able to modify the functional aspect of their thoughts is potentially related to how likely they would experience feelings of daytime sleepiness. For instance, this may be seen in how someone manages their

pre-sleep arousal. As they modify the functions of their pre-sleep rumination, that person may be able to fall asleep more readily thus prolonging their sleep and reducing the likelihood of experiencing daytime sleepiness.

Moreover, cognitive defusion was found to not be associated with sleep efficiency, which may suggest that cognitive defusion does not play a role in how efficiently someone sleeps. These results may be due to random error. However, it may also be that cognitive defusion plays a role in how people initiate their sleep. As discussed previously, the current sample produced high levels of sleep efficiency which may suggest that their sleep was not fragmented. Furthermore, higher levels of cognitive defusion was found to be associated with lower levels of insomnia. Given the possibility of unfragmented sleep and decreased levels of insomnia, this may increase sleep efficiency of the participant by decreasing their sleep onset time due to them not being cognitive fused with an idea or feeling. For instance, in the Dalrymple & Fiorentino (2010) case study, their patient was not cognitively fused with their sleep in general, but rather the consequences of his poor sleep. Once the patient was able to allow his thought and feelings be present without attempting to alter them, he was able to increase his sleep efficiency (Dalrymple & Fiorentino, 2010). All in all, the lack of association between cognitive defusion and sleep efficiency may be due in part to how cognitive defusion may affect initiating sleep as opposed to how efficiently someone sleeps overall.

The psychological flexibility domain related to focusing one's attention to the present moment was found to be significantly and negatively associated with levels of insomnia as expected. Attention to the present moment indicates an ability to focus and be aware of what is occurring presently to allow for more adaptive behaviors since those behaviors will be related to the present (Hayes, et al, 2006). These results suggest that being more present and being able to

adapt one's thoughts or behaviors to fit what is occurring in the moment, may alter the likelihood of presenting with clinically significant insomnia.

However, attention to the present moment was found to have a small effect size and was not significantly associated with levels of daytime sleepiness and sleep efficiency. These results may suggest that focusing your awareness on the present may not impact how one experiences daytime sleepiness. For instance, being open and aware of presently occurring daytime sleepiness may not alter its impact on the person. Daytime sleepiness tends to produce cognitive and psychomotor difficulties (Riedel & Lichstein, 2000). It may be that bringing attention to present moment will help bring awareness to those cognitive or psychomotor symptoms, but it may not alleviate them. This may explain why the results yielded almost no correlation. In addition, our results may suggest that bringing attention to the present moment may not impact how efficiently someone sleeps. Similarly to what was discussed previously, bringing attention to the present moment may help reduce pre-sleep arousal and thus allow individuals to fall asleep faster. Given that the participants of the current study were described as possibly having difficulty initiating their sleep, bringing attention to their thoughts or feelings that occur prior to falling asleep may be beneficial. The benefit may be seen as they allow those thoughts or feelings to occur and be present within them as opposed to attempting to alleviate them or focusing their attention on the future. Furthermore, given that the current sample had high levels of sleep efficiency, bringing attention to the present moment may help increase their efficiency by allowing them to potentially fall asleep quicker.

The final domain, experiential acceptance, was found to be significantly and negatively associated with levels of insomnia as expected. Experiential acceptance indicates the ability to be aware of and accept one's thoughts, feelings, and behaviors for what they are without holding

judgement towards them (Hayes, et al, 2006). This finding suggests that being aware of and accepting your thoughts or behaviors surrounding sleep-related situations can decrease the likelihood of endorsing higher levels of insomnia. Furthermore, experiential acceptance was negatively, marginally significantly associated with levels of daytime sleepiness. Given the moderate effect size, these results may suggest that the awareness and acceptance of thoughts or behaviors surrounding sleep-related situations, may lead to a decreased endorsement of daytime sleepiness.

Contrary to expectations, experiential acceptance was not significantly associated with sleep efficiency and had a low effect size. These results may suggest that as one becomes more accepting or more aware of their thoughts or behaviors surrounding their sleep, they may not necessarily become a more or less efficient sleeper. However, it may also be that experiential acceptance may or may not impact how one initiates their sleep. Given that the current sample lacked staggered sleep, it may be that they had difficulty initiating their sleep. For example, in the Darlymple & Fiorentino (2010) case study, the patient was actively avoiding actions that he felt would induce insomnia. On the reverse, the patient was unable to accept or was unwilling to experience his insomnia and he would avoid those actions (Darlymple & Fiorentino 2010). The patient was able to improve his sleep once he was willing to experience the sensations and symptoms of his insomnia (Darlymple & Fiorentino 2010). Essentially, it may not be that people need to be accepting of their sleep in general to improve their sleep efficiency, but it may be that they need to be more willing to experience the consequences of their poor sleep that may improve their efficiency. Furthermore, it may well be that being able to accept what they are experiencing may help initiate their sleep. It may be that ACT and its domains are useful for initial insomnia as opposed to those who have difficulty maintaining their sleep. This may

explain why the current sample had efficient sleep since they did not demonstrate staggered sleep.

Strengths and Limitations of the Current Study

Strengths. A particular strength of this study is that it is the first, to this author's knowledge, to examine the role psychological flexibility and the psychologically flexible domains related to cognitive defusion, experiential acceptance, committed action, and attention to the present moment impacts sleep regulation

Another strength of this study is that it is the first, to this author's knowledge, to attempt to develop a measure to assess sleep-related psychological flexibility. There are multiple assessment measures that examine each individual domain of psychological flexibility in certain contexts, but none of them examine them within a sleep-related context.

Limitations. There are several limitations of the current study. The first limitation is the number of participants. Due to the COVID-19 outbreak in March 2020, participant recruitment was halted which resulted in a low sample size. In addition, given that the participants solely included undergraduate college students from the University of Michigan – Dearborn, a clinical sample that included those diagnosed with Insomnia may have produced different results than what was presented in this study.

Another limitation is that the present study utilized an unstandardized measure in the SRPFM. Furthermore, some the questions that were developed for each domain stem from various assessment measures that may not have been specifically examining that specific domain within a sleep-related context. Furthermore, there are no norms to compare the sample data from the SRPFM. Given the lack of a large sample size, the SRPFM was unable to be validated

through the use of various validation analyses that are needed to fully explore the adequacy of the measure.

Another limitation is the sole use of subjective measures. The present study initially intended to use FitBit Charge 3's to provide objective sleep data. However, the FitBit Charge 3 data was excluded due to inconsistent use on the part of the participants, which led to variable data output. For example, oftentimes no sleep data be recorded from the FitBits or the data would suggest that the participant slept from 2:00pm to 8:00pm when their sleep diary showed that they slept from 11:30pm to 6:30am.

Another limitation was the use of examining the effect sizes of insignificant correlations in terms of applying the data to theory. This decision was made given the small sample size, thus the previously discussed data should be taken with caution as the produced effect sizes may be to due to random error.

Future research

Future research recruit a larger and more diverse sample. Given that the present sample was healthy college students, it would be beneficial to examine how diagnosed insomniacs would perform on the various measures presented in this study. Furthermore, comparing patients with insomnia to those without insomnia may help provide a clearer picture as to how psychological flexibility affects sleep and insomnia.

Future research should utilize the domains of ACT within a psychotherapeutic context to help someone struggling with insomnia. Being able to examine the clinical utility of the data in the present study will be beneficial in determining if the association can alter how one experiences insomnia. A clinical trial will be able to determine if the domains have utility and

ultimately determine if ACT can be developed into a newer adjunctive or standalone treatment for insomnia.

Given that the predictor variables were from an unstandardized measure, it would be beneficial to attempt to standardize this measure or develop a standardized measure that assesses sleep-related psychological flexibility. In doing so may provide increased reliability and validity, thus providing more confidence in the data that is produced.

Future research should examine objective measures of sleep. For example, conducting a polysomnography study may provide more information in terms of how psychological flexibility may influence sleep throughout the night. Furthermore, utilizing other objective sleep assessments may provide more accurate results than solely using a sleep diary or other subjective measures.

Implications and Conclusions

The study's findings tentatively suggest that psychological flexibility, mainly cognitive fusion, experiential acceptance, and attention to the present moment, may play a role in the development of insomnia. It may be that as one engages in these psychologically flexible domains, they may be less likely to develop insomnia through the reduction of pre-sleep arousal. The theoretical constructs of ACT need to be further explored as a potential treatment option for insomnia given the present results suggesting a negative relationship between psychological flexibility and insomnia. More specifically, it may be that ACT plays a role in the development of initial insomnia given that the current sample demonstrated initial insomnia as opposed to having difficulty maintaining their sleep. However, these results need to be taken with caution given the use of an unstandardized measure of sleep-related psychological flexibility as well as examining insignificant results through the lens of their effect sizes.

In terms of clinical implications, utilizing the techniques to foster growth within the various domains of ACT may be beneficial in lowering the likelihood of endorsing insomnia. For instance, a clinician may teach the patient to become willing to fully experience their sleepiness. In other words, to be more accepting of their sleep. In addition, fostering more awareness of the present moment through mindfulness techniques may allow for better alignment with the attention to the present moment domain. Finally, having the patient cognitively defuse with their thoughts by having the thought be spoken aloud over and over again until it loses its meaning may allow for decreased endorsement of insomnia (Hayes, et al 2006). All of these domains will guide the patient to become more accepting of themselves and their symptoms, focus more on the present moment, and lower the functional aspects of their thoughts which may decrease their pre-sleep arousal and allow the patient to sleep more readily. An example treatment plan for utilizing ACT for insomnia is seen through Dalrymple, et al's (2010) case study. They utilized various metaphors and various exercises to foster growth within the ACT domains and monitored the patient's sleep progress week-by-week until the patient's sleep efficiency was at a sufficient level (Dalrymple, et al 2010).

Overall, the present study partially supported a relationship between psychological flexibility and insomnia. More specifically, it showed that the flexible domains of cognitive defusion, experiential acceptance, and attention to the present moment, are negative associated with insomnia. As someone embraces these three domains they may be able to decrease their pre-sleep anxiety and initiate their sleep more quickly. However, future research is needed to determine the utility of the SRPFM as well as the utility of the other psychologically flexible domains of ACT in terms of how they play a role in the development of insomnia.

TABLES

Table 1:

Descriptive statistics of sample demographic data (N = 19)

Variable	*Yes*	*No*
Job	7	12
Responsible	1	18
Part Time	7	12
Full Time	0	19
Shift	6	13
OTCorRX	0	19
	Male	*Female*
Gender	7	12

Note: Job = Do you have a job? , Responsible = are you responsible for anyone else (child, parent, grandparent, etc), Part time = Do you work part-time? , Full time = Do you work full time? , Shift = do you work in shifts? , OTCorRX = Over the counter or prescription sleep medication.

Table 2:

Descriptive statistics, skewness, and kurtosis of sample data (N = 19)

Variable	*Range*	*Skewness*	*Kurtosis*	*M*	*SD*
Age	18 – 22	-	-	18.894	1.3701
Avg Credits	12 – 17	-	-	14.157	1.572
Avg hour of sleep/night	4.5 – 8	-	-	6.236	1.071
ISI		0.593	1.843	19.684	5.457
ESS		-0.447	-0.450	9.421	3.060
SaC		0.167	-0.149	26.263	3.088
Val		0.285	0.909	25.789	2.973
CDFuS		0.145	-0.984	25.526	4.937
CA		-0.134	0.371	28.210	4.697
Acc		-0.337	0.358	25.842	5.560
APM		0.051	-0.235	22.684	3.432
EA		0.445	-0.686	22.789	4.366
SRPFM Total		0.715	0.246	139.052	10.726
Sleep Efficiency		-2.358	5.563	0.911	0.079

Note: Age = How old are you, Avg Credits = Average amount of college credits taken in a semester, Avg hour of sleep/night = How many hours of sleep do you get each night, ISI = Insomnia Severity Index, ESS = Epworth Sleepiness Scale, SaC = Self as context, Val = Values, CDFuS = Cognitive Defusion, CA = Committed action, Acc = Acceptance, APM = Attention to present moment, EA = Experiential avoidance, SRPFM Total = Sleep related psychological flexibility measure total score out of 235, Sleep efficiency = How efficient their sleep was out of 1.

Table 3:

Correlations between outcome variables (N = 19) ; r(r^2)

Variable	ESS	Sleep Efficiency
ISI	0.454†	0.185
	(0.2061)	(0.034)
ESS	-	0.087
		(0.007)

Note: ISI = Insomnia Severity Index, ESS = Epworth Sleepiness Scale, Sleep efficiency = How efficient their sleep was out of 1. † = marginal significance

Table 4:

Correlations between predictor variables (N = 19); r(r^2)

Variable	CDFUS	CA	APM	EA
SRPFM Total	0.831** (0.6905)	0.258 (0.0665)	0.671** (0.4502)	0.734** (0.5387)
CDFuS	-	0.165 (0.0272)	0.486* (0.2361)	0.732** (0.5358)
CA	-	-	-0.003 (<0.001)	0.156 (0.0243)
APM	-	-	-	0.517* (0.2672)

Note: SRPFM Total = Sleep related psychological flexibility measure total score out of 235, CDFuS = Cognitive Defusion, CA = Committed action, APM = Attention to present moment, EA = Experiential avoidance.

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed).

Table 5:

Correlations between SRPFM Total, outcome variables, and predictor variables. (N = 19); r(r^2)

Variable	SRPFM Total	CDFuS	CA	APM	EA
Sleep Efficiency	-0.161 (0.0259)	-0.194 (0.0376)	0.192 (0.0368)	0.077 (0.0059)	-0.197 (0.0388)
ISI	-0.763** (0.5821)	-0.804** (0.6464)	-0.253 (0.064)	-0.569* (0.3237)	-0.852** (0.7259)
ESS	-0.275 (0.0756)	-0.409† (0.1672)	0.322 (0.1036)	-0.045 (0.002)	-0.442† (0.1953)

Note: SRPFM Total = Sleep related psychological flexibility measure total score out of 235, ISI = Insomnia Severity Index, ESS = Epworth Sleepiness Scale, Sleep efficiency = How efficient their sleep was out of 1, CDFuS = Cognitive Defusion, CA = Committed action, APM = Attention to present moment, EA = Experiential avoidance.

† = marginal significance

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed).

APPENDICES

Appendix A

Demographics Questionnaire

Please either circle or write your answers in the space provided.

Participant Number: _____

1. How old are you? _____
2. How many credits do you normally take in a semester? _____
3. On average, how many hours of sleep per night do you get? _____
4. Do you have any children or are you responsible for another person? (Yes / No)
5. Do you currently have a job? (Yes / No)
    a. **If yes, is it full time or part time?** (Full time / Part time)
    b. **Also, is it shift work?** (Yes / No)
6. Do you take any of the following over the counter or prescription sleep aides, which you may or may not have a prescription for, to help you sleep?

    Doxepin (Silenor) **Melatonin** **Estazolam** **Lunesta** **Rozerem**

    Valerian **Unisom SleepTabs** **Halcion** **Sonata** **Ambien**

    Edluar **Intermezzo** **Zolpimist** **Belsomra** **Benadryl**

    Aleve PM

    (Yes / No)

Appendix B
Screening Questionnaire

Directions: Please read the following 4 questions and think about whether or not these pertain to you.

Please circle YES if **at least** 1 of these questions pertain to you.
Please circle NO if **none** of these questions pertain to you.

1. Have you had a previously diagnosed sleep disorder?

2. Do you have a treated or untreated, anxiety, or psychotic disorder?

3. Do you currently have any significant medical conditions?

4. Do you currently use any of the following stimulants?

Adderall **Cocaine** **Concerta** **Vyvase** **Methamphetamine**

Dexedrine **Ritalin** **Strattera** **Ecstacy** **Focalin**

Adderall XR **ProCentra** **Zenzedi** **EvekeoDaytrana**

Mydayis **Metadate CD**

(Yes / No)

Please bring this form up to the researcher when you have completed it.

Appendix C

(Sample copy, do not use without permission)

Epworth Sleepiness Scale

Name: _____ Today's date: _____

Your age (Yrs): _____ Your sex (Male = M, Female = F): _____

How likely are you to doze off or fall asleep in the following situations, in contrast to feeling just tired?

This refers to your usual way of life in recent times.

Even if you haven't done some of these things recently try to work out how they would have affected you.

Use the following scale to choose the **most appropriate number** for each situation:

0 = would **never** doze
1 = **slight chance** of dozing
2 = **moderate chance** of dozing
3 = **high chance** of dozing

It is important that you answer each question as best you can.

Situation	**Chance of Dozing (0-3)**
Sitting and reading	
Watching TV	
Sitting, inactive in a public place (e.g. a theatre or a meeting)	
As a passenger in a car for an hour without a break	
Lying down to rest in the afternoon when circumstances permit	
Sitting and talking to someone	
Sitting quietly after a lunch without alcohol	
In a car, while stopped for a few minutes in the traffic	

THANK YOU FOR YOUR COOPERATION

Appendix D

Insomnia Severity Index

The Insomnia Severity Index has seven questions. The seven answers are added up to get a total score. When you have your total score, look at the 'Guidelines for Scoring/Interpretation' below to see where your sleep difficulty fits.

For each question, please CIRCLE the number that best describes your answer.

Please rate the CURRENT (i.e. LAST 2 WEEKS) SEVERITY of your insomnia problem(s).

Insomnia Problem	None	Mild	Moderate	Severe	Very Severe
1. Difficulty falling asleep	0	1	2	3	4
2. Difficulty staying asleep	0	1	2	3	4
3. Problems waking up too early	0	1	2	3	4

4. How SATISFIED/DISSATISFIED are you with your CURRENT sleep pattern?

Very Satisfied	Satisfied	Moderately Satisfied	Dissatisfied	Very Dissatisfied
0	1	2	3	4

5. How NOTICEABLE to others do you think your sleep problem is in terms of impairing the quality of your life?

Not at all Noticeable	A Little	Somewhat	Much	Very Much Noticeable
0	1	2	3	4

6. How WORRIED/DISTRESSED are you about your current sleep problem?

Not at all Worried	A Little	Somewhat	Much	Very Much Worried
0	1	2	3	4

7. To what extent do you consider your sleep problem to INTERFERE with your daily functioning (e.g. daytime fatigue, mood, ability to function at work/daily chores, concentration, memory, mood, etc.) CURRENTLY?

Not at all Interfering	A Little	Somewhat	Much	Very Much Interfering
0	1	2	3	4

Guidelines for Scoring/Interpretation:

Add the scores for all seven items (questions 1 + 2 + 3 + 4 + 5 +6 + 7) = _____ your total score

Total score categories:
0–7 = No clinically significant insomnia
8–14 = Subthreshold insomnia
15–21 = Clinical insomnia (moderate severity)
22–28 = Clinical insomnia (severe)

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Appendix E
Sleep Diary

Date:	**Day 1**	**Day 2**	**Day 3**	**Day 4**	**Day 5**	**Day 6**	**Day 7**
Time to bed: (Indicate AM or PM)							
Time out of bed: (Indicate AM or PM)							
Sleep latency (estimated):							
Number of awakenings:							
Time awake during awakenings:							
Early morning awakenings:							
Time out of bed during awakenings (estimated):							
Number of naps:							
Length of naps:							
Sleep quality (0-4): (0 = very poor; 4 = very good)							
Fatigue (0-4): (0 = no fatigue; 4 = very fatigued)							

Sleep diary

Directions:

- Please fill out this sleep diary every day.
- Don't worry about the exact times, just give your best estimation.
- For areas like fatigue and number/length of naps, please fill these areas out within 1 hour of going to bed if possible.
    - It is okay if you forget to fill out those areas before falling asleep, just try your best to remember them when you fill it out in the morning.
- For the other areas, please fill them out within 1 hour of waking up in the morning.
- Please bring the completed form back with to the second session.

The following tell you what is being asked for each item:

- Time to bed: Approximate time you went to bed to attempt to fall asleep.
- Time out of bed: The time you woke up and did not try to fall back asleep.
- Sleep latency: How long you think it took for you to fall asleep (does not have to be 100% accurate, just give your best estimation).
- Number of awakenings: How many times you woke up during the night.
- Time out of bed during awakenings: Estimated time out of bed before returning to fall asleep.
- Naps number/time: The total number of naps you've taken within the given day and how long they were.
- Sleep quality: Rate your sleep the previous night on a 0-4 scale with 0 being very poor sleep and 4 being very good sleep.
- Fatigue: Rate your levels of fatigue during the day on a 0-4 scale with 0 being no fatigue and 4 being very fatigued.

Appendix F

Sleep-Related Psychological Flexibility Measure

Please enter your research ID number that is located on your sleep diary:

_____

Section 1:

This set of questions is going to be examining different aspects of your sleep over the past month. Please, take your time and answer the questions based on how your sleep has been this past month.

	1 - Strongly disagree (1)	2 - Somewhat Disagree (2)	3 - Neutral (3)	4 - Somewhat Agree (4)	5 - Strongly agree (5)
My life is going well despite my sleep issues. (1)	○	○	○	○	○
There are few things more important than good health. (2)	○	○	○	○	○
My sleep difficulties get in the way of my life. (3)	○	○	○	○	○
When I get distressed thinking about my sleep, I try to fill my head to avoid that feeling. (4)	○	○	○	○	○
When I am about to fall asleep, I can observe experiences in my body and mind as events that come and go. (5)	○	○	○	○	○
Despite the sleeping problems, I am now sticking to a certain course in my life. (6)	○	○	○	○	○
Good health is important to me. (7)	○	○	○	○	○

There are many things I care about more than my health (8)	○	○	○	○	○
When I go to bed and can't fall asleep, I think of other times that I couldn't fall asleep. (9)	○	○	○	○	○
It means a lot to me to have good health. (10)	○	○	○	○	○
When I do not sleep well, I am able to experience myself as more than my thoughts and feelings. (11)	○	○	○	○	○
Above all my poor sleep experiences, there is a sense of myself who is noticing them. (12)	○	○	○	○	○
I wish I could get rid of all of my anxiety towards my sleep. (13)	○	○	○	○	○
I avoid situations if there is a chance that I'll start to feel nervous about my sleep. (14)	○	○	○	○	○

If you don't have your health, you don't have anything. (15)	○	○	○	○	○
If I do not get enough sleep, I'll never be able to catch up on my sleep. (16)	○	○	○	○	○
When I get worried thinking about my sleep, I go out of my way to avoid feeling worried. (17)	○	○	○	○	○
I feel that I have no control over my sleep. (18)	○	○	○	○	○
A single night of bad sleep ruins my entire week. (19)	○	○	○	○	○
I would give up a lot not to feel uneasy about my sleep. (20)	○	○	○	○	○
I'd do anything to feel less anxious about my sleep. (21)	○	○	○	○	○
It's possible to lead a full life even if I am having problems sleeping. (22)	○	○	○	○	○

When I do not get enough sleep the health, appearance, and feelings of my body change, but the sense of myself who is aware of these changes is the same. (23)	○	○	○	○	○
Waking up in the middle of the night (e.g., to go to the bathroom) is a major problem that will have a major negative impact the next day (e.g., noticeable affecting my school or work performance). (24)	○	○	○	○	○
When I get anxious about my sleep, I do things to not feel that feeling. (25)	○	○	○	○	○
I often think about my health. (26)	○	○	○	○	○
I am unable to have good sleep. (27)	○	○	○	○	○

As I'm trying to fall asleep, I think: "If it takes me too long to fall asleep, it would be terrible." (28)	○	○	○	○	○
I can notice what I am thinking and feeling when I do not get enough sleep without getting too caught up in these experiences. (29)	○	○	○	○	○
It's okay that I feel tired during the day. (30)	○	○	○	○	○
I can live a normal life even if I am having difficulty sleeping. (31)	○	○	○	○	○
Above all my poor sleep experiences, there is a sense of myself who is noticing them. (32)	○	○	○	○	○

I am able to remain aware of my experiences from moment to moment when I do not sleep well. (33)	○	○	○	○	○
Good health is only of minor importance in a happy life. (34)	○	○	○	○	○
Although I am often tired, I can make the best of my day (35)	○	○	○	○	○
As I'm trying to fall asleep, I think of how not sleeping well could have a negative impact on things that I'm trying to do the next day. (36)	○	○	○	○	○
If I could magically not feel stressed about my sleep, I would. (37)	○	○	○	○	○
When I am tired, I cannot do the things I want to do. (38)	○	○	○	○	○

When I feel distressed about not sleeping, I can notice what is happening without being overwhelmed. (39)	○	○	○	○	○

Section 2:

The next set of questions will also be examining different aspects of your sleep over the past month. Please, take your time. Answer the questions based on how your sleep has been this past month.

	1 - Almost Never (1)	2 - Rarely (2)	3 - Sometimes (3)	4 - Often (4)	5 - Almost Always (5)
I worry about whether or not I can fall asleep. (1)	○	○	○	○	○
If I wake up in the middle of the night, I worry that I will not be able to fall back asleep. (2)	○	○	○	○	○
I'm scared of the problems that may happen if I don't get enough sleep. (3)	○	○	○	○	○
When I'm in bed and I can't sleep, I focus on what is currently present. (4)	○	○	○	○	○
When I lay in bed I pay attention to the comfortable sensation of laying down. (5)	○	○	○	○	○
I spend time considering ways to improve my sleep. (6)	○	○	○	○	○

I get preoccupied with the present moment. (7)	○	○	○	○	○

Section 3:

Please carefully read each of the statements below. Select the answer that best describes how often you do the following things in order to cope with tiredness or to improve your sleep:

	1 - Almost Never (1)	2 - Rarely (2)	3 -Sometimes (3)	4 - Often (4)	5 - Almdst Always (5)
I do something active close to bedtime to tire myself out. (1)	○	○	○	○	○
I catch up on sleep by napping during the day. (2)	○	○	○	○	○
I avoid caffeine after a certain time of day. (3)	○	○	○	○	○
I try to stop all thinking when trying to fall asleep (4)	○	○	○	○	○
I wear earplugs to block out all sounds that might wake me up or prevent me from falling asleep. (5)	○	○	○	○	○
I look at the clock to see how long it's taking to fall asleep. (6)	○	○	○	○	○
I take something to help myself fall asleep. (7)	○	○	○	○	○
I try to have a consistent sleep schedule. (8)	○	○	○	○	○

I change the time I go to bed in order to try to get adequate sleep. (9)	○	○	○	○	○

Appendix G
Consent to be Part of a Research Study

Title of the Project: An Examination of the Relationship Between Psychological Flexibility and Sleep
Principal Investigator: Jay Sands, Jesands@umich.edu, Masters Graduate Student.
Faculty Advisor: Dr. David Chatkoff, Ph.D Chatkoff@umich.edu

Invitation to be Part of a Research Study

The psychology faculty considers participation in experimental research by subjects to be an educational experience for the students as well as a most important service to the research of the University. Participation is voluntary, if you choose not to participate as a research subject you may participate in another research related activity at no expense to your academic record or standing.

Important Information about the Research Study

Things you should know:

- The purpose of the study is to examine the potential relationship between psychological processes and sleep.
- There are minimal risks in this study, however some individuals may develop anxiety about their sleep.
- The study will be of no direct benefits to the subject.
- Taking part in this research project is voluntary. You don't have to participate and you can stop at any time.

Please take time to read this entire form and ask questions before deciding whether to take part in this research project.

What is the study about and why are we doing it?

The purpose of the study is to examine the potential relationship between psychological processes and sleep. We will be using FitBits, sleep diaries and other psychological measures to determine whether or not there is a relationship between them.

We are doing this because there is little information regarding this topic and this information could potentially lead to newer treatments for various sleep problems.

What will happen if you take part in this study?

If you agree to take part in this study, you will be asked to participate in 2 sessions. The first session, the educational session, will require you to fill out a demographic and screening questionnaire. If you do not meet the inclusion criteria your information will be voided and you will be given partial credit for your participation. After you complete the demographics and screening questionnaires you will be educated on how to use a sleep diary and how to use the FitBit Charge 3 to track your sleep. This first educational session will take approximately 30 minutes. After the completion of this phase you will be awarded 0.5 course credits.

You will then be asked to return back to the lab 1 week later for the data collection session to return your sleep diary and FitBit Charge 3. Once you return the sleep diary and FitBit, you will then be asked to complete 3 psychological measures. Following the completion of the measures you will be debriefed and awarded your remaining 1.5 course credits. This second data collection session will approximately take 30 minutes.

Your information will not be linked to other data (e.g., research data, protected health information, or administrative data such as US Census data).

How could you benefit from this study?

Although you will not directly benefit from being in this study, others might benefit because the data we are collecting and analyzing will be used to determine whether a new treatment for insomnia can be developed. This information may potentially help individuals who are not able to adhere to stereotypical treatments for insomnia by creating new information in an area that is not heavily researched.

What risks might result from being in this study?

There are some risks you might experience from being in this study. As you are tracking the amount of hours you sleep and other information for the sleep diary, you may become anxious or worried about your sleep. However, we try to minimize this by providing information to UM-D's Counseling and Support Services in the debriefing form.

Another risk is the potential loss of privacy related to tracking your actual FitBit data. To mitigate this we have created our own accounts for you to use so there will be no direct connection between any of your personally identifying information and the data your assigned FitBit will be collecting. Furthermore, the information we collect from the FitBit will be stored separately from your personally identify information to help further mitigate this risk.

Another risk is associated with data collection and record keeping. There will be a spreadsheet that contains your name, your assigned participant ID number, and your assigned FitBit ID number. The spreadsheet will be used to determine who has been assigned to which FitBit in case you forget to return it and to keep track of your participant ID number. This spreadsheet will be encrypted, password-protected, and kept separate from any assessment forms or other data. To mitigate the risk of your personally identifying information connecting you to your collected FitBit data, we will delete your personally identifying information from the spreadsheet that links you to your participant ID number once you have returned the FitBit and completed the second phase of the study.

Another risk is an accidental breach in confidentiality. In the rare chance that there is a confidentiality breach, you will be notified and provided the opportunity to withdraw from the study.

The final risk is if there is a theft or loss of the FitBit. If you fail to return the FitBit during the second phase of the project, you will be notified twice via SONA to establish a time to return the

FitBits. To mitigate the possibility of the FitBits being stolen, the University of Michigan logo will be on them. You will be not be charged a replacement fee if the FitBit is lost or stolen.

Other than that, we do not see any other potential risks involved in this study.

How will we protect your information?

I plan to publish the results of this study. To protect your privacy, I will not include any information that could directly identify you.

I will protect the confidentiality of your research records by giving you a participant ID number that will be used in place of your name on assessment forms. There will be a spreadsheet that contains your name, your assigned participant ID number, and your assigned FitBit ID number. The spreadsheet will be used to determine who has been assigned to which FitBit in case you forget to return it and to keep track of your participant ID number. This spreadsheet will be encrypted, password-protected, and kept separate from any assessment forms or other data. Your name and any other information that can directly identify you will be stored separately from the data collected as part of the project**.**

It is possible that other people may need to see the information we collect about you. These people work for the University of Michigan and government offices that are responsible for making sure the research is done safely and properly.

What will happen to the information we collect about you after the study is over?

I will keep your research data to use for future research. Your name and other information that can directly identify you will be deleted from the research data collected at the end of the project. At the end of the study, data will be destroyed. In the extremely rare instance of a confidentiality breach, the participant(s) will be notified and provided the opportunity to withdraw from the study.

I may share your research data with other investigators without asking for your consent again, but it will not contain information that could directly identify you.

How will we compensate you for being part of the study?

As a part of your participation in an Introductory Psychology course at the University of Michigan- Dearborn, you agree to serve as a research subject for this experiment. In total, you will receive 2 subject pool credits for your participation in both sessions. 0.5 credits for session 1 and 1.5 credits for session 2. You may withdraw at any time from today's study without penalty or loss of research participation credit.

As part of your participation in an upper level psychology course at the University of Michigan-Dearborn you agree to serve as a research subject for this experiment In total, you will receive 2 extra credit for your participation in both sessions. 0.5 credits for completing session 1 and 1.5 credits for completing session 2. You may withdraw at any time from today's study without penalty or loss of extra credit.

Your Participation in this Study is Voluntary

It is totally up to you to decide to be in this research study. Participating in this study is voluntary. Even if you decide to be part of the study now, you may change your mind and stop at any time. You do not have to answer any questions you do not want to answer. If you decide to withdraw before this study is completed, the data we already have will be destroyed. Furthermore, any identifying information tying you to the information will be deleted.

Your participation will be terminated by the PI without your consent if you fail to fully complete the sleep diary or wear the FitBit Charge 3. If this is the case again, the information we do have will be marked as void, will not be used in any statistical analyses, and any identifying information tying you to the information will be deleted.

Contact Information for the Study Team and Questions about the Research

If you have questions about this research, you may contact Jay Sands, Jesands@umich.edu, 734-672-2141 or the faculty advisor Dr. David Chatkoff, Chatkoff@umich.edu, 313-593-5612.

Contact Information for Questions about Your Rights as a Research Participant

If you have questions about your rights as a research participant, or wish to obtain information, ask questions, or discuss any concerns about this study with someone other than the researcher(s), please contact the following:

University of Michigan
Health Sciences and Behavioral Sciences Institutional Review Board
2800 Plymouth Road
Building 520, Room 1169
Ann Arbor, MI 48109-2800
Phone: (734) 936-0933 or toll free, (866) 936-0933
Email: irbhsbs@umich.edu

Your Consent

By signing this document, you are agreeing to be in this study. Make sure you understand what the study is about before you sign. I will give you a copy of this document for your records. I will keep a copy with the study records. If you have any questions about the study after you sign this document, you can contact the study team using the information provided above. If you would like to learn the findings of this study, please email me at Jesands@umich.edu and I will be happy to forward that information to you. Thank you for your participation in this study.

I understand what the study is about and my questions so far have been answered. I agree to take part in this study.

Signature:_____

Date: _____

Printed Subject Name: _____

Address: _____

Enrolled in: Psychology: _____

Psychology Instructor:_____

To be filled by experimenter:

Experiment: _____

Date: _____

Experimenter: _____

Appendix H

Debriefing form

POST PARTICIPATION INFORMATION

Thank you for your participation in this research project.

In this project, we were examining the relationship between different aspects of sleep and the domains that consist of Psychological Flexibility. If you wish to learn more about these subjects, please examine the citations below:

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Hayes, S. C., Luoma, J. B., Bond, F. W., Masuda, A., & Lillis, J. (2006). Acceptance and Commitment Therapy: Model, processes and outcomes. *Behaviour Research and Therapy*, 44(1), 1–25. https://doi.org/10.1016/j.brat.2005.06.006

This sheet is provided as a reminder that should your participation in this project lead to a desire to seek additional services, you may contact any of the agencies below.

UM-D Counseling and Support Services (UM-D Students only) 313-982-8495.

If you have questions about your rights as a research participant, or wish to obtain information, ask questions, or discuss any concerns about this study with someone other than the researcher(s), please contact the following:

University of Michigan
Health Sciences and Behavioral Sciences Institutional Review Board
2800 Plymouth Road
Building 520, Room 1169
Ann Arbor, MI 48109-2800
Phone: (734) 936-0933 or toll free, (866) 936-0933
Email: irbhsbs@umich.edu

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